An Exploration of Heterogeneity in Electronic Medical Record Use: Information Technology Use as Emergent and Driven by Values and Expertise

Journal:	*International Conference on Information Systems 2008*
Manuscript ID:	ICIS-0602-2008.R1
Track:	Human Behavior and IT
Keywords:	IS use, Complex adaptive systems, Heterogeneity in IT use, Professional organizations, Emergence, Values and Expertise
Abstract:	We explore heterogeneity in the use of an organization-wide information technology (IT) by both individuals and groups in a professional organization. We study electronic medical record use by physicians and clinic work groups in two medical practices operating within one multi-specialty health care clinic. Data collection methods include interviews, non-participant observations, and questionnaires. Drawing on theories of professional organizations and complex adaptive systems, we offer as an explanation of heterogeneity in IT use by individuals that IT use is a function of professional values and expertise and of heterogeneity of IT use among groups the insight that IT use at a collective level is an emergent property arising from the interactions of diverse, learning agents. This study contributes to information systems research by enriching current understandings of IT use and by providing new insights about heterogeneous IT use in professional organizations.

Exploration de l'hétérogénéité dans l'emploi de fichers médicaux électroniques: L'emploi de la technologie informatique en voie de développement et poussée par les valeurs et la compétence

Nous étudions deux cabinets médicaux å partir d'une base de données constituée d'entrevues, d'observations par non-participants, et de questionnaires. Nous exploitons des théories d'organisations professionnelles et de systèmes adaptatifs complexes pour fournir une explication de l'emploi hétérogène de la technologie informatique par des individus: nous constatons d'abord que l'emploi de la technologie informatique répond aux valeurs professionnelles et à la compétence des individus, et deuxièmement qu'il s'affirme, au niveau collectif, comme une propriété émergente résultant de l'interaction de divers agents d'apprentissage. |

An Exploration of Heterogeneity in Electronic Medical Record Use: Information Technology Use as Emergent and Driven by Values and Expertise

Holly Jordan Lanham
The University of Texas at Austin
McCombs School of Business
1 University Station
Austin, Texas 78712
holly.lanham@phd.mccombs.utexas.edu

Reuben R. McDaniel, Jr.
The University of Texas at Austin
McCombs School of Business
1 University Station
Austin, Texas 78712
reuben.mcdaniel@.mccombs.utexas.edu

Abstract

We explore heterogeneity in the use of an organization-wide information technology (IT) by both individuals and groups in a professional organization. We study electronic medical record use by physicians and clinic work groups in two medical practices operating within one multi-specialty health care clinic. Data collection methods include interviews, non-participant observations, and questionnaires. Drawing on theories of professional organizations and complex adaptive systems, we offer as an explanation of heterogeneity in IT use by individuals that IT use is a function of professional values and expertise and of heterogeneity of IT use in groups the insight that IT use at a collective level is an emergent property arising from the interactions of diverse, learning agents. This study contributes to information systems research by enriching current understandings of IT use and by providing new insights about heterogeneous IT use in professional organizations.

Keywords: information technology use, heterogeneity in IT use, emergence, values and expertise, professional organizations, complex adaptive systems

Exploration de l'hétérogénéité dans l'emploi de fichers médicaux électroniques: L'emploi de la technologie informatique en voie de développement et poussée par les valeurs et la compétence

Nous étudions deux cabinets médicaux à partir d'une base de données constituée d'entrevues, d'observations par non-participants, et de questionnaires. Nous exploitons des théories d'organisations professionnelles et de systèmes adaptatifs complexes pour fournir une explication de l'emploi hétérogène de la technologie informatique par des individus: nous constatons d'abord que l'emploi de la technologie informatique répond aux valeurs professionnelles et à la compétence des individus, et deuxièmement qu'il s'affirme, au niveau collectif, comme une propriété émergente résultant de l'interaction de divers agents d'apprentissage.

Introduction

Six years after implementing an electronic medical record (EMR), MetroClinic, a large multi-specialty health care organization, was dissatisfied because of the difficulty they faced in explaining persistent differences in how users incorporated the EMR into their work processes. Differences in EMR use were expected when work tasks differed. However, differences in EMR use occurred even when specific tasks and/or work processes were the same, and this was a source of puzzlement. Despite upfront and ongoing user involvement in decision making with respect to the IT, tailored training for users, good vendor support, open-minded leadership and management, and the application of financial penalties to guide user behavior, MetroClinic continued to see puzzling differences in EMR use behaviors. EMR use differences were observed at both the individual (physician) and group (clinic) levels. This research is motivated by the following research questions: Why do individuals working in the same roles in a professional organization use IT differently from each other? Why would work groups in a professional organization use IT differently from each other even when the IT is intended to be used similarly across groups?

This paper has two main purposes: 1) to present observations from a two-case field study of the heterogeneity of IT use in a professional organization and 2) to present possible explanations for this phenomenon. During the course of this research, two key insights emerged. First, we began to recognize a potentially important role for values and expertise in helping to explain individual level differences in IT use in professional organizations (Benveniste 1987). Individuals working in professional organizations bring diverse values and expertise with them to the work place creating conditions where IT use is likely to be heterogeneous. Second, studying organizations as complex adaptive systems (Gell-Mann 1994) enabled the insight that group level IT use is likely an emergent property arising from the local relationships among agents in a system (Holland 1998). If group level IT use is an emergent property, then heterogeneity in use across work groups is expected rather than unexpected.

The importance of understanding IT use heterogeneity in professional organizations is increasing as these types of businesses continue to invest in IT and become increasingly reliant on IT (Huber 1984; Kohn et al. 2000; Institute of Medicine 2001). Just as medical organizations are struggling to unravel the role of electronic medical records in their businesses (Hillestad et al. 2005), law firms are contemplating customer relationship management systems for cross-selling purposes (Jones 2007), accounting and professional services firms are working to leverage investments in knowledge management systems and universities are debating online education portals that introduce fundamental changes in how education is delivered. Professional organizations such as these operate in environments characterized by dynamism and continuous, but unpredictable change (Bourgeois and Eisenhardt 1988; Brown and Eisenhardt 1997; Haveman 1994; Orlikowski 1996; Tushman and Anderson 1986). As professional organizations are made up of autonomous workers employed based on the knowledge they possess and as much of their work takes place in work groups, understanding how these individuals and work groups integrate IT into their work processes is vital knowledge for professional organization executives to have when faced with IT investment decisions.

Through a multiple case study, we observed individuals and groups in a professional organization using an organization-wide IT. The professional organization we study is a multi-specialty health care clinic and the workers are administrative support staff, clinical support staff and physicians working within this clinic. We contribute to information systems research through an exploratory study that provides new insights into the important issue of heterogeneity of IT use by individuals and work groups in professional organizations. The following section provides a discussion of relevant literature.

Theoretical Background: IT Use, Professionalism and Complex Adaptive Systems

IT Use

Research investigating IT use is evolving from trying to understand pre-adoption and adoption behaviors (Davis 1989; Taylor and Todd 1995; Venkatesh et al. 2003) toward trying to understand post-adoption behaviors (Ahuja and Thatcher 2005; Beaudry and Pinsonneault 2005; Jasperson et al. 2005; Kim and Malhotra 2005). In contexts where organizations have already made an adoption decision, the more relevant and interesting research questions are those aimed at understanding how people incorporate IT into their work. Another movement in IT use research

is the use of study designs that provide rich accounts of how people in organizations use IT. Finally, IT/IS scholars are seeking organizational-level understandings of IT use to complement knowledge of IT use by individuals.

At its core, IT use research is aimed at understanding how people integrate IT artifacts into work processes. Early theories of IT use focus on understanding antecedents of IT adoption by individuals. Davis' work on technology acceptance by individuals is perhaps the most highly recognized work in this stream of research (Davis 1989; Venkatesh et al. 2003). Others have examined issues related to IT use with more of a practice lens (Brown and Duguid 1991; Edmondson 1999; Edmondson 2003; Edmondson et al. 2001; Faraj and Xiao 2006; Orlikowski 2000), through which work tasks are viewed as non-routine and situated within unique contexts. Barley's (1986) work on the structuring of IT and organizational roles in two radiology departments implementing identical computerized tomography scanners, DeSanctis and Poole's (1994) work on adaptive structuring of IT and organizational change and Faraj and Xiao's (2006) work on coordination in fast-response teams are good examples of research carried out using a practice lens. These efforts tend to study IT use phenomena with process models, as opposed to variance models, of causal agency (Markus and Robey 1988), and they tend to view IT as a social object, enabling the study of IT use among groups of people as opposed to individuals.

Structuration theory has played a significant role in efforts to understand IT use in organizations (Orlikowski and Robey 1991; Poole and DeSanctis 2004). Research grounded in structuration theory has influenced current thinking on a wide range of IS topics including IT use (Desanctis and Poole 1994) IT implementation (Barley 1986; Orlikowski 1993), IS development (Newman and Robey 1992), virtual teams (Majchrzak et al. 2000), and online relationships (Chidambaram 1996). Viewing technology as a social entity whose meaning is derived through the interactions of agents as they use the technology enables new understandings of the role of IT in reshaping work roles and patterns of interaction among workers (Barley 1986). Recognizing a "duality of technology" (Orlikowski 1992) offered fundamentally new understandings of the role of IT in organizations.

While IT/IS researchers have argued well from an organizational culture perspective that IT and other organizational structures are interdependent and continually reshaping each other through interaction, fewer studies have sought more fine-grained, micro-level explanations for heterogeneity in IT use often observed across seemingly similar end users and work contexts. Heterogeneity in IT use has been studied by comparing different populations (e.g., voluntary versus mandatory settings, male versus female subjects or old versus young subjects), but little attention has been paid to heterogeneous use among similar users. Despite similarities in both the IT artifact and the environment in which work groups operate/carry out work tasks, individuals and groups often use IT differently from each other (Barley 1986; Edmondson et al. 2001). In this study, we focus on investigating heterogeneity in IT use among both individuals and groups in professional organizations in an effort to better understand how and why such differences arise over time.

Professional Organizations Paradigm

Professional organizations can be described as "organizations that embody the transformation process in people rather than in machines and represent a strategy to deal with uncertainty in the workplace" (Weick and McDaniel 1989). At the same time IT is sometimes framed as a strategy to manage uncertainty in the workplace. Examples of professional organizations are accounting firms, law firms, professional services firms, universities, and health care organizations. Professional organizations are "created to apply professional values and expertise to the resolution of difficult, often ambiguous problems" (Anderson and McDaniel 2000; p. 85). Because work tasks in professional organizations are likely to be uncertain, ambiguous and non-routine (Anderson and McDaniel 2000) understanding the role of values and expertise in these organizations may provide insights into their use of IT. People generally understand the notion of expertise as shared agreement among knowledgeable actors about cause/effect relations and about preferences regarding possible outcomes (Thompson 1967). Less clarity exists about the meaning of values, particularly as the term is used in organizational life. Beyer (1981) suggests that, "Values are defined as a rationalized normative system of preferences for certain courses of action or certain outcomes. …. Values make some courses of action more desirable than others or some outcomes more desirable than others, and so values influence choices of what or which courses of action to take" (pp. 166-167). An example of physicians' expertise is their understanding of the effect of insulin on blood glucose levels. Values enter the picture when physicians think about whether patients with diabetes should be managed by a primary care physician or by a specialist. Professional values and expertise are properties of the larger society, not of the organization (Freidson 1994), because

professionals are trained and socialized, not by their organizations, but by their colleges and universities and their professional associations.

Professional organizations have had surprising difficulty incorporating IT into their operations. For example, law firms are reluctant to use electronic data search technologies and customer relationship management systems because of fear of decreased control over client lists and of litigation for mistakes made in work carried out by non-human/non-traditional means (Cohen 2005; Coulter 2005). In the health care industry, use of IT has often been promoted as a way to control both costs and quality of health care delivery (Institute of Medicine 2001). Despite the expenditure of significant resources for both the development and promotion of EMRs, their acceptance has been slow (Valdes et al. 2004). Reluctance to use EMR technologies by health care professionals has been attributed to many factors including a fear of experiencing decreased work efficiency, the perception that an EMR offers a low value proposition, and the belief held by some that using an EMR alters physician identities and signals less distinction for physicians (Fiol and O'Connor 2004). The importance of expertise and values to the managing of uncertainty in professional organizations and the great difficulty these organizations have experienced in incorporating IT suggests that expertise and values are important considerations when attempting to understand IT use heterogeneity.

Complexity Science and Complex Adaptive Systems Theory

Complexity science, in particular complex adaptive systems, is also relevant to IT use heterogeneity. Complexity science is a set of ideas aimed at understanding two types of phenomena: 1) how systems made up of a complex set of inputs can generate simple outputs (Waldrop 1992) and 2) how systems made up of a simple set of inputs can generate complex outputs (Prigogine 1996; Prigogine et al. 1984). Complexity science has been successfully applied in organizational research (Allen et al. 2005; Anderson 1999; Boisot and Child 1999; Brown and Eisenhardt 1997; McDaniel and Driebe 2001; McKelvey 1999) and in research on IT and organizations (Curseu 2006).

Organizations are CAS (Bettis and Prahalad 1995; Boisot and Child 1999; MaGuire et al. 2006; McDaniel and Driebe 2001; Stacey 1995). CAS derive their unique qualities from nonlinear interactions among their agents. For the purposes of our analysis it is important to note that these nonlinear interactions often lead to emergent properties - properties at one level of analysis that cannot be determined by knowing properties at lower levels of analysis. Nonlinear interactions and emergent properties are sources of uncertainty in CAS. Studying IT use heterogeneity with a CAS lens focuses attention on the relationships among agents and on the management of uncertainty. Understanding worker relationships in professional organizations and the properties that emerge from these relationships may help us understand heterogeneity in IT use.

In this paper, we report on an exploratory study investigating the heterogeneity of EMR use in a large multi-specialty medical clinic, MetroClinic. As with other information technologies aimed at improving work processes in professional organizations, the design of the EMR purchased by MetroClinic allowed for high levels flexibility in how people used it. To complicate matters even more, EMR use is expected to change over time, as familiarity and learning occur and work processes are adapted. In addition to individual level EMR use, we observed heterogeneous EMR use at a group level. The two clinics demonstrate widely different patterns of EMR use that we suggest are manifestations of their distinct cultures – one a culture of ongoing negotiation and the other a culture of diversity absorption. Executives at MetroClinic struggled to get its employees to use the EMR in ways that improve the effectiveness of the organization as a whole – striving, in particular, for improved information and knowledge transfer, coordination of care and patient information management. They focused training programs and other organization-wide efforts on reducing heterogeneity in EMR use behaviors across the organization. MetroClinic is representative of professional organizations trying to benefit from investments made in IT.

From our observations we developed potential explanations for heterogeneity in IT use in a professional organization. First, individual-level IT use behaviors seem to be influenced by values and expertise and from professional's perceptions of how IT intersects with their fundamental work task. Using this set of observations, we suggest that values, expertise and perceptions of the IT held by the person with the most sophisticated knowledge about the task at hand (the physician) are in part responsible for the patterns of IT use that develop in the work group and in the organization (the clinic) of which this person is a part. Second, group-level IT use behaviors seemed to emerge from the relationships among workers in each clinic. The relationships among workers differed between clinics in ways that seemed to be connected with differences in clinic level IT use. Using this insight, we suggest

that patterns of worker relationships in professional organizations contribute to, or give rise to, an organization's developing patterns of IT use. Taken together, these two observations suggest that IT use in professional organizations is, in part, driven by professional values and expertise and by the relationships among workers. We offer as the core contribution of this paper an enrichment of our understanding of what contributes to different IT use patterns despite similar work tasks. We offer a better understanding of how individuals and organizations operating in similar environments using the same IT can develop heterogeneous patterns of IT use.

Methodology

We conducted our study in summer 2007 at MetroClinic, a 120+ physician for-profit multi-specialty medical clinic. MetroClinic is made up of 24 medical specialties operating in 17 locations. By the time of the study, the organization had already implemented an EMR, a computer-based system used for documenting medical information. Six years had passed since MetroClinic implemented this IT, creating conditions where users had developed observable IT use behaviors. According to the Chief Information Officer, MetroClinic decided to purchase an EMR to: 1) improve information timeliness and availability to geographically dispersed users (information delivery among caregivers); 2) eventually be able to compile patient data and medical delivery data over time in order to learn about the population of patients being cared for by this organization (population quality improvement); and 3) provide physicians with alternative tools for medical documentation (patient medical history maintenance).

By studying the same IT, our study design allows us to observe for differences in IT use that can be explained by differences in organizational, as opposed to technological, factors. In addition to observing IT use, we observed patterns of relationships among employees in each of the field sites. These organizational factors were included in the study because in complex adaptive systems, relationships are important for shaping organizational performance.

Description of the IT Artifact: An Electronic Medical Record

Many health care organizations are investing heavily in information technologies (Institute of Medicine 2001), especially EMR technologies (Hillestad et al. 2005). In a general sense, an EMR is a digitized version of a paper medical record. The EMR in this study is an organization-wide IT implemented to ultimately replace a paper-based patient medical record system. Some variation can exist in how clinic members integrate this technology into their work, but to work in a clinical/medical capacity at MetroClinic members must use the EMR at some minimal level. Minimal use in this study is defined as performing the following tasks with the EMR: documenting phone notes, ordering labs, ordering x-rays, and dictating clinic notes using voice recognition software. Heavy use is defined as performing all or most of the tasks with the EMR: all of the tasks included minimal use items plus developing tailored templates for documenting clinical visits, generating patient panel reports, inputting labs from external systems, inputting prescriptions, using flow sheets to track patient data over time, updating medication lists, communicating with others within MetroClinic, communicating with patients, and communicating with pharmacies.

Data Collection

Because the field of IS is in the early stages of understanding actual use of IT by knowledge workers in professional organizations, we chose a multiple case study approach to this study. IRB approval was obtained prior to conducting the study and an approved process for obtaining informed consent was followed.

The two clinics were selected based on observed differences in historical and ongoing patterns of EMR use in these two clinics. We collected data about IT use and about worker relationships by interviewing every member of each field site; observing employees as they worked, paying particular attention to their work with the EMR; and administering questionnaires. Every member of each field site agreed to participate in the study. The first author spent approximately one month collecting data in each field site for a total of approximately 240 hours of observations and interviews. The research team met one day of each week during the data collection period to debrief and critically reflect on observations from the field. These debriefing sessions were used to (1) facilitate critical reflection of the observation process and the methods, (2) discuss any early findings or emergent patterns in the data, (3) refocus/reshape observation methods if needed, and (4) address any study-related issues that emerged

during the clinic observation. In the debriefing session, the authors discussed the state of the study and made adjustments as appropriate. Debriefing sessions were viewed as an essential part of the research effort.

All clinic members participated in semi-structured interviews. To collect in-depth, rich data about EMR use and worker relationships, we used an ethnographic interview approach (Agar 1996). The interview guide was developed based on relevant literature and focused on observing individual and clinic level EMR use and on observing patterns of worker relationships in the clinics. Interviews lasted approximately 30-45 minutes. Each interview was audio recorded and professionally transcribed. An observation template was developed using an observation guide previously used for research in health care organizations (Stroebel et al. 2005). The template was not strictly followed so as to not restrict the observations made; rather, it was used to provide a minimum level of standardization for observing in the two clinics. Included in the observation template were items such as clinic physical layout, work flow description, and patient flow description. Researcher field notes were written each day from jottings taken while in the field. The field researcher administered questionnaires while observing in each field site and obtained a 100% response rate. IT use questions focused on constructs such as perceived usefulness, perceived ease of use, degree of feature use, and degree to which users extend IT use beyond what was provided by training efforts, as suggested by previous research (Davis 1989). Relationship questions focused on trust, mindfulness, heedful interrelating, respectful interaction, social and task relatedness, rich and lean communication, and diversity, as suggested by prior research on relationships in organizations (Cox 1993; Daft and Lengel 1984; Granovetter 1973; Jarvenpaa and Leidner 1999; Kramer 1999; Paul and McDaniel 2004; Weick 1993; Weick and Roberts 1993). The observation strategies used in this study were designed to obtain multiple and different views of EMR use and worker relationships in each clinic. Data collected via interviews were used to inform the story (the case) of a clinic, as were data from observations and data from questionnaires. The questionnaire was not used to simply validate data from the observations and/or the interviews. Rather, we viewed each observation strategy as having the capacity to provide a distinct, relevant perspective on EMR use and worker relationships.

In addition to observations made in the clinics at nursing stations, patient reception areas, support staff work areas, and employee break rooms, we shadowed several workers in each role as they worked with the EMR. Supplementing our observations, the research team conducted interviews with MetroClinic's Chief Information Officer, Chief Medical Director, Associate Director of the Board, family practice administrator, and several members of MetroClinic's internal IT staff to gain a more in-depth understanding of the history surrounding the use of the EMR in this organization and of existing user behaviors, perceptions and attitudes about this IT. The first author received clinical support staff EMR training from MetroClinic's EMR training staff to better understand observations made during the study.

Analysis and Results

We examined our data to study IT use at both individual and group levels of analysis. Analysis was aided by a comparative research design, allowing for contrasts between the ways the EMR was used in the two clinics. Interview data and observation fieldnotes were analyzed in three distinct steps: 1) theme formation, 2) theme matching according to worker role, and 3) theme comparison between clinics. Each interview was professionally transcribed. Both authors read through the interviews and fieldnotes separately and then discussed them together. This process was done iteratively in order to identify themes relevant to individuals, worker roles and clinics. Themes were developed by articulating a unifying idea that represented interpretations from multiple ideas in the interview and observation data. Conceptual labels were assigned to organize themes according to a common thread among ideas. At each iteration, themes were refined whereby similarly labeled ideas were combined into themes and given more general labels. Iterations of this process produced the categories shown in Table 1 as well as the findings described below. During the analysis of the interview and observation data, we noted themes that connected individual level EMR use with values and expertise. We noted commonalities in EMR use that seemed to be connected with worker role (see Table 2). Additionally, we used the comparative research design to study differences in EMR use between clinics. We compared differences in EMR use by worker role in the two clinics. We also studied differences in EMR use that seemed to be occurring at the clinic level but that were not adequately explained by worker role. Clinic level themes were compared directly and associated with differences in worker relationships within clinics.

From the questionnaire data, clinic level scores of IT use and worker relationships were calculated and analyzed for patterns at individual, group (clinic) and work role levels. Considering the small size of our dataset composed of 16

individuals in one clinic and 7 in the other (n = 2, clinic level of analysis; n = 23, individual level of analysis), we did not conduct traditional statistical testing on our questionnaire data. Rather, we analyzed the questionnaire data using non-statistical methods focusing on the detection of qualitatively distinctive patterns across individuals, clinics and work roles. Patterns detected in the questionnaire data were not used as primary data but were used to supplement patterns detected in the observation and interview data.

Introduction to Field Sites

MetroClinic is a multi-specialty medical clinic. Over the years, MetroClinic has aggressively pursued forward-looking technologies throughout the clinic. This clinic has been perceived as a leader in health care as noted by the fact that many of its physicians have received local and national recognition for clinical accomplishments.

Family Works is a family medicine clinic with 16 clinic members including three physicians. Making up clinical support roles were a clinical manager, a licensed vocational nurse (LVN), three medical assistants (MA), a phlebotomist, and an x-ray technologist and making up the non-clinical support roles were a business manager, three business associates (BA), a medical records clerk and a referral coordinator. This clinic was selected for the study based on the significant difference in how the three physicians incorporated the EMR into their work processes. Two of the three physicians serve on the Clinic Board of Directors; one serves as the Chairman of this Board. The third physician is relatively new to the clinic, having joined the clinic approximately one year prior to the study. One physician is considered a high user of the EMR, because this physician tries to use the EMR for all clinical documentation as well as other features such as e-faxing prescriptions to pharmacists. Another physician is considered to be a middle-user, because this physician uses the EMR for clinical documentation when patients have relatively simple conditions to treat. A third physician is considered a low user, because this physician uses the EMR only minimally and relies on paper medical records for the majority of clinical documentation.

Women's World is an endocrinology clinic operating within MetroClinic specializing in menopause care. This clinic is made up of two physicians, two LVNs, two MAs and one BA. Women's World was the first clinic at MetroClinic to implement the EMR and has been used as a model clinic for EMR use within MetroClinic. Both physicians in Women's World were highly interested in the EMR from the beginning phases of adoption and implementation and were optimistic about its ability to help improve clinical documentation and clinical work processes in general. All members of this clinic are considered high users of the EMR, based on their high degree of feature use and very little to no reliance on paper medical records.

EMR Use: Individual Level

We found that both worker roles and the degree to which a job was routine/non-routine make a difference in terms of the individual level patterns of EMR use that develop over time. EMR use behaviors at the physician level varied the most among all of the clinic worker roles we observed. As worker roles required less frequent interaction with physicians and less technical knowledge related to the work of the clinic, less heterogeneity in EMR use behaviors was observed. We found that the topics of interest expressed about the EMR varied depending on worker role. In general, physicians' comments focused on the level of appropriateness of the EMR for helping with the task at hand while non-physicians (both clinical and non-clinical support staff) focused on the accessibility of information provided by the EMR. Both physicians and non-physicians commented on the accuracy of information in the EMR; however, the ideas expressed in the comments differed greatly between the two user groups. These observations were consistent across the two clinics.

Physicians

When speaking about the EMR, physicians also spoke about their values about the practice of medicine. Physicians shared the following values with us during interviews. The first part of each bullet is the stated value; the second part of each bullet demonstrates the connection between values and EMR use.

- **Value:** Efficiency is critical in practicing medicine; **EMR Use:** I only use features of the EMR that make me more efficient in my work (i.e. I ask patients about their current medication list rather than take the time to search for it in the EMR).

- **Value:** Medical complexity is important to consider in practicing medicine; **EMR Use:** The way I use features of the EMR depends in part on the medical complexity of the patient I am treating (i.e. I use a template to document simple cases such as the common cold, but for highly complex cases such as a patient with diabetes, cardiovascular disease and depression, I use dictation software for documentation purposes.
- **Value:** Integrating information for the patient is critical in practicing medicine; **EMR Use:** I use features of the EMR that help me integrate relevant information for my patients (i.e. I use trend-tracking features to show patients how their weight or certain lab values are changing over time).
- **Value:** Knowing patients on a personal level is critical in practicing medicine; **EMR Use:** I document in the EMR in ways that help me signal to my patients that I know them on a personal level (i.e. I cut from a previous visit note and paste into the current visit note relevant personal information, such as how a patient's mother is recovering from the death of her husband, so that I remember to ask my patients about personal matters).
- **Value:** I am responsible for effectively communicating information about my patients to other health care providers; **EMR Use:** I document in the EMR in ways that make it easy for other health care providers to understand my assessment of the patient and my plans for patient care (i.e. I document the same thing in multiple places in the EMR so that it is more likely that colleagues can find my work).
- **Value:** Being present in the exam room in critical to my practice; **EMR Use:** I use the EMR only to the extent that it does not get in the way of my relationships with patients in the exam room (i.e. I do all of my clinical documentation in my office, not in the exam room).
- **Value:** Accurate documentation is critical to practicing medicine; **EMR Use:** I use the EMR only to the extent that is does not distort my account of what happened in the clinical visit (i.e. I will not select a box from a template that is close enough, per se, to capturing an aspect of patient care – rather, when an option is not provided in the template, I write out a description so that what is in the EMR is accurate.
- **Value:** Consideration for litigation risk is important in how I practice medicine; **EMR Use:** I use the EMR in ways that reduces my risk of litigation (i.e. I spend less time with my patients and more time documenting in the EMR to reduce the likelihood of successful litigation)

We observed these eight values in five physicians. While overlap existed, none of the physicians were observed to be the same in terms of their values. When we asked physicians about the EMR they often responded by saying, I think *x* about the EMR because I think *y* about my job. Because physicians' ideas about the EMR were so tightly connected to ideas about their job, we have reason to believe that values influenced their use of the EMR.

Physicians also spoke about their particular areas of expertise during conversations about the EMR. The following areas of expertise were expressed by physicians. The first part of each bullet is the stated expertise; the second part of each bullet demonstrates the connection between expertise and EMR use.

- **Expertise**: Reliance on physical exam for diagnosis; **EMR Use**: I use the EMR in ways that help me accurately diagnose patients through a physical exam (i.e. I do not let the EMR dictate which diagnostic tests I should run on my patients).
- **Expertise**: Extensiveness of referral network; **EMR Use**: I use the EMR in ways that enable collaboration with consulting physicians (i.e. I document all requests for referrals using a standard template).
- **Expertise**: Extracting data from medical records; **EMR Use**: I use the EMR in ways that help me organize patient information so that I can find it later when I need it (i.e. I document all phone conversations with patients in a separate and dated phone note).
- **Expertise**: Extracting information from patients; **EMR Use**: I use the EMR in ways that help me gather information from my patients (i.e. if I sense a patient needs time, I use the EMR to provide time for the patient to reflect and respond to my question).
- **Expertise**: Creating a sense of well-being for the patient; **EMR Use**: I use the EMR in ways that increases patient comfort in the exam room (i.e. I face the patient, not the EMR).
- **Expertise**: Organizing medical information; **EMR Use**: I use the EMR in ways that help me organize patient information (i.e. I use several different templates to document different types of medical visits).
- **Expertise**: The ability to deal with patient family members; **EMR Use**: I use the EMR as a tool to help patient family members feel part of the medical visit.

Physicians spoke about areas of expertise such as the ones noted above. While some overlap existed, within the group of five physicians none was observed to be completely the same in terms of expertise. Because physicians'

ideas about the EMR were also connected to their ideas about job expertise, we have reason to believe that differences in expertise influenced their use of the EMR.

Physicians displayed the most heterogeneity in EMR use behaviors of the worker roles we studied. In Family Works, we observed the following. One physician sought to use the EMR for all clinical documentation and much of his[†] communication with others in the organization about patients, despite admitting that using the EMR makes him less efficient and often makes his job more difficult. Another physician in Family Works used the EMR as little as possible. This physician stated that he did not believe that the EMR could help him practice medicine and he repeatedly mentioned a general distrust in the accuracy of the information in the EMR (and cited reasons for this distrust). This physician opted to use paper medical records and had his transcribed dictations scanned into the EMR for others in the organization to use. A third physician in Family Works developed EMR use behaviors that were somewhere "in-between" – using it to document easy/simple ("bread and butter") cases and using it less for more complicated/complex cases. In Women's World, we observed more nuanced differences in how the two physicians used the EMR. While they were both considered to be high users, they developed different strategies for keeping track of their patients and for creating work flows that included the EMR. For example, one physician in Women's World would often cut and paste information from a previous medical note into the current medical note to improve work flow. Another example of this more nuanced use behavior was observed when one of the physicians in Women's World created a space in the clinical documentation (in the EMR) where he would jot down personal facts/write special notes about personal aspects of patients' lives for the purpose of bringing this up in the next visit so the patient would feel that what they said to the physician mattered.

Almost every physician talked about the EMR in terms of its appropriateness, or its capacity to help them complete work tasks. The low user stated the following reasons for not using the EMR for clinical documentation: decreased efficiency when using the EMR, lack of computer skills, mismatch between what the EMR is and what medical practice is (the template design of the EMR often forced users to check boxes that most accurately resemble what was observed in the patient rather than write out exactly what the patient says or what the physician sees), and having a philosophy of medicine that sees the EMR as contradictory to practicing good medicine.

Almost every physician talked about the highly non-routine nature of their job tasks, and often included in comments that the EMR is less helpful in non-routine work. All physicians, regardless of use level, talked about how using the EMR made their job less efficient and more difficult. Some talked about how it changed the job of the physician for the worse – contributing to less good/worse medical practices. Physicians, in general, did not focus on the topic of increased availability of information across the organization. Physicians disagreed about the accuracy of the information in the EMR. All physicians were interested in having and using accurate information for decision making. They differed, however, in where they thought the most accurate information was located. For instance, the high user of the EMR in Family Works spoke about the need for accurate information for effective medical decision making in real time; he stated "the most accurate information about my patients is in the EMR." The low user of the EMR in Family Works also talked about the need for accurate information for effective medical decision making; he, however, stated "the most accurate information is in the patient sitting in front of me." This physician then went on to say that the information in the EMR is of unknown accuracy. The high user of the EMR said that patients are not good at remembering what medications and dosages they are taking; therefore; he relied on the EMR to have the most accurate medication list. The low user said that it is too easy for physicians to cut and paste medication lists using the EMR and that it is impossible to detect when medication lists have been copied and pasted without checking with the patient to see whether this list of medications is still accurate.

Clinical Support Staff

Clinical support staff's use of the EMR seemed to be less a function of their own values and expertise and more a function of the EMR use behaviors of their physician and of the patterns of EMR use occurring in their clinic. For instance, nurse use of the EMR was highly consistent with how the physician they worked with used the EMR. This

---

[†] While both male and female physicians worked in the two clinics we studied, we use male descriptors throughout the paper when describing behaviors or statements made by subjects whose identities could be compromised with knowledge of their gender. The scope of this paper does not include an investigation of the effects of gender on IT use. We recognize this as a limitation to understandings of differences in IT use that could be explained by differences in gender.

Human Behavior and IT

seems to be the nature of physician-nurse teams. EMR use behaviors among clinical support staff differed less than those of physicians and more than those of non-clinical support staff. We observed that nurses generally performed more administrative work with the EMR than did physicians.

In interviews with clinical support staff, we observed a consistent focus on information accessibility when using the EMR. Many in this role talked about the fact that the EMR (when compared to paper medical records) offered dramatic improvements in their ability to accomplish work tasks because it increased their access to information about patients and about the organization. Most clinical support staff described the EMR as a tool that was helpful because having access to more information meant that they could avoid "bothering the physician" or "interrupting the physician with questions," often saying "the information is right here" or "I know what to do because it [the EMR] tells me what to do." The clinical manager, a nurse, in Family Works used this recently available information to manage employees virtually. Being able to see when patients arrived at the clinic, when they were taken back to the exam room, when they were in the exam room with the physician, and when they exited the clinic allowed both managers and employees alike to quickly assess various clinic functions, such as how patients were flowing through the clinic, how busy the clinic was at any given time, how much work was piling up on a particular person's desktop, the ratio of nurse phone calls to nurse visits, etc.

We also found that clinical support staff were likely to believe information in the EMR to be more accurate than information in the paper medical record. Clinical support staff talked more than physicians did about administrative benefits of the EMR as compared with the paper medical record. Clinical support staff spoke about ways in which the EMR helped them check-in patients, schedule patients, and reconcile clinic schedules throughout the day.

Non-clinical Support Staff

EMR use behaviors of workers in non-clinical support roles varied the least among all of the worker roles we observed. Non-clinical support workers interacted least with physicians in doing their work tasks. Non-clinical support workers used information provided by the EMR less frequently in doing their jobs. The work in non-clinical support roles can be characterized as fairly routine, particularly when compared to the work of physicians and, to a large extent, the work of nurses and other clinical support roles. While we observed some focus on information accessibility in interviews with non-clinical support workers, as a group they talked less about information accessibility compared to clinical support staff. Interviews with non-clinical support staff indicated that these workers are less likely to question what they see in the EMR than what they see in a paper medical record.

Some overlap in focus on accuracy and accessibility of information occurred among clinical and non-clinical support workers. All support staff (clinical and non-clinical) spoke about both of these topics when talking about the EMR during interviews. Non-clinical support workers spoke more than physicians did about administrative benefits of the EMR as compared with the paper medical record. Table 1 provides examples of statements people made as they talked with us about the EMR.

EMR Use: Clinic Level

To understand organizational factors that may be influencing patterns of IT use in these organizations, we studied the social systems within the two clinics paying particular attention to the systems of relationships within the two organizations. Despite the fact that these two clinics were operating within the same larger organization and were using the same IT, and were treating a patient population with similar levels of clinical acuity, two distinct patterns of IT use had unfolded over time. The following section describes observations of IT use from our two cases.

Family Works

Relationships in Family Works were constrained by formal positions. Conversations among physicians were cordial and tended to not focus on work issues. EMR use in Family Works was fragmented and diverse. Nurses in Family Works agreed less about the nature of the relationships in the clinic than did physicians and BAs. BAs felt more positively about the relationships in the clinic than did nurses and physicians, and nurses felt more positively about the relationships in their clinic than did physicians. Family Works displayed high cognitive diversity at the physician level and low cognitive diversity at non-physician levels. In general, across all clinic members there was low agreement about the nature of the relationships.

Table 1. Summary of EMR focus topics by worker role supported by quotes from interviews and fieldnotes				
Physicians	Appropriateness	Frequently Discussed	Low Agreement	"I don't believe an [EMR] can help me do what I need to do for patients." "Using the EMR makes me less efficient, but I can see tremendous benefits in terms of managing patients by using it." "The EMR works for me when I am seeing simple, bread and butter, cases. But when I have a patient with multiple illnesses or a complicated medical history, it doesn't work as well for me."
	Accuracy	Moderately Discussed		"I need the most accurate information about the patient and that information is in the EMR." "To do my job, I need the most current and accurate information about the patient and that information is in the patient sitting right in front of me." "When people cut and paste from previous notes then it's hard to know what information is right."
	Accessibility			- Infrequent discussion topic -
Clinical Support Roles	Appropriateness			- Infrequent discussion topic -
	Accuracy	Moderately Discussed	High Agreement	"We don't have to worry about mistaking what labs the doctor wanted the patient to have done [with the EMR]." "It's not confusing when it's all [the information] right here…it's all here." "With the EMR, I don't have to bother the doctor as much to clarify things."
	Accessibility	Frequently Discussed		"This [the EMR] makes my job easier because so much more information is available for me to use. Before, we had to talk to people, or call people to find out things about patients. Now the information is right there in the computer so we can usually find answers to our questions without interrupting the doctor." "Before the EMR, we had to talk to the doctor when we had questions about what was going on. Now, we can look things up in the computer and we don't have to bother the doctor as much."
Non-Clinical Support Roles	Appropriateness			- Infrequent discussion topic -
	Accuracy	Frequently Discussed	High Agreement	"We don't have to worry about what the doctor meant because it's written right there in the computer." "There's less confusion about what I am supposed to do. With the EMR, it's there or it's not. It's not difficult to see what's in the computer." "We don't have to worry about misunderstanding what the doctor wanted because of messy handwriting."
	Accessibility	Moderately Discussed		"The EMR helps me do my work because I can look things up when patients ask questions. If a patient asks me about a lab they think the doctor has ordered for them and I don't see it in the lab system, I can look in the notes to see if they wanted the patient to have a lab test ordered and then I can order the lab." "With the EMR I can see what other people in the clinic are doing. So, I can see if a doctor is busy or if a nurse is waiting to hear back from a patient. This is really helpful when you get patients asking questions."

The three physicians in Family Works displayed high heterogeneity in EMR use. The non-physicians, clinical and non-clinical support staff, in this clinic worked to absorb differences in the ways that the physicians use the EMR. It seems that the non-physicians in this clinic have developed strategies for dealing with the diversity among the physicians – diversity in terms of EMR use but also in terms of their approach to practicing medicine. For instance, non-physicians in this clinic pay close attention to both patient and physician characteristics and know how to move patients (both new and existing) through the system (clinic). They routinely evaluate new patients as they enter the clinic in order to make decisions about which physician would best match the needs of the patient. These evaluations are improvised, not scripted, and they include relatively straightforward variables such as age, gender, and reason for medical visit as well as more intuitive considerations such as how much time the patient expects to spend with the physician and whether or not the patient is likely to return to the clinic.

Women's World

The relationships among the members of this clinic were cooperative, cohesive, and not constrained by formal positions in the clinic. EMR use in Women's World was in-sync and highly coordinated with extensive conversations across hierarchical levels focused on the central work of the clinic. Nurses in this clinic agreed the least about the relationships in the clinic; whereas, physicians agreed the most about the relationships in the clinic. Physicians felt more positively about the relationships in the clinic than did nurses and BAs. BAs felt more positively about the relationships in their clinic than did nurses. The two physicians in Women's World used the EMR in a highly congruent manner; displaying only very nuanced or fine-grained heterogeneity in EMR use. Both physicians are considered to be high users of the system – electing to use the EMR for all clinical documentation and to use many features offered by the system. When asked about paper charts, the nurse manager replied, "Why would we need them? There would be nothing in them. Yeah, they store them offsite, but we don't have a use for them anymore." The non-physicians (clinical and non-clinical support staff) in this clinic use the EMR in ways that are consistent with and that complement the use by the physicians. We observed considerable overlap in EMR use styles. For instance, all members of the clinical staff (including physicians) in this clinic used "quick text" to document information in the EMR. Quick text is a feature of the EMR that allows users to personalize their use of the system in a way that makes the work more efficient over time.

We observed an ongoing negotiation related to the clinic's use of the EMR taking place in Women's World. Clinical support staff and physicians were observed to be participating in an ongoing conversation about how to best use the EMR for the work of the group. We heard clinic members talk about a shifting of work both from the physicians to the nurses and from the nurses to the physicians; shifts in EMR use were moving in both directions. The clinical support staff and the physicians in this clinic were actively paying attention to how their work was going, including their work with the EMR, and making periodic assessments of changes that might make the work of the clinic more effective and more efficient. When needed, the clinic made changes to the parties named responsible for completing tasks through the EMR. These changes in tasks were decided upon as a group, but might be led by the nurse manager and/or the lead physician.

Discussion

Using a combination of methods including observation, interviews and questionnaires, we identified IT use behaviors at both individual and group levels of analysis that help explain relevant and interesting heterogeneity in IT use behaviors. Principally, we argue that in professional organizations, IT use by individuals is driven in part by the specific values and expertise held by each individual and that IT use by work groups is an emergent property arising from the nature of worker relationships. For these reasons, we argue that IT use in professional organizations will unlikely be homogeneous across individuals or across work groups – even when these entities seem highly similar. By describing specific individual and group level EMR use behaviors in two medical clinics, this study generates new understandings of how people working in seemingly similar professional organizations using the same IT can develop heterogeneous patterns of system usage.

Individual Level IT Use: Driven by Values and Expertise

Our findings indicate that IT use at an individual level is a function of fine-grained differences in the values and expertise that each professional brings to their work. Professionals are distinguished by their values and expertise,

and they have different ideas about how their work can and should be done. This occurs even in situations where two professionals have essentially identical work functions (i.e. two family practice physicians in the same medical clinic). We distinguish professional values from attitudes and subjective norms articulated in TAM studies (Davis et al. 1989; Davis 1989) in tat values are "a rationalized normative system of preferences for certain courses of action or certain outcomes" (Beyer 1981), whereas attitudes are "an individual's positive or negative feelings about performing the target behavior" (Azjen 1991, p. 216) and subjective norms are "the person's perception that most people who are important to him think he should not perform the behavior in question" (Fishbein and Azjen 1975, p. 302). We distinguish professional expertise from experience articulated in previous IT use studies (Venkatesh et al. 2003) in that we define expertise as shared agreement among knowledgeable actors about cause/effect relations and about preferences regarding possible outcomes (Thompson 1967), whereas experience describes a user's previous experience with a particular IT or IS. Values and expertise influence how professionals use IT. This at least partially explains why it is likely that one will observe physicians using an EMR differently from each other. Additionally, professionals differ in the relative power of the values that they bring with them to the firm. Nurses and administrative workers brought values to the system, but their values were, in general, not as influential in this setting as the values of physicians. Clinical support workers' values seemed to take a back seat to physicians' values as they worked with the EMR.

We also distinguish appropriateness, accuracy, and accessibility from perceived usefulness and perceived ease of use. We define appropriateness as the extent to which an individual believes an IT maps well onto, or fits, her job tasks. We define accuracy as the degree to which an individual believes the information stored in an IT is correct. We define accessibility as the extent to which an individual can view, manipulate and extend information using an IT. These three constructs emerged from the qualitative data analysis. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320). Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320). While it is likely that some conceptual overlap exists among these constructs, (i.e. between appropriateness and perceived usefulness and between accessibility and perceived ease of use), our intent here was to report our findings as generated by the data as opposed to categorizing them into existing results. Future research should consider how our three IT use constructs relate with previous IT use constructs.

While functions and roles are defined by the organization and often influence IT use in organizations, in professional organizations it is the expertise and values of workers, rather than worker functions and/or roles, that seem to drive IT use. If management does not organize work functions and roles taking into account differences in worker expertise and values, then IT use will likely differ among highly trained and professionally socialized individuals providing what seems to be the same function/working in the same role. For example, while two individuals may both be family physicians, the expertise each physician has may be quite different; and although they may have been trained similarly, their values may be highly different. In these conditions, IT use is likely to be different. The view of executives that IT is tightly tied to work processes and therefore should be the same across individuals does not adequately recognize differences between professionals who may seem to be much more alike than they really are. The impact of the task and work processes on IT use is weakened by the fact that the tasks in professional organizations are ambiguous and are often dominated by fundamental uncertainties.

Group Level IT Use: An Emergent Property

Our observations suggest that group level IT use in professional organizations is an emergent property. That is, the way a work group uses an IT arises from the relationships among workers in that group. We observed heterogeneity in EMR use across work groups. The patterns of EMR use we observed in Family Works were not the same as patterns of EMR use we observed in Women's World. Because Family Works is a primary care clinic and Women's World is an endocrinology clinic, it is tempting to explain this observation using a generalist/specialist argument. Based on conversations, however, with both generalists and specialists at MetroClinic, we believe that differences in EMR use between clinics are not well-explained by this argument. There are specialist clinics within MetroClinic with high levels of EMR use and specialist clinics with low levels of EMR use. The same is true for generalist clinics. What we observed, however, were differences in worker relationships between the two clinics. Because CAS theory suggests that IT use is emergent, arising from the relationships among agents, we believe that the heterogeneity in IT use that we observed between the two work groups can be explained by the differences in the relationship systems in the two work groups.

Because work groups in professional organizations are unlikely to be made up of homogenous agents relating in predictable ways around routine and unambiguous tasks, they are likely to develop idiosyncratic methods for incorporating IT into their work processes. Complicating matters even more is the fact that the work of professional organizations is dynamic - often making what was the task at one point in time, no longer the task at some other point in time. This is seen in the work of a clinic as it cares for its patients. Not only does the task of the clinic change from Patient X to Patient Y, but it also changes from Patient X at time t to Patient X at time t+1. What a patient with a history of depression expects and needs during an annual exam is likely to be different from what that same patient expects and needs during a return visit for acute onset of depression following a series of traumatic life events.

Our insights about group level IT use as an emergent property enrich the growing literature on the role of CAS theory in understanding organizational phenomena (MaGuire et al. 2006). CAS theory helps one understand that emergent properties are properties of a system that cannot be understood by analyzing the parts of the system; they arise from local interactions of agents (Holland 1998; Johnson 2001). The notion of emergence is not new in research at the intersection of IS and organizations. A recent special issue of the *Journal of Information Technology* included a paper discussing emergence in virtual teams (Curseu 2006). Majchrzak et al. (2007) have written about the formation of emergent response groups during disasters and examined this process through the lens of transactive memory systems. Markus and Robey (1988) articulated an emergent perspective of causal agency, a perspective that organizational change arises from unpredictable interactions among IT, people and organizations. Conceptualizing IT use as an emergent property in studies of IT use heterogeneity can enable interesting and relevant insights into both research and management efforts in this domain.

Both our own observations and a review of foundational work studying IT use enables the insight that IT use is an emergent property. Re-examining Barley's (1986) study of two radiology units from the perspective that IT use may be emergent provides an alternative explanation for how two seemingly similar work groups could implement the same technology, move through a similar sequence of implementation phases and end up at very different places in terms of how they integrated a technology into their work. Re-examining DeSanctis and Poole's (1994) study of group decision support systems from the perspective of IT use as emergent provides another way to explain heterogeneity in group use of IT. Considering IT use as an emergent property can extend current structuration based frameworks and introduce additional understandings about IT use. Fewer attributes of organizations move in predictable and/or controllable trajectories than once believed, and more attributes of organizations are being recognized as emergent with unpredictable dynamics. We suggest that IT use is an emergent property of organizations and believe that recognizing IT use in this way will shed light on current puzzles of IT use, uncover new puzzles of IT use and catalyze the development of new strategies for managing IT.

This study has limitations that must be acknowledged. The explanations for heterogeneity of IT use in professional organizations are based on insights gained from two work groups operating within one organization in one professional sector. Our primary objective was to conduct an in-depth investigation of how and why individuals and work groups operating in similar contexts and with the same IT develop different patterns of IT use. We traded off breadth of generalization in favor of depth of the analysis. The IT used was limited in scope which may have affected the scope of explanatory variables encountered. A more general purpose IT may lead to different usage patterns. Because emergence is a process variable, confirmation of our ideas on IT use as emergent requires longitudinal study. Additionally, the organizations studied were relatively small and interdependencies between these organizations and others were minimal. Future research should consider systems with greater interdependencies to see how degree of interdependence affects the amount of heterogeneity in IT use. For example, EMRs are normally tied to system-wide billing systems, an interdependency that may reduce heterogeneity of IT use. As is true of case research, some sources of heterogeneity could not be assessed.

Implications for Practice and Research

Executives often believe they want users to be homogenous in their use of IT. They often think this because they believe that idiosyncratic differences in IT use behaviors will prevent organizations from realizing the full benefits of their IT investment. Our findings suggest that IT use at both individual and group levels is highly heterogeneous. Adding to this challenge is the fact that professional work is dynamic and it often unfolds in unpredictable trajectories. For these reasons, IT use may be difficult, or perhaps impossible, to standardize in professional organizations. Resources/efforts to standardize how people in professional organizations use IT might be better

spent developing strategies for leveraging the patterns of IT use that emerge as individuals and groups work with an IT. Heterogeneity in IT use is likely to arise between individuals in the same role and groups with the same fundamental task. In professional organizations, efforts to standardize IT use is likely to be seen as efforts to de-professionalize work. Executives should try to fairly assess the consequences of heterogeneous IT use before attempting to eliminate it. Possible strategies for managing heterogeneous IT use includes developing relationships among professionals that encourage IT use knowledge transfers among workers as opposed to just between the IT group and the professional (i.e. enable decentralized conversations focused on IT and IT use). Alternatively, managers could evaluate IT use in terms of patterns of IT use as opposed to one element at a time (i.e. For what kinds of tasks does Dr. Jones typically use the EMR vs. Is Dr. Jones using the prescription fax feature on the EMR?). Evaluating patterns of IT use could help the organizational learn about current and future IT capabilities. IT design and implementations must involve the user in ways that frame user input in terms of values and expertise. Doing this would allow organizations to improve IT use by working within employee values and maximizing expertise as opposed to focusing on optimizing work tasks, particularly in contexts where optimization may not be the best approach.

Future efforts to understand heterogeneity of IT use in professional organizations may benefit from deeper investigations of the role of professional values and expertise in individual level IT use and of investigations of group level IT use as an emergent property. Research addressing heterogeneity of IT use in professional organizations should be conducted across multiple professional sectors in order to gain a better understanding of how IT use varies across a range of professional organizations. Both individual and group level IT use behaviors seem to be important in understanding heterogeneity of IT use and, therefore, multilevel studies must be considered in future research (Burton-Jones and Gallivan 2007). In order to understand collective IT use by work groups, the relationships among workers must be studied. Additional understandings of heterogeneity of IT use in professional organizations are likely to come from longitudinal studies as well as from comparative studies. Longitudinal multiple case studies designed to observe the dynamics of group level IT use and worker relationships over time would enable studies of these issues.

Conclusion

In this paper, we discuss observations from an exploratory study investigating the heterogeneity of EMR use in a large multi-specialty medical clinic. Our research effort was aimed at providing insights into how and why heterogeneous IT use arises in professional organizations. At an individual level, we observed values and expertise giving rise to heterogeneous IT use. At a group level, we observed relationships among workers leading to the emergence of heterogeneous IT use. This study enriches understandings of why individuals and groups working in professional organizations use IT differently from each other. Insights from this study can also be helpful in understanding heterogeneous IT use in other professional contexts such as law firms, professional services firms, accounting firms and universities. MetroClinic started with a set of models for how the EMR should be used in their organization. These models were categorized by work function (i.e. a physician model, a nurse model, a medical assistant model, etc.) and the different models were reflected in training programs. Idiosyncratic patterns of EMR use emerged, however, as individuals and groups in each clinic interacted around the EMR. Over time, both individuals (physicians) and groups (clinics) drifted apart in terms of their EMR use behaviors. The drivers of this movement were physician's values and expertise and the relationships among the members in the clinics. Hence, after six years, MetroClinic executives continued to see IT use unfolding in puzzling and unexpected ways. Recognizing heterogeneous IT use as a natural dynamic will make MetroClinic and organizations like them more capable of wisely manage their investments in IT.

Acknowledgements

Human Behavior and IT

References

Agar, M.H. *The Professional Stranger: An Informal Introduction to Ethnography*, (2nd ed.) Academic Press, San Diego, CA, 1996.

Ahuja, M.K., and Thatcher, J.B. "Moving Beyond Intentions and Toward the Theory of Trying: Effects of Work Environment and Gender on Post-Adoption Information Technology Use," *MIS Quarterly* (29:3) 2005, pp. 427-459.

Allen, P.M., Strathern, Mark, & Baldwin, James S. "The Evolutionary Complexity of Social Economic Systems: The Inevitability of Uncertainty and Surprise," in: *Uncertainty and Surprise in Complex Systems,* J. Reuben R. McDaniel, & Dean J. Driebe (Eds.), Springer-Verlag, Berlin, 2005, pp. 31-50.

Anderson, P. "Complexity Theory and Organization Science," *Organization Science* (10:3) 1999, pp. 216-232.

Anderson, R.A., and McDaniel, R.R. "Managing Health Care Organizations: Where Professionalism Meets Complexity Science," *Health Care Management Review* (25:1) 2000, pp. 83-92.

Azjen, I. "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes* (50:2), 1991, pp.179-211.

Barley, S.R. "Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments," *Administrative Science Quarterly* (31:1), 1986, pp. 78-108.

Beaudry, A., and Pinsonneault, A. "Understanding User Responses to Information Technology: A Coping Model of User Adaptation," *MIS Quarterly* (29:3) 2005, pp. 493-524.

Benveniste, G. *Professionalizing the Organization,* Jossey-Bass, San Francisco, 1987.

Bettis, R.A., and Prahalad, C.K. "The Dominant Logic: Retrospective and Extension," *Strategic Management Journal* (16:1) 1995, pp. 5-14.

Beyer, J.M. "Ideologies, Values, and Decision Making in Organizations," in: *Handbook of Organizational Design, Vol. 2,* W.H. Starbuck (Ed.), Oxford University Press, New York, NY, 1981, pp. 166-202.

Boisot, M., and Child, J. "Organizations as Adaptive Systems in Complex Environments: The Case of China," *Organization Science* (20:3) 1999, pp. 237-252.

Bourgeois, L.J., III, and Eisenhardt, K.M. "Strategic Decision Processes in High Velocity Environments: Four Cases in the Microcomputer Industry," *Organization Science* (34:7), 1988, pp. 816-836.

Brown, J.S., and Duguid, P. "Organizational Learning and Communities-Of-Practice: Toward a Unified View of Working, Learning, and Innovating," *Organization Science* (2:1), 1991, pp. 40-57.

Brown, S.L., and Eisenhardt, K.M. "The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations," *Administrative Science Quarterly* (42:1) 1997, pp. 1-34.

Burton-Jones, A., and Gallivan, M.J. "Toward a Deeper Understanding of System Usage in Organizations: A Multilevel Perspective," *MIS Quarterly* (31:4) 2007, pp. 657-679.

Chidambaram, L. "Relational-Development in Computer-Supported Groups," *MIS Quarterly* (20:2) 1996, pp. 143-165.

Cohen, A. "The Inside Story: Corps are Slowly Starting to Realize," *American Lawyer* (27:6) 2005.

Coulter, S. "Why So Much Resistance," *Law Technology News* (12:9) 2005.

Cox, T. "Cultural Diversity in Organisations: Intergroup Conflict," in: *Classic Readings in Organizational Behavior,* J.S. Ott (Ed.), Wadsworth Pub. Co., Belmont, 1993.

Curseu, P.L. "Emergent States in Virtual Teams: a Complex Adaptive Systems Perspective," *Journal of Information Technology* (21:4) 2006, pp. 249-261.

Daft, R.L., and Lengel, R. H. "Information Richness: A New Approach to Managerial Behavior and Organization Design," in: *Research in Organizational Behavior,* L.L. Cummings (Ed.), JAI Press, Greenwich, CT, 1984, pp. 191-233.

Davis, F.D. "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology," *MIS Quarterly* (13:3) 1989, pp. 318-340.

Davis, F.D. Bagozzi, R.P. Warshaw, P.R. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science* (35:2) 1989, 982-1003.

DeSanctis, G., and Poole, M.S. "Capturing the Complexity in Advanced Technology: Adaptive Structuration Theory," *Organization Science* (5:2) 1994, pp. 121-147.

Edmondson, A.C. "Psychological Safety and Learning Behavior in Work Teams," *Administrative Science Quarterly* (44:2), 1999, pp. 350-383.

Edmondson, A.C. "Speaking up in the Operating Room: How Team Leaders Promote Learning in Interdisciplinary Action Teams," *Journal of Management Studies* (40:6) 2003, pp. 1419-1452.

Edmondson, A.C., Bohmer, R.M., and Pisano, G. "Disrupted Routines: Team Learning and New Technology Implementation in Hospitals," *Administrative Science Quarterly* (46:4) 2001, pp. 685-716.

Faraj, S., and Xiao, Y. "Coordination in Fast-Response Organizations," *Management Science* (52:8) 2006, pp. 1155-1169.

Fiol, C.M., and O'Connor, E. "Stuff Matters: Artifacts, Identity and Legitimacy in the U.S. Medical Profession," in: *Artifacts and Organizations,* A. Rafaeli and M. Pratt (Eds.), Lawrence Erlbaum Associates, Inc., Mahwah, NJ, 2004.

Fishbein, M. and Ajzen, I. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA, 1975.

Freidson, E. *Professionalism Reborn: Theory, Prophecy, and Policy,* The University of Chicago Press, Chicago, IL, 1994.

Gell-Mann, M. "Complex Adaptive Systems," in: *Complexity: Metaphors, Models and Reality,* D.P. G. Cowan, & D. Meltzer (Eds.), Addison-Wesley, Reading: MA, 1994, pp. 17-45.

Granovetter, M.S. "The Strength of Weak Ties," *American Journal of Sociology* (78:6), May 1973, pp. 1360-1380.

Haveman, H.A. "The Ecological Dynamics of Organizational Change: Density and Mass Dependence in Rates of Entry into New Markets," in: *Evolutionary Dynamics of Organizations,* J.A.C. Baum and J.V. Singh (Eds.), Oxford University Press, New York, 1994, pp. 152-166.

Hillestad, R., Bigelow, J., and Bower, A. "Can Electronic Medical Record Systems Transform Health Care? Potential Health Benefits, Savings, and Costs," *Health Affairs* (24:5) 2005, pp. 1103-1117.

Holland, J.H. *Emergence: From Chaos to Order* Addison-Wesley, Reading, MA, 1998.

Huber, G.P. "The Nature and Design of Post-Industrial Organizations," *Management Science* (30:8) 1984, pp. 47-71.

Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century.* National Academy Press, Washington, D.C., 2001.

Jarvenpaa, S.L., and Leidner, D.E. "Communication and Trust in Global Virtual Teams," *Organization Science* (10:6) 1999, pp. 791-815.

Jasperson, J., Carter, P.E., and Zmud, R.W. "A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems," *MIS Quarterly* (29:3) 2005, pp. 525-557.

Johnson, S. *Emergence: The Connected Lives of Ants, Brains, Cities, and Software,* Addison-Wesley, New York, NY, 2001.

Jones, A. "The Big Squeeze," *Law Firm, Inc.* (5:7) 2007.

Kim, S.S., and Malhotra, N.K. "A longitudinal Model of Continued IS Use: An Integrative View of Four Mechanisms Underlying Postadoption Phenomena," *Management Science* (51:5) 2005, pp. 741-755.

Kohn, L., Corrigan, J., and Donaldson, M. *To Err is Human: Building a Safer Health System* National Academy Press, Washington, D.C., 2000.

Kramer, R.M. "Trust and Distrust in Organizations: Emerging Perspectives, Enduring Questions," *Annual Review of Psychology* (50) 1999, pp. 569-598.

MaGuire, S., McKelvey, B., Mirabeau, L., and Oztas, N. "Complexity Science and Organization Studies," in: *The SAGE Handbook of Organization Studies,* S.R. Clegg, C. Hardy, T.B. Lawrence and W.R. Nord (Eds.), SAGE Publications, Ltd, Thousand Oaks, CA, 2006.

Majchrzak, A., Jarvenpaa, S.L., and Hollingshead, A.B. "Coordinating Expertise Among Emergent Groups Responding to Disasters," *Organization Science* (18:1) 2007, pp. 147-161.

Majchrzak, A., Rice, R.E., Malhotra, A., King, N., and Ba, S. "Technology Adaptation: The Case of a Computer-Supported Inter-Organizational Virtual Team," *MIS Quarterly* (24:4) 2000, pp. 569-599.

Markus, L.M., and Robey, D. "Information Technology and Organizational Change: Causal Structure in Theory and Research," *Management Science* (34:5) 1988, pp. 583-598.

McDaniel, R.R., Jr., and Driebe, Dean J. "Complexity Science and Health Care Management," in: *Advances in Health Care Management,* M.D.F. John D. Blair, & Grant T. Savage (Eds.), JAI Press, Stamford, CN, 2001, pp. 11-36.

McKelvey, B. "Avoiding Complexity Catastrophe in Co-evolutionary Pockets: Strategies for Rugged Landscapes," *Organization Science* (10:3) 1999, pp. 294-321.

Newman, M., and Robey, D. "A Social Process Model of User-Analyst relationships," *MIS Quarterly* (16:2) 1992, pp. 249-266.

Orlikowski, W.J. "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3:3) 1992, pp. 398-427.

Human Behavior and IT

Orlikowski, W.J. "Learning from notes: Organizational Issues in Groupware Implementation," *Information Society* (9:3) 1993, pp. 237-250.

Orlikowski, W.J. "Improvising Organizational Transformation Over Time: A Situated Change Perspective," *Information Systems Research* (7:1), 1996, pp. 63-92.

Orlikowski, W.J. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations.," in: *Organization Science*, INFORMS: Institute for Operations Research, 2000, pp. 404-428.

Orlikowski, W.J., and Robey, D. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2:2) 1991, pp. 143-169.

Paul, D.L., and McDaniel, Reuben R., Jr. "A Field Study of the Effect of Interpersonal Trust on Virtual Collaborative Relationship Performance," *MIS Quarterly,* (28:2), June 2004, pp. 183-227.

Poole, M.S., and Desanctis, G. "Structuration Theory in Information Systems Research: Methods and Controversies," in: *The Handbook of Information Systems Research,* M.E. Whitman and A.B. Woszczynski (Eds.), Idea Group Inc, Hershey, 2004, pp. 206-247.

Prigogine, I. *The End of Certainty,* The Free Press, New York, NY, 1996.

Prigogine, I. and Stengers, I. *Order Out of Chaos: Man's New Dialogue with Nature,* Bantam Books, New York, NY, 1984.

Stacey, R.D. "The Science of Complexity: An Alternative Perspective for Strategic Change Processes," *Strategic Management Journal* (16:6) 1995, pp. 477-495.

Stroebel, C.K., McDaniel, R.R., Jr., Crabtree, B.F. Miller, W.L., Nutting, P.A., and Stange, K.C. "How Complexity Science Can Inform a Reflective Process for Improvement in Primary Care Practices," *Journal on Quality and Patient Safety* (31:8), August 2005, pp. 438-446.

Taylor, S., and Todd, P.A. "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* (6:2) 1995, pp. 144-176.

Thompson, J.D. *Organizations in Action; Social Science Bases of Administrative Theory,* McGraw-Hill, New York, 1967.

Tushman, M.L., and Anderson, P.C. "Technological Discontinuities and Organizational Environments," *Administrative Science Quarterly* (31:3), 1986, pp. 439-465.

Valdes, I., Kibbe, D.C., Tolleson, G., Kunik, M.E., and Peterson, L.A. "Barriers to Proliferation of Electronic Medical Records," *Informatics in Primary Care* (12:1) 2004, pp. 3-9.

Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27:3) 2003, pp. 425-478.

Waldrop, M.M. *Complexity: The Emerging Science at the Edge of Order and Chaos* Simon & Schuster, New York, NY, 1992.

Weick, K.E. "The Collapse of Sense Making in Organizations: The Mann Gulch Disaster," *Administrative Science Quarterly* (38:4) 1993, pp. 628-652.

Weick, K.E., and McDaniel, R.R., Jr. "How Professional Organizations Work: Implications for School Organization and Management," in: *Schooling for Tomorrow: Directing Future Reforms to Issues that Count,* (Ed.), Allyn and Bacon, Boston, 1989, pp. 330-355.

Weick, K.E., and Roberts, K.H. "Collective Mind in Organizations: Heedful Interrelating on Flight Decks," *Administrative Science Quarterly* (38:3), 1993, pp. 357-381.