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Päivi Häkkinen, Editor in Chief

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Original Articles

Human Technology is an interdisciplinary, scholarly journal that presents innovative, peer-reviewed articles exploring the issues and challenges surrounding human-technology interaction and the human role in all areas of our ICT-infused societies.

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From the Publisher

THE JOURNAL *HUMAN TECHNOLOGY*: AN ONGOING RESOURCE FOR HUMAN-TECHNOLOGY RESEARCH

Antti Hautamäki
Director
The Agora Center
University of Jyväskylä, Finland

The Agora Center was established in 2002 to provide a platform for interdisciplinary research within the field of human technology. As an independent institute within the University of Jyväskylä, the Agora Center draws together interdisciplinary research teams from a variety of fields, such as information technology, cognitive science, psychology, education, communication, and so on. By establishing international networks and integrating researchers from a variety of countries, the Agora Center team furthers new perspectives on the intersection of humans and technologies. The goal of all of this, then, is to encourage interdisciplinary and intercultural dialogue, cooperation, and collaboration; to encourage and create multiperspective insights and resourcefulness; and to explore creative human-centered solutions to many "wicked problems": those challenges in life and society that are particularly complex, multifaceted, and require innovative, astute, and productive resolutions.

As our researchers began their interdisciplinary work, we soon found that most journals that focus on a particular field had little interest in the sometimes "messy" reality of interdisciplinary research. So, we decided to forge our solution: *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, which was launched in April 2005. Our fully open-access journal has provided a space for the publication of a variety of interesting research topics either as open submission issues or as part of special/themed issues. The papers published in *Human Technology* have emphasized the human side of technology, for example, in providing a better understanding of the challenges and benefits for humans brought about in a highly technological environment, and deeper investigations into the processes and products facilitated by technologies. As a small and growing journal, we are proud of the contribution we have been able to make to multiple fields of scientific inquiry. In a large perspective we see our open-access journal as an important step toward open science.

Now *Human Technology* is in its eighth volume, having published scores of manuscripts. We also welcome a new editor in chief, Professor Päivi Häkkinen, who has contributed to the interdisciplinary fields of human-technology for nearly two decades and has served as a board

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member of the Agora Center. During her 3 years at the helm of *Human Technology*, we look toward the enhanced profile of the journal and perhaps new perspectives on scholarly publishing. At this time, I also thank Professor Pertti Saariluoma, the journal's founding editor in chief, for his years of dedication in establishing *Human Technology* as an important resource and vehicle for human-technology researchers around the world.

We, the staff of *Human Technology* and the Agora Center, look forward to many decades of opportunity to contribute to the interdisciplinary fields of human-technology research. We thank those who have published and edited issues for our journal, who have served on our editorial board, and the academics and researchers around the world who have provided their time and expertise as reviewers. And we encourage our readers to participate with us—through manuscript submissions, reviews, and special issues—to help *Human Technology* continue and grow as an asset in scholarly research.

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From the Editor in Chief

TENSIONS IN HUMAN–TECHNOLOGY RESEARCH

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As I begin my tenure as editor in chief of *Human Technology: An Interdisciplinary Journal of Humans in ICT Environments*, I am pleased both personally and professionally to continue building the significance of this journal in the scientific literature of many research fields. The founding editor in chief, Professor Pertti Saariluoma, has contributed greatly to defining the basis for the scope of *Human Technology*. During his editorial tenure, the papers published in the journal have addressed a wide variety of questions related to human–technology research. Earlier issues of the journal have covered research on mobile communication, innovations, ICT and education, human technologies for special needs, games and smart environments, culture, creativity and technology, distributed leadership and on-line communities, design-use relationships, cognition and HCI, psychology of programming, and creativity in software design. This variety of fields and topics certainly illustrates the multidisciplinary nature of human–technology research. In the inaugural issue of the journal, Professor Saariluoma stated that becoming familiar with the wide variety of questions at the intersection of humans and technology and the potential solutions demands exploration irrespective of the field of research (Saariluoma, 2005). Clearly, no single theory or particular approach will solve the totality of human–technology problems (e.g., the grand challenges or "wicked problems" in many societies). One of the guiding principles in multidisciplinary research, therefore, has been to foster and support openness towards multiple schools of thoughts (Stahl & Hesse, 2011).

It is evident that multidisciplinary fields of research include theoretical and methodological diversity. For example, in the research field of computer-supported collaborative learning,[1] no one particular theoretical view or analysis method defines the field; rather the object of the study, in this case some type of collaborative use of technology for teaching and learning purposes (Clarà & Mauri, 2010), is the focus. To move ahead, then, researchers and publishers must account for alternative perspectives and dialogues as necessary prerequisites for any multidisciplinary field of research, such as computer-supported collaborative learning or human–technology research in general. Moreover, the confrontation amid a diversity of viewpoints and the critique of established paradigms are typical for scientific revolutions. However, this diversity makes the articulation of theoretical perspectives, methodological choices, and research results complicated. According to Clarà and Mauri (2010), it is not the diversity itself that complicates

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multidisciplinary research, but rather the difficulty of positioning specific results within this diversity. Reliably identifying the theoretical and methodological tensions enables the dialectic development of different approaches to the field (Clara & Mauri, 2010).

In addition to tensions between the different approaches and paradigms, the relation between scientific and practical perspectives remains in constant tension in human–technology research. Although the scientific community at large can regard many principles of human–technology research as highly promising, implementing them among broader communities of practitioners is challenging. As Professor Saariluoma stated in 2010, human–technology interaction interests both academics and industry. Scientists aim to understand how things are, whereas industry is more interested in how things should be (Saariluoma, 2010). One example of this contradiction is the field of educational technology, where many scientific promises are difficult to implement, especially among the broader community of teachers and students. A typical scenario is that, although teachers and students have access to computers, technology is not used in pedagogically relevant ways, that is, how researchers have defined as promising. Advanced pedagogical practices are often developed in research-based "light-house" projects, rather than by modifying good practices as part of a new culture of schooling. Developing sustainable pedagogical practices requires long-term commitment and close collaboration among and between teachers and researchers. Restated differently, sustainable pedagogical practices utilizing technology are not found ready-made, but emerge only from the interactions of and between practitioners and researchers. In education, and many other fields of human–technology interaction, changes in the learning and use cultures are slow to grow and to be integrated and involve long-term effort (see, e.g., the special issue of ICT and Education; Kankaanranta, 2005).

The continuous tensions between the various theoretical and methodological approaches, as well as between scientific and practical stances, swirl within a wide range of views, and beliefs abound about the role of technology in our learning society. According to the most optimistic opinions, technology plays a tremendous role in leading society toward a learning revolution. But critical views on technological hype also frame the discussions. For example, a vast discussion continues regarding the phenomenon of the so-called Net Generation students (Tapscott, 2009), or digital natives (Prensky, 2001). Many assume that this generation—born in the Internet age—can access, use, and create information and knowledge in different and more flexible ways than earlier generations. Although the ubiquitous availability and use of the latest technology enable contextualized learning experiences by making information available at any time and place, several challenges to learning must be addressed. Multitasking of information resources might lead to increased cognitive load and surface-level processing of information at the cost of coherent thinking. "Grasshopper minds," with parallel processing and a short attention span (Papert, 1994), can utilize visually organized information, but might have challenges in producing conceptually well-organized texts and solving complex problems (Carr, 2010). Growing interest in these areas has resulted in many assumptions but substantially fewer theoretical elaborations and empirical research on how Net Generation students actually learn, collaborate, and use technology. Indeed, the rapid development of technology and on-line services requires rethinking of the traditional views on human–technology interaction. The urgent need in every discipline involved in human–technology inquiry is a deep and critical analysis of the human perspective as a core part of technology development.

Diverse and multidisciplinary approaches toward human–technology interaction are evident as well in this issue of the journal. We open the issue with papers focused on understanding the practices and innovations in work organizations. In their article, **Luoma-aho, Vos, Lappalainen, Lämsä, Uusitalo, Maaranen, and Koski** present the theoretical basis for a measurement system that will help organizations create and advance a more innovative climate. Their work arises from multidisciplinary research on intangible assets, drawing on the literature from disciplines such as psychology, human resources management, communication, information technology, and marketing. The factors they identified as key assets of organizational innovativeness vary from the individual to the organizational levels, and form the basis for future testing.

Koskinen, Luomala, and Maaranen continue the discussion on intangible assets in organizational innovation by focusing on ICT-related intangibles. Specifically, they attend to connectedness and organizational flexibility as enablers of innovation. Through a Delphi study, these researchers identified multiple constraints on organizational innovation and, from these, results indicators were formulated. Koskinen and her colleagues highlight the importance of ICT-related factors, but emphasize that their nature is closely related to other organizational factors and people.

The importance of the human perspective in developing work practices is emphasized in the study by **Winman and Rystedt**. Their study focuses on electronic patient records (EPRs) as part of medical practice. EPRs are used to improve interprofessional communication and decision making. According to their results, EPRs should not be viewed as definitive or constraining knowledge but rather flexible technologies that help to deconstruct information into patterns based on shared expectations within the work environment, and thus prestructuring a pathological reality. Yet Winman and Rystedt point to the human agent within technology usage as a crucial role. Namely, their results indicate that the members' knowledge on bridging the standardized categories in EPRs and their local meanings is a necessary prerequisite for how EPRs can support interprofessional collaboration.

The users' perspective and voice is strongly present in research on digital storytelling. Digital storytelling has been theorized as a means to disseminate the stories and voices of "ordinary" people. The paper by **Hancox** discusses a digital storytelling project in Australia as a means to give voice to and validate the lived realities of those marginalized and/or traumatized in societies. She concludes that the standard forms, expectations, and processes of employing digital storytelling as a method need to be revisited and reformed to address the specific needs of marginalized storytellers.

Human technology research aims to take user's perspective into account through practices such as interaction design. In line with this goal, **Lehane** focuses in his paper on interaction design and the attempt to make system designs intuitive. Based on his action research and grounded theory analysis, Lehane outlines categories for system acceptance surveys and research during the transitions in organizational technologies.

As the editor in chief, it is my honor and pleasure to continue the deserving work of *Human Technology*'s founding editor, Professor Saariluoma, who stated in the inaugural issue of the journal, "Instead of intuitions, we need serious scientific analysis of human role in and interaction with technology" (p. 2). *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments* will continue to offer an open forum for the scientists who

wish to improve understanding through multidisciplinary research into the wide diversity of human technology topics. In that vein, the papers in this issue demonstrate the need for diverse approaches and methods, but also interaction between these approaches.

ENDNOTE

1. For more information, see http://ijcscl.org/

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ADDED VALUE OF INTANGIBLES FOR ORGANIZATIONAL INNOVATION

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Abstract: *The purpose of this paper is to present the theoretical basis for a measurement and improvement system that will help organizations create a more innovative climate. The role of intangible assets in contributing to organizational innovativeness is clarified within six hypotheses on the basis of a cross-disciplinary literature review combining studies from psychology, human resources management, communication, information technology, and marketing. These factors range from the individual level to interaction with the environment surrounding the organization, and involve (a) individual psychological flexibility, (b) institutional and interpersonal trust, (c) diverse human resources, (d) strategic transformational leadership, (e) agile information and communication technology systems, and (f) coproduction of the brand with customers.*

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The critical factors point out areas for organizational innovation, and we advocate a cross-disciplinary approach to ensure that diverse aspects of organizational life are considered. These hypotheses require testing in order to assist organizations in improving their innovativeness.

Keywords: *innovation, intangibles, flexibility, organizational trust, transformational leadership.*

INTRODUCTION

The importance of innovation and innovativeness for organizational survival has been noted in the literature (Nonaka & Takeuchi, 1995; Schumpeter, 1950; Subramanian & Nilakanta, 1996; Wang & Ahmed, 2004). The construct is dynamic because "innovativeness is a driver of growth, quality is a driver of profit, and both are drivers of market value" (Cho & Pucik, 2005, p. 569). How this innovativeness is achieved, however, has been less evident. Previous studies have confirmed factors such as organizational learning (March, 1991), organizational culture (Ahmed, 1998), institutional trust (Ellonen, Blomqvist, & Puumalainen, 2008), and absorptive capacity (Cohen & Levinthal, 1990) as central. However, understanding innovative behavior in organizations remains a challenge, partly due to the various definitions of innovation used in the field (Cho & Pucik, 2005) and partly due to the interdisciplinary nature of innovation.

We suggest in this paper that innovation in organizations is increasingly achieved by investments in intangibles (Lev, 2001). In line with the resource-based view (Penrose, 1959), we propose that sustainable competitive advantage results from intangible assets because they enable the accumulation of other types of assets. Intangible assets are inimitable, rare, and nontradable (Lev, 2001), and include brand, knowledge, flexible technology, personnel skills, contracts, and efficient procedures (Wernerfelt, 1984). We believe that understanding the role of intangible assets for organizational innovativeness needs a more thorough approach than has been attempted thus far, and consider intangible assets to matter inside the organization, but also within the organization's relations with its external stakeholders. Intangible assets are seen particularly valuable for knowledge-intensive services and organizations (Koch & Strotmann, 2008), but aid innovation only if aligned with the organizational strategy (Kaplan & Norton, 2004). "Because resources and strategies required for the implementation of innovation and quality focus are different, a firm has to master how to allocate its limited resources in ways aligned with its strategic goals" (Cho & Pucik, 2005, p. 556).

Recently, fostering an innovative culture and furthering creativity have become goals for many organizations. Several studies have demonstrated that innovativeness requires specific conditions, an important one of which is organizational culture (Ahmed, 1998; e.g., Judge, Fryxell, & Dooley, 1997; Martins & Terblanche, 2003; Ulijn & Weggeman, 2001; Westwood & Low, 2003). Therefore, it can be argued that having an innovative culture within an organization has a strongly positive effect on organizational innovation because it motivates people working within the organization to deal with novelty, individual initiatives, and collective actions, while equally shaping their understandings and behaviors in regard to risks and opportunities (Kaasa & Vadi, 2008).

However, to become innovative demands more from an organization than simply debate and resources: It requires an organizational culture—both explicit and implicit—that guides the organization's members to strive constantly for innovation (Ahmed, 1998). We believe that more precision is required in seeking to understand the role of intangible assets: Several central areas of organizational innovation, such as the role of individuals in organizations—particularly their ability to adapt to new or changing conditions—have been overlooked (Georgsdottir & Gets, 2004). Although intangibles have been addressed in relation to specific fields, such as manufacturing (de Meyer, Miller, Nakane, & Ferdows, 1989) or information and communication technology (Chesbrough, 2003; Conboy & Fitzgerald, 2004), many issues remain unstudied.

By bringing critical factors for innovation together, we feel this paper contributes to interdisciplinary research through our developing performance indicators for measuring the contribution of intangibles for innovation, as inspired by Kaplan and Norton (2004). Our project aims at a better understanding of the role of intangibles and possibly increasing the value they add for organizational innovation. This cross-disciplinary paper delivers, as a first step, the critical factors found as hypotheses for further research.

The paper is organized as follows. First, we present a short introduction to intangible assets and their role in organizational innovativeness. Second, innovativeness in organizations is briefly defined. We then discuss the six hypotheses on how intangibles contribute to organizational innovativeness: a) individual psychological flexibility, b) institutional and interpersonal trust, c) diverse human resources, d) strategic transformational leadership, e) agile information and communication technology, and f) coproduction of the brand with customers. To conclude, we summarize and discuss our findings, present a model embodying the innovativeness values, and suggest considerations for future studies.

INTANGIBLE ASSETS

Intangible assets, or in short *intangibles*, refer to something indefinite and incapable of being perceived by the senses: Intangibles lack physical substance or intrinsic productive value, yet they are saleable, although not materially or physically (Diefenbach, 2006). Intangibles can be thought of as capital, like other forms of capital, in that organizations can invest in them. They consist of efforts and inputs that often take long periods of time to develop and become productive (Dean & Kretschmer, 2007). Although typically nonphysical, intangibles are long-lived and have measurable value. Examples of intangibles in the context of organizations include trust, ideas, skills, reputation, processes, established social networks, patents, trademarks, and brands (Contractor, 2000; Dean & Kretschmer, 2007; Gardberg & Fombrun, 2006; Kaplan & Norton, 2004; Petrick, Scherer, Brodzinski, Quinn, & Ainina, 1999). Each of these adds unique value to the organization, yet they often remain uncalculated and underappreciated, individually and collectively, due to their intangible nature.

Intangibles are central to innovativeness and renewal in organizations today, and they "surpass physical assets in most business enterprises, both in value and contribution to growth" (Lev, 2001, p. 7). Moreover, intangibles enable the accumulation of other types of capital and, as such, constitute a central resource for organizations. As Cho and Pucik (2005, p. 556) indicated, a firm's capability to be innovative while simultaneously delivering quality

products and services to its customers represents its intangible resource. When intangibles are discussed, concepts such as social capital, human capital, intellectual capital, communication capital, and trust capital take center stage. Gardberg and Fombrun (2006, p. 330) suggested that once intangibles, such as reputational capital, are well established, they protect the organization's success in the long run. Intangibles currently tend to remain off organizational balance sheets, even though "including intangibles [there] allows for a more accurate quantification of the sources of economic growth and of the dynamics of production and capital accumulation, and the aggregate empirical analysis of productivity and innovation is improved" (Corrado, 2009, as cited in Mackie, 2009, p. 25).

In sum, the basic assumption behind all intangibles is that they become capital only when they provide something useful and applicable. Even more vital, however, is that intangibles are valuable only when they align with the organization's strategic goals (Kaplan & Norton, 2004). Investments can be made in intangibles, but they typically yield results only over long periods of time (Lev, 2001). Moreover, the profitability of such investments is difficult to quantify accurately (Cinca, Molinero, & Queiroz, 2003; Rothstein & Stolle, 2003), despite the importance of intangibles for organizational innovativeness.

DEFINING ORGANIZATIONAL INNOVATIVENESS

Organizational innovativeness refers to the innovative abilities needed within an organization and among its employees. Innovativeness is "the overall internal receptivity to new ideas and innovation that is demonstrated through individuals, teams and management, and that enables the formation of an innovative culture" (Wang & Ahmed, 2004, p. 205). Innovativeness is based on the concept of innovation, the process of creating and delivering new customer value in the marketplace (Carlson & Wilmot, 2006).

Drucker (1993) viewed innovation as simply the application of knowledge to produce new knowledge, whereas Griffiths and Zammuto (2005) emphasized the role of continuous improvement. Hult, Hurley, and Knight (2004) have suggested innovation is a means for adapting an organization, whether as a response to changes occurring in its internal or external environment or as a preemptive move taken to influence that environment. Success in innovation results from naturalizing an innovation's novelty and managing expectations (Hargadon & Douglas, 2001).

Some suggest that the best innovations result from producing new customer value (e.g., Carlson & Wilmot, 2006), whereas others (e.g., Verganti, 2006) note that customers do not always know what they should or could want (Leonard-Barton & Doyle, 1996; von Hippel, 1988; Workman, 1993). Verganti (2006) argued for the need to see the full context of client demand and meanings, and that customer wants often reflect the symptoms of the situation more than actual needs. New sociocultural models should be established. For example, the model of a design-driven innovation (Verganti, 2006) embodies innovation as an aim to redefine the market, to require a culture of collaboration and the development of both internal and external teams, and to support flexibility as a means to monitor and act quickly on emerging trends. Such an innovation is argued to be sustainable because it is not dependent on factors such as technological development, but rather is focused around creating new meanings (Verganti, 2006).

Baregheg, Rowley, and Sambrook (2009) conducted a literature review on the definition of innovation, identifying 60 definitions of the concept. They synthesized, then, the main attributes of innovation as follows:

- *Nature of innovation* refers to the form of innovation as in something new or improved;
- *Type of innovation* refers to the kind of innovation, as in the type of output or the result of innovation (e.g., product or service);
- *Stages of innovation* refers to all the steps taken during an innovation process, which usually start from idea generation and end with commercialization;
- *Social context* refers to any social entity, system or group of people involved in the innovation process or environmental factors affecting it;
- *Means of innovation* refers to the necessary resources (e.g., technical, creative, financial) that need to be in place for innovation;
- *Aim of innovation* is the overall result that the organizations want to achieve through innovation. (Baregheg et al., 2009, p. 1331–1332)

Consequently, innovation is defined as a "multi-stage process whereby organizations transform ideas into new/improved products, services, or processes to advance, compete and differentiate themselves successfully in their marketplace" (Baregheg et al., 2009, p. 1334). Innovation, then, always relates to the ability of individuals to create and maintain connections to each other, both inside and outside an organization (Jansen, Van den Bosch, & Volberda, 2006).

Next, attention is turned toward how intangibles contribute to the goal of organizational innovativeness. Overall, intangible assets can enhance connectedness, which is needed to anticipate or react to emerging markets and changing customer needs. Moreover, intangible assets can have a positive impact on organizational innovation by enhancing flexibility (de Meyer et al., 1989), which is needed to implement change and renewal within organizations.

SIX HYPOTHESES FOR ORGANIZATIONAL INNOVATIVENESS

For this paper, the role of intangible assets in contributing to organizational innovativeness was studied through a cross-disciplinary investigation and analysis of existing literature. We combined studies from psychology, human resources management, communication, information technology, and marketing. Keyword searches were conducted within each discipline and their central journals, looking for key topics and reoccurring issues. Relevance was central, and those articles that showed a clear link between intangible assets and their contribution to innovativeness received the most attention. Several suggestions for key topics were surfaced within each discipline, and the topics were discussed within the research group. The topics were grouped onto different levels, from micro to macro. After the discussion, the most relevant hypotheses for intangibles that contribute to organizational innovativeness were identified: a) individual psychological flexibility, b) institutional and interpersonal trust, c) diverse human resources, d) strategic transformational leadership, e) agile information and communication technology, and f) coproduction of the brand with customers. These six hypotheses are now addressed individually.

Individual Psychological Flexibility

It is generally agreed that innovation is rooted in the contributions of flexible and open-minded individuals (Woodman, Sawyer, & Griffin, 1993). Organizations consist of individuals with a shared aim, and hence the capacity to develop and foster innovation within employees plays a crucial role in organizational development and success (Reuvers, Van Engen, Vinkenburg, & Wilson-Evered, 2008, p. 227–228). It has been argued that the key drivers enabling an organization to remain competitive are flexibility and willingness to change (Ståhle, Sotarauta, & Pöyhönen, 2004). As noted by Thurston & Runco (1999), flexible individuals are able to adapt to new, challenging circumstances. They have the ability to adopt new strategies to solve a problem; to redefine the problem in order to find a new solution (adaptive flexibility); or to find several solutions to a problem (spontaneous flexibility). Thus, flexibility could be regarded as an essential behavioral or cognitive ability for innovation, as well as for innovative actions in organizations. Psychological flexibility in individuals is a vital aspect for organizational learning that has been established as central to organizational innovativeness (e.g., Argyris & Schön, 1982; Cohen & Levinthal, 1990; Wang & Ahmed, 2004).

Psychological flexibility is not a static state but it can be influenced and increased in organizational settings (e.g., Bond & Bunce, 2000, 2003; Bond & Flaxman, 2006; Donaldson-Feilder & Bond, 2004) through, for example, acceptance and commitment therapy (ACT; Bond & Flaxman, 2006). The practical application of behavior analysis and ACT has led to new psychological interventions and training that increase individual psychological flexibility and, in turn, improve the overall health and creativity of organizations. A psychologically flexible individual is able to engage the present moment as a conscious human being, and to act in accord with his or her chosen values (Hayes, Bunting, Herbst, Bond, & Barnes-Holmes, 2006). This results in being conscious of one's own thoughts, and acting effectively through this consciousness. It enables individuals to persist in or to change their actions according to what they value as important, and decreases rigid thinking and behavior (Bond & Flaxman, 2006), all of which have been linked to organizational innovativeness.

According to ACT, psychological flexibility is established through six core processes within the individual: acceptance, cognitive defusion, contact with the present moment, self as a context, values, and committed actions. The processes can be divided into three stages: acceptance and defusion are about "opening up," that is, separating the individual from overpowering thoughts and feelings, and allowing matters to come and go without struggling with them. Contact with the present moment and self as a context are about being in the present moment, here and now, processes that increase one's skills at observing and attending to thoughts associated with innovative thinking. Values and committed actions involve clarifying one's values about what constitutes a meaningful life and taking effective action guided by those values (Bond & Flaxman, 2006). Committed action is linked to flexible action, and enables individuals to take action despite the possibility that their actions may evoke unpleasant emotional reactions and thoughts (e.g., when presenting new ideas to coworkers). It could be argued that all these skills may be crucial for developing individual as well as organizational innovativeness. Hence we advance Hypothesis 1: Individual psychological flexibility supports organizational innovativeness.

Institutional and Interpersonal Trust

Organizational trust is a positive attitude held by one organizational member toward another that assumes that the other party will act according to the rules of fair play and will not take advantage of one's vulnerability and dependence in a risky situation (Das & Teng, 1998; Lewis & Weigert, 1985; Rousseau, Sitkin, Burt, & Camerer, 1998). Trust may be felt toward individuals and organizations alike, though the underlying mechanisms in each case may differ. This confidence in the other party's benevolent behavior develops from the experience and belief that the trustee has earlier followed the same values and principles (Connell, Ferres, & Travaglione, 2003). Moreover, trust depends on organizational members' work morale and competence (Lämsä & Pučėtaitė, 2006).

A high level of organizational trust is an important feature of an organizational culture that is innovative because trusting relationships provide a safe environment for people to take risks (Sztompka, 1997). According to Dovey (2009), organizational trust is one of the key factors in the creation of a social environment in which ideas are freely generated, honestly assessed and selected, and collectively transformed into profitable new products and services.

A study by Ellonen et al. (2008) addressed behavioral innovativeness, defined as "the overall internal receptivity to new ideas and innovation that is demonstrated through individuals, teams and management, and that enables the formation of an innovative culture" (Wang & Ahmed, 2004, p. 205). Behavioral innovativeness was most effectively enhanced by building institutional trust, which is understood as trust in organizational structures, processes, and policies supporting organizational interaction, and thus also social trust. The study explained that trust in the leader's reliability as a form of interpersonal trust in an organization was found to be critical in terms of providing the support needed for the reception of new ideas and innovations. Further, Wang and Ahmed's (2004) research attested to the importance of leaders as role models and initiators of organizational innovativeness. Organizations can adopt several managerial approaches, such as transparent, open, and understandable communication (Moenart, Caledries, Lievens, & Wauters, 2000), encouraging the participation of employees, and fair and just human relations management (HRM) practices to enhance organizational trust (Ellonen et al., 2008; Pučėtaitė, Lämsä, & Novelskaite, 2010). Hence we advance Hypothesis 2: Institutional and interpersonal trust support organizational innovativeness.

Diverse Human Resources

The innovative capability of an organization (Wang & Ahmed, 2004) highlights the likelihood that an organization produces innovative outcomes. The more diverse the human resources are, the larger the pool of skills and perspectives available to the organization, the more creative and innovative this pool of individuals, and the higher the likelihood of generating peak levels of performance (Cox & Blake, 1991; Thomas, 1990). Most prior research and discussions have focused on the visible characteristics of diversity, such as sex and race (Foldy, 2002); more recent developments have extended the research domain to "invisible" diversity (Kirton & Greene, 2005).

Many recent studies have suggested that workforce diversity enhances organizational innovation (e.g., Miller & Triana, 2009; Mohamed, 2002; Rose-Anderssen & Allen, 2008). For example, Rose-Anderssen and Allen (2008) contended that organizations with a diversity of

employee behaviors have the capacity to exceed marginal or average improvements into more far-reaching performance improvements, therefore producing innovative, radical solutions. Additionally, Mohamed (2002) provided empirical evidence that effective and innovative groups have members who represent different demographic dimensions, and a study by Miller and Triana (2009) found that gender and racial diversity on organizational boards are positively related to innovation. The reasons for this may be that diverse groups engender more perspectives and external contacts, and that subgroups stimulate positive competition to enhance innovation. Cabrales, Medina, Lavado, and Cabrera (2008) stated that team diversity and the combined use of long- and short-term incentives are associated with incremental innovation; the development of risk-taking attitudes within the team is associated with radical innovation. To bring out the best in diverse team composition, attention to leadership modes is recommended (Zander & Butler, 2010). Consequently, diversity alone does not guarantee organizational innovation: Leadership must understand its value. Hence we advance Hypothesis 3: Diverse human resources support organizational innovativeness.

Strategic Transformational Leadership

Innovativeness should always be linked to what the organization expects for the future, its vision (Kaplan & Norton, 2004); organizational leadership plays a critical role in such achievements. A motivating vision, grounded in a sound understanding of the market, is established in internal communication, which then guides the business's competitive advantage efforts and sets the broad outlines for strategy development, with specific details to emerge later (Day, 1990; Hamel & Prahalad, 1994; Senge, 1990).

The leaders of organizations play a significant role in defining and shaping the organizational culture (Schein, 1985), and there is evidence that leadership style is an important determinant of innovation (Dess & Picken, 2000). In particular, transformational leadership has been shown to have a crucial, positive influence on organizational innovation (e.g., Gumusluoglu & Ilsev, 2009; Jung, Chow, & Wu, 2003; Sarros, Cooper, & Santora, 2008). Transformational leadership enhances coworkers' feeling of freedom to innovate (Jung et al., 2003), while also providing a meaningful focus for them through the processes of articulating a vision in internal communication and setting of high performance expectations and provisions of support (Sarros et al., 2008).

Bass and Avolio (1994) characterized transformational leadership as being composed of four unique but interrelated behavioral components: (a) charismatic role modeling, (b) individualized consideration, (c) inspirational motivation, and (d) intellectual stimulation. The first component refers to a leader's charisma, which inspires admiration and respect, and emphasizes the importance of a collective sense of mission and a shared vision, both of which have been associated with successful innovation processes, both reciprocally and longitudinally (e.g., Pearce & Ensley, 2004). Charismatic role modeling helps organizational members in experiencing and comprehending a meaningful focus in their roles and tasks in an organization that is not too detailed and constrained in its guiding principles. Moreover, one source of creative behavior is psychological empowerment, which can be increased by transformational leaders.

Taken together from the viewpoint of organizational innovativeness, it can be said that transformational leadership values a small power distance between leaders and employees.

Moreover, such leadership behavior also includes clear communication of the organization's strategic vision, which helps avoid potential chaos in an innovative culture. Hence we advance Hypothesis 4: Transformational leadership supports organizational innovativeness.

Agile Information and Communication Technology

In contemporary organizations, information and communication technologies (ICTs) pervade every aspect of an organization's value chain as a vast electronic network of interconnected applications and data (Kohli & Melville, 2009). Not only the organization's daily operations but also the very processes of innovation rely on ICTs, which makes ICT-related factors important as enablers or hinderers of organizational innovation. Innovativeness is related to change, which means that business processes need to be flexible and able to adapt to changing needs (MacKinnon, Grant, & Cray, 2008). The demand for connectedness and flexibility presents challenges for the organization's ICT infrastructure, as well as for the services provided by the information management function.

Connectedness becomes a key concept when discussing organizational innovativeness in the context of ICTs because it means enhancing interrelatedness and supporting interaction within the organization and between the organization and the environment. Connectedness is related to openness toward new ideas in that innovation requires people to combine ideas, capabilities, skills, and resources in new ways (Fagerberg, 2003). In practice this includes ensuring system integration and data transfer. Connectedness is especially emphasized in the early phases of an innovation because it is required for gathering knowledge about market needs, other companies, and new possibilities from innovation networks inside and outside the organization (Siebra, Filho, Silva, & Santos, 2008). A well-designed ICT architecture increases opportunities for informal interaction and accessibility to knowledge sources, and helps individuals to combine knowledge and to create new knowledge as well. Connectedness is essential for developing trust and cooperation among individuals so as to develop a deeper understanding that enables existing products, processes, and markets to be further refined and improved (Jansen et al., 2006).

Flexibility is emphasized in the later phases: The greater the innovation, the more it necessitates organizational changes and the more complicated it is to adopt (Chesbrough, 2003). A complex architecture of ICT systems should decrease the likelihood of flexibility becoming a hindrance to innovation. Flexibility is not merely the ability to adapt to changes in the environment, but also means embracing change. Thus, flexibility is a two-way process in which the organization not only reacts to change but also influences it (Conboy & Fitzgerald, 2004). ICT systems need to support organizations in adapting quickly to environmental changes. A related term, agility, refers to a combination of flexibility and speed (Conboy & Fitzgerald, 2004). Seo and La Paz (2008, p. 136) defined organizational agility as a set of processes that allow an organization to sense changes in the internal and external environment, to respond efficiently and effectively in a timely and cost-effective manner, and to learn from the experience to improve the competencies of the organization. Hence we advance Hypothesis 5: Agile information and communication technology supports organizational innovativeness.

Coproduction of the Brand with Customers

The competitive markets in which organizations operate have become a venue for proactive customer involvement (Prahalad & Ramaswamy, 2000). Competition no longer occurs at the core-product level but rather according to the added values that the brand represents (Simões & Dibb, 2001). A customer-oriented firm can be defined as a firm with the ability and the will to identify, analyze, understand, and answer user needs (Gatignon & Xuereb, 1997). Hunt and Morgan (1995) proposed market orientation as a kind of organizing framework that, if adopted and implemented, becomes culturally embedded in an organization over time.

Value can be created and innovativeness enhanced when customers are introduced into the production process. Customers are increasingly becoming active partners in the buying process, rather than just passive targets of product development and branding. Day (1994) argued that market-driven organizations are not just superior in market-sensing, but also excel in customer-linking capabilities, which require organizations to integrate the skills, abilities, and processes needed to achieve collaborative customer relationships. As such, much is demanded from the organization: transparent communication, high involvement, and commitment to working across organizational boundaries (Prahalad & Hamel, 1990).

Coproduction of the brand with customers means more than being consumer oriented; it also involves collaborating with and learning from customers, as well as being adaptive to their individual and dynamic needs. Relationships among marketing actors often have a continuous nature. In using a product, the customer advances the marketing, consumption, value-creation, and delivery processes, resulting in the consumer being viewed as a coproducer (Vargo & Lusch, 2004). Consumers will develop relationships with organizations that can provide them with an entire host of related services over an extended period (Rifkin, 2000). In fact, organizations benefit themselves, their customers, and society at large by increasing this service flow, or the customer defined "continuous flow of value" (Hawken, Lovins, & Lovins; 1999, pp. 125, 127). In the business-to-business environment, this process involves codeveloping products and services with lead clients (von Hippel, 1988); in consumer markets, brand communities cocreate brand meaning (Muniz & O'Guinn, 1995). To enable innovativeness from the coproduction process with customers, organizations should think in terms of self-reinforcing "value cycles," rather than linear value chains (Day, 1990). Hence we advance Hypothesis 6: Coproduction of the brand with customers supports organizational innovativeness.

DISCUSSION AND CONCLUSIONS

The concept of innovation has become something of a cure-all for various organizational malaises. Previous studies have proven the importance of organizational innovation and renewal, yet have failed to identify how innovativeness could be measured or enhanced. To enable innovativeness in organizations, research and development functions are no longer enough to be able to compete successfully in a dynamic international market. All of the various organizational intangibles should be geared optimally toward innovativeness, and organizations should enable a culture of innovation by creating an internal atmosphere and relationships with stakeholders that foster flexibility for innovation and change. The most innovative organizations in the future will be those that do not simply focus energy on products or technical innovation, but also manage to

build enduring environments of human communities striving toward innovation through the creation of an appropriate organizational culture (Ahmed, 1998).

The role of intangibles for organizational innovativeness is timely because "innovations are created primarily by investment in intangibles" (Lev, 2001, p. 16). However, previous research has not yet adequately mapped the various intangibles influencing innovativeness in organizations. This paper provides one attempt to integrate cross-disciplinary knowledge on organizational innovativeness. By combining literature from communication studies, marketing, psychology, information technology, and human-resource management, we were able to identify six dimensions concerning the contribution of specific intangibles to innovativeness, ranging from individual level to the society at large. These are not exhaustive, but mainly highlight the most important areas where intangibles are related to organizational innovativeness.

As a result of our cross-disciplinary investigation and analysis, we put forward the following hypotheses for further research:

1. Individual psychological flexibility supports organizational innovativeness;
2. Institutional and interpersonal trust supports organizational innovativeness;
3. Diverse human resources support organizational innovativeness;
4. Transformational leadership supports organizational innovativeness;
5. Agile information and communication technology supports organizational innovativeness;
6. Coproduction of the brand with customers supports organizational innovativeness.

Hypothesis 1 highlights the important role of the individual in the innovation process: Organizations consist of individuals and hence ensuring individual well-being through nurturing psychological flexibility is the first step toward improved organizational innovativeness. Hypothesis 2 focuses on the innovative nature of the organizational culture and climate surrounding these individuals, and underlines the importance of trust on both the interpersonal and institutional levels. Hypothesis 3 focuses attention on the importance of the unique individuals who constitute the organization, that is, those who compose its diverse human resources. Individuals in organizations operate in unison only when led well, and thus Hypothesis 4 highlights the importance of formulating a strategic vision and the vital role of transformational leadership in communication. Hypothesis 5 concentrates on the organizational systems that both connect and restrict individuals in organizations, and emphasizes the importance of agile information and communication technology systems. Moving from the organizational context to the environment surrounding the organization, Hypothesis 6 takes account of how innovative organizations work in collaboration with, and listen to, those they aim to serve, as well as introduces the idea of coproduction of the brand with customers.

Figure 1 shows the critical factors identified in this paper, starting with the microlevel (lower portion of the figure) of the individuals inside organizations, then moving to the meso-level of organizations and organizational processes, and ending with the macrolevel of relations with the organization's external stakeholders. None of these factors can be seen as independently producing organizational innovativeness, but they are related, and require innovation-friendly leadership that allows for employee empowerment (Pieterse, van Knippenberg, Schippers, & Stam, 2010). The hypotheses indicate vital enablers of organizational innovativeness.

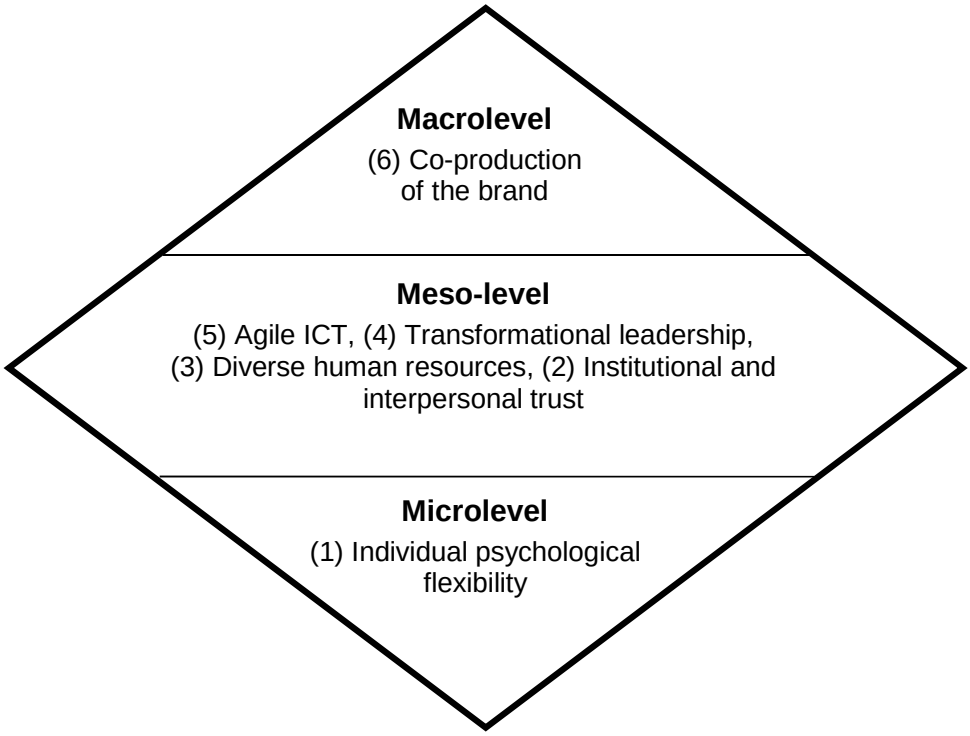

Figure 1. The Value-Diamond: Intangible assets support organizational innovation on different levels.

This paper is a first attempt to integrate cross-disciplinary knowledge on organizational innovativeness. Future research should test these hypotheses in a variety of contexts and industries. Our investigation has surfaced a multitude of research results from various disciplines in the literature that indicate the important contribution intangibles provide to organizational innovation. By testing these hypotheses, more insight can be gained into the role of intangibles for innovation. In this way, organizations may develop a better grasp on intangibles, the human factor in organizational innovativeness.

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ICT-RELATED INTANGIBLES AND ORGANIZATIONAL INNOVATION: INDICATORS FOR IMPROVING CONNECTEDNESS AND FLEXIBILITY

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Abstract: *In this paper we address the role of ICT-related intangible assets in organizational innovation. We focus on two important innovation enablers: first, connectedness, the ability of individuals to create and maintain connections to each other; and second, organizational flexibility to adapt to changing needs. For connectedness and flexibility, an agile ICT infrastructure and information management services are needed. Through a Delphi study, we identified several factors hindering organizational innovation, and formulated a set of indicators and related metrics for improvement. We conclude that it is necessary to consider ICT-related factors when organizations pursue improving their innovativeness. However, ICT solutions do not lead to organizational innovativeness independent of other organizational factors and people. If the organization is well-functioning, suitable ICT solutions can provide important added value for its innovation activities.*

Keywords: *organizational innovation, ICT solutions, information management, intangibles, connectedness, flexibility, improvement.*

INTRODUCTION

The development, adoption, and implementation of innovations are critical determinants of organizational competitiveness and effectiveness (Baregheh, Rowley, & Sambrook, 2009). In contemporary organizations, information and communication technologies (ICTs) pervade every aspect of an organization's value chain, creating a vast electronic network of interconnected applications and data (Kohli & Melville, 2009). Not only do an organization's daily operations

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rely on ICTs, but the innovation processes do as well, which makes ICT-related factors important as enablers or hindrances of organizational innovation.

Two key issues enable innovation. First, innovation relates to the ability of individuals to create and maintain connections to each other informally (Jansen, van den Bosch, & Volbera, 2006). Second, innovation is associated with change, which means that business processes need to be flexible and able to adapt to changing needs in and beyond an organization (MacKinnon, Grant, & Cray, 2008). The demand for connectedness and flexibility set challenges for the organization's ICT infrastructure, as well as for the services provided by the information management function. To be able to make proper decisions regarding ICT-related issues, organizations need knowledge of the factors that enable or hinder connectedness and flexibility.

Guidelines for an organization's ICT infrastructure and ICT services are set in the enterprise architecture. It establishes an organization-wide road map to achieve the organization's mission through optimal performance of its core business processes within an efficient ICT environment (Institute for Enterprise Architecture Developments, 2007). It provides important added value for the organization and enables more effective strategy making and better knowledge of the effects of various decisions by high-level management (Varveris & Harrison, 2005). To support innovation processes effectively, the enterprise architecture should incorporate connectedness and flexibility as important issues in ICT-related decision making.

In this study, we identified intangible ICT-related factors that enable connectedness and flexibility in organizations, as well as metrics for their assessment. The study is based on qualitative data gathered using the Delphi method (Linstone & Turoff, 1975). A group of panelists, primarily Finnish ICT and innovation experts within academia and industry, were asked to identify ICT-related factors that hinder flexibility and connectedness in organizations and which thereby impede innovation processes. Various statements about the identified factors were formulated from the data and given to the panelists for further comment, refinement, and corrections. A list of indicators was formulated based on the identified factors, and related metrics were identified from the gathered data and relevant literature.

This paper is organized as follows. First, we provide a literature review on issues related to innovation and ICT. We then describe the research setting and methodology. After that, we present the indicators and metrics identified as the result of the study. Finally, we discuss some conclusions from the study.

A REVIEW OF THE LITERATURE

In this section, we discuss various issues related to innovation and ICTs. These issues include innovation processes, connectedness and flexibility in an innovation process, and ICTs in innovation processes.

Innovation Processes

Baregheh et al. (2009) defined innovation as "the multi-stage process whereby organizations transform ideas into new/improved products, services or processes, in order to advance, compete and differentiate themselves successfully in their marketplace" (p. 1334). This definition

emphasizes that the innovation activity concerns not only the process of inventing but also extends idea inventing into the implementation and commercialization of the innovation.

Innovation has specific characteristics, as presented by the Commission of the European Communities (2009). Innovation concerns successfully exploiting new ideas and transforming them into economic value and sustainable competitive advantage. Innovation, then, is something new for the company but not necessarily for the field of markets; it must be beneficial to customers and customers must be willing to pay for it. Innovations help organizations diversify and improve the quality of their product and service selection, and improve processes. Innovation activities can be promoted by creating an inventive and creative working environment and investing in R&D activities, networking, and information technology. Furthermore, as Hautamäki (2010) indicated, innovation always occurs within local and global innovation ecosystems, that is, an environment that contains other companies, research institutes, funders, labor, markets, common legislation, and so forth.

Innovations may concern technology or social and organizational arrangements (Edström, Lind, & Ljungberg, 2004). They can be clever, insightful, and useful ideas from anyone in an organization, or they can arise from organized innovation activities, with resources allocated for research and development to create innovations (Godin, 2004). The innovation process may be organized in different ways. An organization may invest in the necessary research and development itself (a closed innovation process) or acquire the innovation from other organizations, for example, in the form of licenses or technologies (open innovation process; Chesbrough, 2003; Hautamäki, 2010). The innovation may also be developed in a networked community for exclusive use of the participants (private-collective innovation process) or to be used freely (common innovation process; Hautamäki, 2010). Another way is to gather the ideas from customers or users who want to improve products to better meet their needs (customer-driven innovation process; Hautamäki, 2010).

Moreover, innovations can be classified in various ways. Explorative innovations open up completely new ways of thinking and actions, while exploitative innovations refine and improve already existing explorative innovations (Jansen et al., 2006; March, 1991). Explorative innovations can create new fields of knowledge, breed new technology, open new markets, enable novel ways of doing things, and spur renewal of organizational structures and practices (Jansen et al., 2006). However, returns from exploration are systematically less certain, more remote in time, and organizationally more distant from the locus of action and adaptation (March, 1991). Innovations also can be distinguished by how they affect design structures. Modular innovations change the core design components, whereas architectural innovations change their interrelationships (Henderson & Clark, 1990). Autonomous modular innovation can be done without modifying other components, whereas systemic innovation requires significant modifications to other related components (Teece, 1996).

Various models of the innovation process are presented in the literature and, typically, they include three to six stages. For example, Chesbrough (2003) identified three stages: research, development, and marketing. Baregheh et al. (2009) proposed five stages: creation, generation, implementation, development, and adoption. Siebra, Filho, Silva, and Santos (2008) distinguished three stages: production of scientific and technological knowledge, transforming knowledge into working artifacts, and responding to and creating market demands. For the purposes of our study, we identify four generic phases of innovation processes: detecting and making sense of the problem, creating ideas to solve the problem,

studying and developing solutions to the problem, and adopting a solution. We find these phases independent of the type of the innovation and the innovation process.

Connectedness and Flexibility in an Innovation Process

Two characteristics of organizations are important for successful innovation processes: connectedness and flexibility. Both are necessary throughout the innovation process, although with varying emphases.

Connectedness is the ability of people to relate with each other inside and outside the organization (Jansen et al., 2006) in the interactive webs of relationships embedded within social networks (Cross & Parker, 2004). Human connections such as trust, personal networks, and sense of community play important roles in thriving organizations and contribute to knowledge sharing, innovation, and high productivity (Cohen & Prusak, 2001). Innovation communities often involve interpersonal ties that provide sociability, support, information, a sense of belonging, and social identity (von Hippel, 2005) Most of the work in organizations is not done through the formal organizational structure but rather through informal social networks, and the multiple dimensions of communication therein dictate an organization's ability to innovate (Cross & Parker, 2004).

Networks are communities of practice in which connectedness is built upon shared histories, experiences, reciprocity, affections, and mutual commitment, and which contribute to organizational learning and innovation through engagement, imagination, and alignment (Wenger, 2000). Any process of knowledge socialization and collective learning is based on relationships of meaning building and sharing within a context of coparticipation that promotes the development of shared values, reciprocity, and mutual trust (Sawhney & Prandelli, 2000). Knowledge building occurs by combining people's distinct individualities with a particular set of activities, and it is this combination that enables innovation (Leonard-Barton, 1995). Networks are not only a means of accessing distributed information and capabilities, but also a form of coordination guided by the enduring principles of an organization (Kogut, 2000). Practice creates epistemic differences among the communities within an organization, and the organization's advantage lies in dynamically coordinating the knowledge produced by these communities despite such differences (Brown & Duguid, 2001).

Connectedness is emphasized in the early phases of innovation processes, and is essential for gathering knowledge from innovation networks inside and outside the organization about market needs, other companies, and new possibilities (Siebra et al., 2008). Connectedness increases opportunities for informal interaction and accessibility to knowledge sources and also helps individuals to combine knowledge and to create new knowledge (Jansen et al., 2006). Dense social relationships resulting from connectedness help individuals share experiences. Connectedness forms the foundation for developing trust and cooperation among individuals, which subsequently develops a deep understanding for refining and reshaping existing products, processes, and markets (Jansen et al., 2006). Connectedness also relates to openness to new ideas, because innovation requires people to combine ideas, capabilities, skills, and resources in new ways (Fagerberg, 2003).

Flexibility is the ability of an organization to respond to potential internal and external changes in a manner that sustains or increases its value delivery (cf. Browne, Dubois, Rathmill, Sethi, & Stecke, 1984). Flexibility is not merely adapting to the changes in the environment but

embracing change: It is a two-way process in which the organization not only reacts to change but also influences it (Conboy & Fitzgerald, 2004). Flexibility is particularly important in innovation processes that are internal to organizations in that internal innovation requires implementation in the organization. In such an innovation process, flexibility is emphasized in the later phases because the greater the innovation, the more it necessitates organizational changes and the more complicated it is to adopt (Chesbrough, 2003). The willingness of managers and other employees to change their ways of doing things, particularly in willingness to engage risk, is important for new ideas to be translated into action (Shavinina, 2003). ICTs play a role in organizational innovation as well, because they can further an organization's ability to adapt and be competitive (Fitzgerald & Wynn, 2004).

Agility is a term that combines flexibility and speed (Conboy & Fitzgerald, 2004). Seo and La Paz (2008, p. 136) defined organizational agility as a set of processes that allow an organization to sense changes in the internal and external environment, to respond efficiently and effectively in a timely and cost-effective manner, and to learn from the experience to improve the competencies of the organization. MacKinnon et al. (2008) discussed strategic flexibility, referring to an organization's deliberately crafted agility to recognize, assess, and act to mitigate threats and to exploit opportunities in a dynamically competitive environment. Strategic flexibility also refers to a set of organizational abilities to behave proactively and/or to respond quickly to a changing competitive environment, and thereby to develop and maintain a competitive advantage.

Zhang (2005) identified two organizational capabilities crucial to a firm's ability to pursue a variety of strategic options in responding to changing markets: product flexibility and cross-functional coordination. Product flexibility enables an organization to manipulate its product variety and to change efficiently and rapidly, thus developing more product strategy options to address environmental uncertainties. Tight cross-functional coordination within and across organizations promotes the smooth acquisition and sharing of critical information that the organization needs to quickly detect market and product changes, to redesign business processes and work flows, and to develop new insights and skills.

ICT in Innovation Processes

Information capital is an essential category of assets for implementing any business strategy, which includes the organization's databases, information systems, networks, and technology infrastructure (Kaplan & Norton, 2004). In contemporary organizations, ICTs pervade every aspect of an organization's value chain as a vast electronic network of interconnected applications and data (Kohli & Melville, 2009). The innovation processes and the organization's daily operations, which might change in the implementation of an innovation, rely on ICTs. The strategic readiness of information capital measures how well the IT infrastructure and applications support the critical internal processes (Kaplan & Norton, 2004). From the viewpoint of innovation processes, this includes a demand for ICT solutions and services that support and enable organizational connectedness and flexibility.

McAfee (2006) suggested that ICTs set off several kinds of revolutions in organizations and identified three distinct categories of these technologies (see Table 1). The first category, Function IT, involves technologies that make the execution of stand-alone tasks more efficient, technologies such as simulators, spreadsheets, computer-aided design, and statistical software.

Table 1. The Three Varieties of Work-changing Information Technology (IT; McAfee, 2006, p. 145).

Category	Definition	Characteristics	Examples
Function IT	IT that assists with the execution of discrete tasks	Can be adopted without complements Impact increases when complements are in place	Simulators, spreadsheets, computer-aided design, and statistical software
Network IT	IT that facilitates interactions without specifying their parameters	Does not impose complements but lets them emerge over time Does not specify tasks or sequences Accepts data in many formats Use is optional	E-mail, instant messaging, wikis, blogs, and mash-ups
Enterprise IT	IT that specifies business processes	Imposes complements throughout the organization Defines tasks and sequences Mandates data formats Use is mandatory	Software for enterprise resource planning, customer resource management, and supply chain management

They enhance experimentation capacity and increase precision. These technologies achieve their highest value when they have complements, such as new design processes. The second category, Network IT, provides the means by which people communicate with one another, such as e-mail, instant messaging, blogs, and groupware. They facilitate collaboration, allow expressions of judgment, and foster emergence. These technologies bring complements with them but allow users to implement and modify the complements over time. Finally, Enterprise IT encompasses applications that organizations adopt to restructure interactions among groups of employees or with external partners, such as software for enterprise resources planning, customer resource management, and supply chain management. They redesign business processes, standardize work flows, and monitor activities and events efficiently. These technologies introduce new interdependencies, processes, and decision rights, and necessitate organizational changes as soon as the new systems go live.

According to McAfee (2006), the adoption of the various types of technologies set different challenges for the organization's management. For Function IT, the managers' main responsibility is to help create the complements that will maximize the technologies' value. Because Function IT does not bring its complements with it, managers must find ways to identify them and spur their use. For Network IT, because the use is voluntary, the managers' role is more demonstrative, that is, showing how these technologies can be used and setting norms for participation. The most challenging type of technology to adopt in organizations is Enterprise IT. They define new cross-function business processes that impose the processes on employees without allowing employees to modify them and, thus, bring higher levels of oversight. In some cases, management may need to intervene forcefully throughout the adoption, when new processes, changed decision rights, and greater interdependence are introduced.

ICTs have dual importance from the viewpoint of innovation processes. First, innovation processes are enabled by appropriate ICT solutions and hindered by inappropriate ones. The first phases of innovation processes concern detecting and making sense of the problem and then creating ideas to solve the problem, and thus necessitate a great deal of investigation and

collaboration. Technologies in the first two categories, Function IT and Network IT, are emphasized here because investigation and collaboration can be supported by, for example, knowledge management systems (Alavi & Leidner, 1999; Robey, Boudreau, & Rose, 2000) and networking and collaboration tools (Schneidermann, 2007). Additionally, various social media applications may enable social creativity and networking (Schneidermann, 2007). The need for collaboration continues in the later phases, in addition to support for developing and implementing the innovation. Various modeling and simulation tools, as well as prototyping systems, become helpful in studying and developing solutions to the problem (Schneidermann, 2007).

Secondly, adopting an innovation in an organization often involves changing the tasks or processes that the current ICT solutions support, and hence the adoption may be enabled or hindered by these solutions. Here, the flexibility and agility of an organization to take the innovation into use become important. In relation to innovations that are intended for improving the performance of an organization, this concerns the flexibility of the organization's ICT solutions and services and the agility of the organization to carry out ICT-related changes. Different solutions bring forth different issues to consider. For example, the flexibility of an enterprise resource planning (ERP) system refers to allowing changes in the ways of working. ERP systems integrate internal and external management information across an entire organization, and they often have caused trouble in process changes, such as delays in implementation, increasing staff requirements, and system upgrade problems (MacKinnon et al., 2008). As a result, the ability to adjust rapidly to changing business needs has become one of the essential requirements of ERP systems (Kirikova, 2009). Implementing a mix of information systems and integrating them through suitable middleware is a more flexible solution and less disruptive to the organization, but because the software packages typically come from different vendors, integration problems may arise, and maintenance and upgrades are more problematic than in ERP systems (MacKinnon et al., 2008). Regardless of the solution, a flexible ICT infrastructure should ease the transformation or at least not hinder the change.

The definition of an ICT (or IT) infrastructure varies in the literature. Duncan (1995) defined IT infrastructure as a set of tangible assets, including platform technology, network and telecommunication technologies, key data, and core data processing applications. Rockart, Earl, and Ross (1996) concurred with the four assets but required integrating and interconnecting them in a way that, from the viewpoint of users, all types of information can be expeditiously and effortlessly routed through the network. Typical functional requirements for a flexible ICT infrastructure are extensibility, adaptability, and integratability. Byrd and Turnder (2000) identified both technical and human components. Thus, technical IT infrastructure includes IT connectivity, application functionality, IT compatibility, and data transparency, whereas the human IT infrastructure includes technology management, business knowledge, management knowledge, and technical skills. The latter are components that combine business processes and ICTs in an effective way. A flexible ICT infrastructure should enable the organization to embrace changes and provide relevant data for decision making.

In aligning business processes and ICT infrastructure, the enterprise architecture plays an essential role (Pavlak, 2006). Enterprise architecture is a "blueprint" that specifies the main components of the organization, its information systems, the ways in which these components work together to achieve defined business objectives, and the way in which the information systems support the business processes of the organization (Kaisler, Armour & Valivullah, 2005). Enterprise architecture establishes an organization-wide road map to achieve the

organization's mission through the optimal performance of its core business processes within an efficient ICT environment (Institute for Enterprise Architecture Developments, 2007). It is used for defining and controlling the interfaces and interaction of all of the components of the information systems and organizational units (Zachman, 1999). The enterprise architecture provides important added value for the organization and facilitates more effective strategy making and better knowledge of the effects of various decisions by high-level management (Varveris & Harrison, 2005). It is essential for evolving current information systems and developing new systems that optimize their mission value (Institute for Enterprise Architecture Developments, 2007). In order to support an innovative organization, the enterprise architecture must include characteristics that support connectedness and flexibility.

Various frameworks have been developed to provide a common basis for describing enterprise architectures, for example, the Zachman Framework (Zachman, 2008) and TOGAF (The Open Group, 2010). The framework used in this study is the enterprise architecture grid (EA Grid; Hirvonen & Pulkkinen, 2004; Pulkkinen, 2006; Pulkkinen & Hirvonen, 2005), which is based on TOGAF. We describe the framework below.

RESEARCH SETTING AND METHODOLOGY

In this section, we present the empirical foundation for our study. We define the objective and questions of our study, introduce the research framework, and describe the research methodology and process.

Research Objective and Questions

This study was carried out within a multidisciplinary research project on the added value of intangibles for organizational innovation. Adopting the resource-based view (Penrose, 1959), we propose that sustainable competitive advantage results from intangible assets because they enable the accumulation of other types of assets. The project focused on intangibles as drivers of organizational innovation in Finnish companies that are active in an international context. The overall objective of the project was to identify critical factors for the intangibles that support innovation in organizations. The purpose is to reduce unnecessary barriers in the organizations' systems and procedures, and strongly stimulate connectedness and flexibility that are important for innovation. The results will be used to construct a tool that supports analysis and gives directions for improving innovation performance. In addition, ways for improvement and change management will be indicated. The project focused on intangibles in the areas of human resources, communication, marketing, and ICTs.

In this study, we focused specifically on ICTs. The objective of the study was to identify intangible ICT-related factors that enable connectedness and flexibility in organizations, as well as related metrics for assessment and improvement. The research questions were the following:

1) Which intangible ICT-related factors are important for innovation processes in light of enabling connectedness and flexibility in organizations?
2) What metrics are needed for their assessment and improvement?

To answer these questions, we first searched for issues that hinder connectedness and/or flexibility and tried to understand what makes them hindrances. The factors were then reframed as the polar opposites of these issues and restated as indicators. Metrics were then formulated, based on what is needed to remove hindrances.

We recognize that the relationship between ICT-related factors and their effects on organizations is complex, mediated, and uncertain. The relationship can be described as having functional affordances, that is, possibilities for goal-oriented action afforded to specified user groups by technical objects (Markus & Silver, 2008). Whether the fulfillment of certain ICT-related indicators actually leads to organizational innovativeness depends on other organizational factors and people, but their absence is likely to slow down or hinder innovation processes.

Research Framework

We took a resource-based view on ICT-related intangible assets. According to this view, anything that could be thought of as a strength of a given organization can be viewed as a resource, for instance, brand names, in-house knowledge of technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, and capital (Wernerfelt, 1984). Intangible assets are resources that have no physical existence—they are inimitable, rare and nontradeable (Lev, 2001). The resource-based view suggests that intangible assets are elemental for creating and sustaining a competitive advantage because they enable the accumulation of other types of assets (Penrose, 1959).

Distinguishing between tangible and intangible assets is not always an easy task where ICTs are concerned. Without doubt, the physical technology, hardware, and networks, including any of their physical characteristics, are tangible. However, software and data cannot, self-evidently, be classified as tangibles. A running software application requires a physical medium for its existence and to enable people to interact with it, but the physical characteristics are not the only thing people deal with when they use the software. The support that the program provides to the users is very much intangible. The difference involved here is similar to the difference between a book (tangible) and its contents (intangible). Therefore, the availability of a technical means may also contribute to intangible capabilities. Furthermore, software systems require organization-specific processes, such as configuration, integration, and maintenance, to operate. Although some of the prerequisites and results of these processes are tangible, the procedures are not.

In this study, we used an enterprise architecture framework to aid in the identification of intangible ICT-related factors. This was a natural choice for two reasons: (a) assessments, decisions, descriptions, and catalogs of ICT-related assets are a large part of enterprise architecture; and (b) connectedness and flexibility require decisions to be made regarding the enterprise architecture in order to achieve them in practice.

We selected the EA Grid (Hirvonen & Pulkkinen, 2004; Pulkkinen, 2006; Pulkkinen & Hirvonen, 2005) as the specific framework. It has been used for developing and improving enterprise architectures in many organizations, for example, the Ministry of Finance in Finland. The EA Grid describes enterprise architectures from four different viewpoints (cf. Hirvonen & Pulkkinen, 2004):

> *Business architecture* describes the components of the enterprise and their interrelationships, such as business objectives and principles, business processes,

service structures, and organizational activities. These provide guidelines for the structure and functions of the enterprise. In this study, we were interested in the components that relate to the organization of ICT services in an enterprise. We also note important business-related prerequisites to successful organization of ICT services.

Information Architecture focuses on information services required by business processes, services, and activities, including information structures and their interconnections, and principles governing their development, maintenance, and use. Examples of such structures are metamodels, vocabularies, and data models. These provide guidelines for information services used by business processes and services. In this study, we were interested in the types of structures that relate to using ICT in the creation, maintenance, and use of information.

Systems Architecture represents the information systems that provide support for business processes and information services, their interconnections and characteristics, and the principles governing their development, maintenance, and use. These provide guidelines for the support of business processes and services. This part of the enterprise architecture is ICT-specific, and therefore we were interested in any related intangibles in this study.

Technology Architecture covers technological solutions, the various aspects of technology infrastructure, structural components, and interrelationships, as well as the related principles for building information and communication systems, such as application technology, hardware, and networks. These provide guidelines for the technological basis of information and communication systems. In addition, this part of the enterprise architecture is ICT-specific, and therefore we were interested in any related intangibles in this study. Because technology architecture covers mostly tangibles, it is likely that many surfacing issues should be noted as technological prerequisites.

The framework is illustrated in Table 2. The main purpose of the framework in our study was to aid the participants in thinking about issues from different viewpoints. Accordingly, we used the framework to organize the questionnaires and to categorize the identified factors. Each of the viewpoints included issues at strategic, domain, and system levels, but explicitly distinguishing between these levels would have unnecessarily complicated the questionnaire and hence reduced its usability in the study.

Table 2. Enterprise Architecture Grid as the Research Framework in this Study.

	Business Architecture	**Information Architecture**	**Systems Architecture**	**Technology Architecture**
Describes	Components of the enterprise and their interrelationships	Information structures and their interconnections	Information systems and their interconnections and characteristics	Technological structures and interdependencies
Role in the architecture	Guidelines for the structure and functions of the enterprise	Guidelines for information services used by business processes and services	Guidelines for the support of business processes and services	Guidelines for the technological basis of systems

Research Methodology and Research Process

We used the Delphi method in this study to identify various ICT-related factors that enable organizational innovation. The Delphi method (Linstone & Turoff, 1975) was developed originally for identifying future research, but it can be used as well for solving problems that cannot be solved by one exact analyzing technique. Information used in the solving process can be gathered from different persons or it can be based on an individual view. It can be used for gathering values, new points of view, or ideas to support planning and decision making.

In a Delphi study, a group of experts are used as the source to gather data for a specific well-defined and bounded research question. Due to the nature of the relationship between ICTs and their organizational effects, we decided to formulate the questions through a negation. Therefore, we asked for factors the experts believe may hinder an organization's flexibility and connectedness, thereby affecting negatively its innovation processes. For data gathering, we identified a group of ICT and innovation experts in Finland. The experts were chosen from universities, research institutes, businesses, and some public sector organizations. The invitation letter was sent via e-mail to 150 potential participants. 29 panelists responded anonymously to the questionnaire.

In a Delphi study, the data is gathered through two or three rounds of questionnaires that are tested and revised before being sent to the panelists. In this study, we collected qualitative data in two rounds. The first questionnaire was used to collect answers from the panelists individually. We asked them to identify factors that may hinder an organization's flexibility and connectedness in each of the categories of the research framework; there was no limit to how many factors each participant could suggest, nor a condition that all categories had to be addressed. In the analysis of the answers, we first collected similar comments into each category and formulated statements thereof. Whenever we detected different opinions or viewpoints, we formulated the statements in a way that showed these differences. The formulations were made by one researcher and double-checked by another to ensure that they reflected the answers as accurately as possible. We then combined related statements and formed specific factors thereof. This was done by two researchers reviewing and revising each other's formulations.

In the second round, the compiled lists of factors and related statements were given to the panelists for comments, corrections, and additions. In cases of differing opinions or viewpoints, the panelists were asked to discuss their perspectives and try to reconcile on the issue. The responses were collected anonymously via a wiki so that all the panelists could see and comment on each other's comments. The data gathered in the second round was used to revise and enhance the factors identified in the first round.

When the second round was completed, we formulated a list of indicators and statements based on the gathered data. If the panelists had not reconciled on a factor or a statement, that factor or statement was omitted. Finally, the data and relevant literature were used for identifying related metrics.

RESULTS

In this section we present the results of our Delphi study. About half of the factors identified in the study were found suitable for creating intangible ICT-related indicators, while the

others serve as prerequisite factors for the indicators. In the following subsections, the prerequisite factors are mentioned only briefly because the main focus is on the indicators as the objective of this study. We present the results in each category of the research framework.

Business Architecture

Business architecture describes the basic components of the enterprise, such as business processes, service structures, and organizational activities. Those components may exist even without any digital information processing devices. From the viewpoint of ICT infrastructure planning, business architecture is the foundation upon which the actual planning will be based (Hirvonen & Pulkkinen, 2004). In order to achieve a flexible ICT infrastructure, business architecture should be designed flexibly before planning how to support the processes with ICTs. On the other hand, a flexible ICT infrastructure makes the ability to change in business architecture possible in the first place.

We identified a set of prerequisite factors related to organization and business processes that should be mentioned as a background for the indicators. These factors remind us that ICTs cannot remedy the shortcomings in the organization, its ways of working, or its culture. To set the foundation for a flexible business architecture, unnecessary size, complexity, and hierarchy should first be removed from the structures and organizational integration by way of well-working cross-functional operational and management processes. Agile, open, and networked interaction should be fostered in the activities both horizontally and vertically. Sufficient resources should be allocated for the creation and maintenance of an innovative operational environment. Then, business processes should be integrated so as to cover the entire value chain from suppliers to customers, and to meet the organization's business needs, strategies, and goals. These processes should be meaningful, fluent, and practical in providing services for customers. Processes should be locally flexible, enabling the details of work and workflows to be decided and negotiated where the actual work is done. When the organization and its business processes are designed to embrace opportunities for innovativeness, suitable ICT services can be implemented to support them. In the following paragraphs, we describe the identified indicators and metrics that relate to business architecture (see also Table 3).

Indicator 1: Top management should be competent in ICT-related issues. Ignorance of or distrust towards ICTs may be present in the top management, which may hinder decision making on ICT-related issues and comparisons of the effects, advantages, and disadvantages of different choices. Top management should have an open but realistic attitude towards ICTs and how they contribute to business innovation, and then base decisions on well-grounded expert evaluations. ICTs are strategically important because they should, as services and tools, help achieve the organization's strategies. Therefore it is important that the director of the IM (information management) function participates in the organization's highest level decision making and brings forth technological issues and options in the discussion.

Indicator 2: ICT services should meet the needs of business processes and their integration. In contemporary organizations, the implementation of business processes relies largely on the provided ICT services. Unless the ICT services support business processes and the business processes are adapted to new ICT solutions, real benefits are not gained. This concerns innovativeness as much as any other characteristic. The provided ICT services should cover all

Table 3. Key Indicators Identified for Business Architecture.

Indicator	Statement	Measurement
Indicator 1 ICT Competence of Top Management	Top management is competent in ICT-related issues.	Top management has an open but realistic attitude towards ICT and bases its decisions on well-grounded expert evaluations. The director of the IM function participates in the organization's highest level decision making.
Indicator 2 Matching ICT Services and Business Processes	ICT services meet the needs of business processes and their integration.	The provided ICT services cover all aspects of business processes. All gaps between ICT services and business processes have been identified and dealt with efficiently.
Indicator 3 Information Management Functions as a Service Provider	The IM function operates as a service provider for users.	The operations of the IM function are organized and managed as services. IM personnel perceive themselves as service providers. ICT services are designed as services for users, and users interact directly with the designers of the services to improve them. User training is well-planned and organized.

aspects of business processes, and any gaps between the processes and ICT services need to be identified and dealt with efficiently.

Indicator 3: The IM function should operate as a service provider for users. The IM function's role in the organization may be perceived too often as a technology provider instead of focusing on providing services. The basis of a service orientation is that the operations are organized and managed as services and that the IM personnel perceive themselves as service providers. If ICT services are not designed from the viewpoint of the users, then service roles may become blurred. Furthermore, although ICT services may become more fluent for the IM function, service tasks typically are not reduced but just transferred to the users. When this happens, the overall efficiency does not improve and the result may be even more costly. ICT services should be designed as services for the users, and the users should interact directly with the designers of the services to improve them. ICT services should also be accompanied by well-planned and organized user training.

Information Architecture

Information architecture focuses on the information used, created, and stored in a business, including high-level structures of business information and, at a more detailed level, the data architecture (Hirvonen & Pulkkinen, 2004). In the following we describe the identified indicators and metrics that relate to information architecture (see also Table 4).

Table 4. Key Indicators Identified for Information Architecture.

Indicator	Statement	Measurement
Indicator 4 Clarity in the Provision of Information Services	Information services have been defined.	Information requirements of different business processes have been identified. Information flows have been optimized to ensure that correct information is delivered timely to the right place when needed.
Indicator 5 Cross-organizational Interoperability	Cross-organizational interoperability is enabled.	The needs for cross-organizational interoperability have been identified. Standardized data formats or application interfaces are used for cross-organizational data transfer.
Indicator 6 Support for Perceived Added Value of Information Capital	The users have support for perceiving and utilizing the added value of the information residing in the organization's data repositories and other information sources.	Means exist to analyze, parse, and filter data from different information sources. Ability to share and store tacit and informal knowledge is established.
Indicator 7 Integrated Data Models	The organization's data models are integrated.	Data models are compatible with the operational ontology of the organization's information services. Master data have been identified and managed with appropriate tools. Metadata are specified extensively and consistently based on a common vocabulary and schemes.
Indicator 8 Ability to Transfer Data Between Information Systems	Data repositories enable flexible and reliable data transfer between systems.	Data models are compatible with the operational ontology of the organization's information services. Master data have been identified and managed with appropriate tools. Metadata are specified extensively and consistently based on a common vocabulary and schemes.

Indicator 4: Information services should be defined. Information requirements for business processes should be identified and information flows optimized so that correct information will be delivered in a timely fashion to the right place when needed. Access to information should be flexible and unobstructed. According to Alavi and Leidner (1999), the free information flow between and among applications and people makes an organization able to react flexibly to changes needed for innovations.

Indicator 5: Cross-organizational interoperability should be enabled. Converting data from various entities or from different contexts for the organization's data repositories may be time consuming and reduce the organization's ability to take action in a timely

manner (Seo & La Paz, 2008). Standardization of data formats or application interfaces is a good solution for cross-organizational interoperability, particularly when the interaction is frequent and continuous, such as between partnering organizations. The needs for cross-organizational interoperability should be identified so that standardization can take place and the necessary application interfaces implemented.

Indicator 6: The users should have support for perceiving and utilizing the added value of the information residing in the organization's data repositories and other information sources. Added value will be lost if the potential of existing information capital is not perceived and utilized for creating new competences and knowledge, enhancing existing processes, or creating additional services or new products. Perceiving is difficult when huge amounts of unstructured information exist and its context and relevance are not clear (Seo & La Paz, 2008). The users should have support for perceiving and employing information from various sources to create added value. Knowledge management systems are necessary to provide this support in a complex information environment, but they require that information is stored in a way that is easy to locate, access, and analyze (Alavi & Leidner, 1999). Data gathered from various sources should be parsed into a standardized format that can be used efficiently by the organization's information systems. Information filtering may be needed so that only reusable and relevant data are stored (Seo & La Paz, 2008). An important source of information is people, and therefore means by which to share and store tacit and informal knowledge is essential.

Indicator 7: The organization's data models should be integrated. Without integration, the organization's data become fragmented, which means that the same data are stored in different systems, possibly using different formats, different concepts, and even having different contents. Fragmentation leads to the vulnerability of systems, duplicated storage, and poor access to data. Data models should be compatible with the operational ontology of the information services. In a fragmented data environment, master data should be identified and managed with appropriate tools. Metadata should be specified extensively and consistently based on a common vocabulary and schemes.

Indicator 8: Data repositories should enable data transfer between different systems. Flexible and reliable data transfer between different information systems is not possible if the organization's data repositories do not have interfaces for integration or the interfaces are not adequate for the purpose. In addition, if data repositories require ad hoc fixes to meet the data transfer needs, changes to systems become increasingly difficult to manage and integration is vulnerable. Data repositories should have interfaces that enable all necessary data transfer between different systems.

Systems Architecture

Systems architecture represents the information systems and their interconnections. Major components thereof are organizational information systems, which are usually implemented either as one-vendor ERP systems or as a combination of different software packages (MacKinnon et al., 2008). In the following we describe the identified indicators and metrics that relate to systems architecture (see also Table 5).

Indictor 9: The organization's systems architecture should be well-planned, unified, and consistent, and used as a basis for system acquisition and utilization. An organization may use a number of different information systems that need integration, and such complexity is

Table 5. Key Indicators Identified for Systems Architecture.

Indicator	Statement	Measurement
Indicator 9 Systems Architecture	The organization's systems architecture is well-planned, unified and consistent, and it is used as a basis for system acquisition and utilization.	The roles and interdependencies of different systems and applications in the organization's business processes have been specified. Common system standards and directions for lean and flexible acquisition processes have been specified.
Indicator 10 Systems Integration	The organization's information systems can be integrated rapidly and reliably.	Information systems provide adequate and documented interfaces for their integration. Information systems are integrated with suitable middleware, or an organization-wide ERP system has been implemented.
Indicator 11 Upgrades and Realignment of Systems	Existing information systems are upgraded and realigned easily and rationally.	Systems can be upgraded and realigned without changes in other systems and unwanted side effects. Upgrades and changes are made only if they are business-wise necessary.
Indicator 12 Support for Business Processes and Innovation Activities	Information systems provide the support needed in business processes and innovation activities.	Information systems and applications support all aspects of business processes and innovation activities. New applications suitable for innovation activities are identified continuously and their use is promoted. Information systems enable gathering and reporting of information on the organization's business performance.
Indicator 13 Usability and Flexibility of Systems and Applications	The use of systems and applications is easy and flexible.	Systems and applications support meaningful ways of working. Systems and applications are easy to use together, transparent and clear to use, and their user interfaces are well-designed for the task. Systems and applications can be customized to special user needs, and varying mental and operational models.

very difficult to manage successfully. A well-planned, unified, and consistent systems architecture is required to enable rational and well-grounded decision making and systems acquisition and integration so that the output is optimal for the organization. The systems architecture should specify the roles and interdependencies of various systems and applications in the organization's business processes. It should set common system standards and give directions for lean and flexible acquisition processes.

Indicator 10: Information systems should be rapidly and reliably integrable. A major issue in enabling organization-wide and fluent business processes is system integration. Integration is difficult or even impossible if the organization's information systems are incompatible, do not have adequate interfaces or the number of interfaces is too great to manage, or the interfaces have not been documented. Information systems should provide adequate and documented interfaces for their fluent and reliable integration. Point-to-point integration, the so-called spaghetti integration, is a maintenance nightmare when many systems need to be integrated. Individual systems should provide adequate interfaces for their integration, and they should be integrated with suitable middleware (MacKinnon et al., 2008; Zhang, 2005). Another choice is to implement an organization-wide ERP (MacKinnon et al., 2008).

Indicator 11: Existing information systems should be easily and rationally upgraded and realigned. Whether an organization decides to use middleware for system integration or to implement an organization-wide ERP system, the solution should support modularity. This means that the individual systems or system modules can be changed and new ones added without changes in other systems or modules (Chung, Byrd, Lewis, & Ford, 2005). The larger the change, the more time it takes, the more side effects are to be expected, and the higher the cost. Another problem involves ongoing changes to and in software. Frequent upgrades and software changes make the management of systems difficult, and new systems and versions may not be adequately perfected. Supplier-driven upgrades and changes are not necessarily wise for the organization. Therefore upgrades and changes should be made only if they are beneficial for the business (Kankaanpää & Maaranen, 2009).

Indicator 12: Information systems should provide the support needed for business processes and innovation activities. It should be ensured that information systems and applications support all aspects of business processes and innovation activities. Externally available applications and systems also should be considered. New applications suitable for innovation activities should be identified continuously and their use promoted (e.g., social web applications). Information systems should enable gathering and reporting of information on the organization's business performance, so that needed improvements can be detected in a timely manner.

Indicator 13: The use of systems and applications should be easy and flexible. Systems and applications often are difficult to use, take more time than is reasonable, and divert attention from the actual task. The benefits of use may be unclear, which weaken the users' motivation to use them. Systems and applications should support meaningful ways of working. They should be easy to use together, transparent and clear to use, and the interfaces should be well-designed for the task. Systems and applications also should be customizable to users' special needs, as well as to the varying mental and operational models of the users.

Technology Architecture

According to Pulkkinen (2006), technology architecture concerns the technologies and technological structures used to build information and communication systems, such as application technology, hardware, and networks. The key task of technology architecture is to offer technological possibilities for flexible information systems and other innovation supporting tools.

We identified some technological factors that, as tangibles, cannot be included as indicators, but which are important prerequisites for intangible assets. First, the speed, flexibility, capacity,

and coverage of the internal and external technology infrastructure should meet the needs of the organization's information services and systems. Second, many of the previously discussed integration and management issues require the various tangible technologies and technology platforms to be integrated and managed properly, and that technology-independent external access to the organization's data and systems is possible. Third, the various tangible technologies should be easy to use and easily adapted to different user needs. We now describe the identified indicators and metrics that relate to technology architecture (see also Table 6).

Indicator 14: Technology-related decisions, and the acquisition, implementation, and maintenance of technology are well-planned and organized. Common technology architecture, standards, and a strategy should be defined: The lack thereof easily leads to a fragmented and unmanageable technology infrastructure. These should be consistently used in decision making, acquisition, and maintenance.

Indicator 15: Adopted technology is affordable and easy to maintain. The existing technological solutions should be documented in a way that their life cycles can be managed. It should be possible to implement new technological solutions smoothly and without heavy additional investments. Maintenance of technology should not be dependent on any one person or supplier because the loss of that person or supplier would pose a great risk for the organization.

Table 6. Key Indicators Identified for Technology Architecture.

Indicator	Statement	Measurement
Indicator 14 Management of Technology	Management of technology is well-planned and organized.	A common technology architecture, standards, and strategy have been defined, and they are consistently used in decision making, acquisition, implementation, and maintenance.
Indicator 15 Acquisition and Maintenance of Technology	Adopted technology is affordable and easy to maintain.	The existing technological solutions have been documented in a way that their life cycles can be managed. New technological solutions can be implemented smoothly and without heavy additional investments. Maintenance of technology is not dependent on one person or supplier.

DISCUSSION AND CONCLUSION

In this study, we employed an internal organizational approach to the innovation process. The importance of connectedness and flexibility in the various phases of the innovation processes has been noted in previous research. Both are needed throughout the process, but we conclude that they are emphasized differently. Connectedness is emphasized in the early phases of the innovation process because it is required for gathering knowledge from innovation networks inside and outside the organization. Flexibility is emphasized in the later phases because of the needed organizational changes. If the aim of innovation is to improve the performance of the

organization, the flexibility of the organization's ICT solutions and services and the agility of the organization to carry out ICT-related changes are extremely important.

Our findings confirm that organizational issues related to ICTs are very important; indeed the majority of the identified factors are found in the business architecture category, and only about a half of these factors deal with ICTs or information management. Innovativeness should be a strategic concern for the organization. Lean and well-functioning business processes and organizational structure are necessary foundations for good ICT-related decisions. The strategic role of ICTs in achieving business processes and innovativeness should be recognized as well. When the organization and its business processes are designed to embrace opportunities for innovativeness, suitable ICT services and systems can be implemented to support them. ICT solutions have limitations, however, which need to be considered during planning and implementation.

Clearly a major issue identified in this research for enabling connectedness and flexibility is integration. Factors related to integration can be found in all categories, extending from organizational and business process integration to systems and technological integration. Integration is a concern not only within the organization but extends beyond the organizational boundaries. Integration creates a basis for well-functioning connections within and between organizations, and is necessary for connectedness. Flexible integration, on the other hand, is a basis for flexible organizational structures and ways of working, which are needed for implementing the changes involved in adopting innovations. In this way, integration is important both in the early phases of innovation processes by enabling connectedness and in the later phases by enabling flexibility.

Service thinking and user-orientation also arose in several indicators. They show a requirement for fitness, fluency, and flexibility that not only relates to existing processes and workflows but also promotes innovation therein. Fluent workflows and ways of working with well-designed and adaptable tools enable users to focus on their actual work instead of the systems and applications they are using. Service orientation also helps the service provider understand the customer's business processes or the users' ways of working, thereby improving the ability to detect and embrace opportunities for new service innovations.

A single but rather obvious factor is the need for systems and applications that support business processes and innovation activities. The systems and applications should support, for example, cooperation, information gathering, and learning. Different aspects mentioned in the responses include group work, networking, unified communication, customer relationship management, data mining, and tacit knowledge sharing. Largely, these support the early phases of innovation processes not only by enhancing connectedness among people but also by improving the accessibility, retrieval, and processing of information. The organization should be active in searching for new systems and applications, identifying the opportunities they may give, and promoting the use of new tools in its innovation processes.

We conclude that it is necessary for organizations to consider ICT-related factors when they intend to improve their innovation activities. ICTs can enhance connectedness and flexibility throughout the innovation process, but they do not lead to organizational innovativeness independent of other organizational factors and people. If the organization is well-functioning, suitable ICT solutions can provide important value adds for its innovation activities.

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ELECTRONIC PATIENT RECORDS IN INTERPROFESSIONAL DECISION MAKING: STANDARDIZED CATEGORIES AND LOCAL USE

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Abstract: *Electronic patient records (EPRs) are a constitutive element of medical practice and are expected to improve interprofessional communication and support decision making. The aim of the current study is to explore the ways in which access to structured information from multiple professions within EPRs enters into the phases involved in arriving at final agreements about patients' future care. The results show that decision making in interprofessional team rounds involves a prestructuring of a pathological reality. Further, the results demonstrate how information in EPRs is deconstructed and recast into patterns that presuppose knowledge about the EPR's structural organization. This means that EPRs are highly flexible technologies and that their design does not determine their usefulness. A major conclusion is that the members' knowledge on how to bridge between standardized categories in EPRs and their local meanings is decisive for understanding the basic conditions necessary for how EPRs could support interprofessional collaboration.*

Keywords: *Electronic patient records, decision making, categories, standardization, communication, information technologies.*

INTRODUCTION

In the present study we explore the ways in which digital information systems for documenting patient care feature in interprofessional decision making. A common characteristic of systems of this type is that they provide an extended access from not only a single profession, but also from other professions involved in the provision of patient care. One crucial issue addressed in the present study is how information from various professions is used to present a typical case, and how such cases are reformulated in the processes of decision making in respect to the patient's future care.

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In addressing these issues, we concur with a number of studies in areas such as computer supported cooperative work (CSCW) and human–computer interaction (HCI) that suggest that, in research on digital technologies, it is necessary not only to focus on technical elements, but also on how such work is carried out in situ (e.g., Hindmarsh, Jenkings, & Rapley, 2007; Kane, Groth, & Randall, 2011). Further, our study aligns with an increasing interest in going beyond doctor–patient consultations and in the direction of collective decision making. In so doing, the forms of communication that arise "between members in health care teams" (Pilnick, Hindmarsh, & Gill, 2009, p. 5) thus become of central concern. Much of the research in this field has a focus on the ways in which health information systems function as constitutive elements of organizational memories (Ackerman & Halverson, 2004), thus pointing to the centrality of these systems for making informed decisions about patients' ongoing and future care (for organizational implications, see also von Krogh & Nåden, 2008). Not only is it widely acknowledged that patient records function as a hub in health care (Berg, 1996), but there is a growing consensus that the introduction of electronic patient records (EPRs) can extend possibilities for interprofessional decision making (Napolitano, Ranaghan, Middleton, & Gavin, 2011), mainly by serving as a source of adequate, timely, and location-independent information for understanding patients' problems (Bossen, 2006). In this context the present study forms a contribution to the growing body of research on the role of technology in the types of problem solving that take place in medical team meetings (Måseide, 2003, 2007, 2011). Not only do these studies suggest that such processes are deeply intertwined with the institutional order and its responsibilities, but they further demonstrate how decisions emerge as a result of the interaction between experts, where cases become reformulated and reconstructed as part of a sequenced process. The reformulations and reconstructions that take place at such meetings ultimately aim at the professionals involved arriving consistently at joint decisions regarding what "can and should be done" with a patient.

Having said this, the ambition of implementing technologies such as EPRs in complex organizations and work processes can often involve overlooking existing problems and, indeed, creating new ones (Clarke, Rooksby, Rouncefield, Procter, & Slack, 2006). This poses a particular risk if the information in EPRs is seen or treated as a self-sustaining entity that can be used and understood in uniform ways, irrespective of the context. Many aspects require attention in order to further improve the understanding of the multifaceted interplay among the organization, professionals, and technologies in collaborative decision making (Niazkhani, van der Sijs, Pirnejad, Redekop, & Aarts, 2009; Tang & Carpendale, 2007). These include problems of cooperation and coordination; of time, space and place; of institutional and professional obligations; and the conceptual knowledge of the professions built into the technology (Bossen, 2002; Martin, Currie, & Finn, 2009; Svenningsen, 2003; Timmermans, Bowker, & Star, 1998).

An important point of departure for the present study is that the meaning of information cannot simply and unproblematically be transferred between one context and another. Rather, such transfers presuppose a shared knowledge among health-care workers as to what the information actually means and the implications that are to be drawn (Hartswood, Procter, Rouncefield, & Slack, 2003). The meaning of information thus cannot be taken as a given. Because EPRs are intended to serve a multiplicity of information needs, considerable demands are placed on users to make sense of data that are relevant for the specific purposes at hand (Berg, 1996). Consequently, local interpretative work in discerning the meaning of

texts, signs, and data is needed before transforming it into a locally relevant fact in the process of decision making (cf. Østerlund, 2008).

A fundamental feature of EPRs is that they enable both intra- and interprofessional decision making, where decisions are built upon categories that facilitate the communication of similar and precise meanings within and across professional boundaries. For this reason EPRs are organized according to certain terminologies and hierarchically structured categories which, simultaneously, are intended to obstruct the input of unformatted information (Timmermans & Berg, 2003; Tjora & Scamnler, 2009). This development also relates to ambitions that EPRs should serve a wide range of processes, such as patient-directed care, quality assurance, and administration. Because of this multiplicity of needs, the information provided in EPRs is often open-ended and not readily available for use.

As previously mentioned, a common characteristic of EPRs is that they are constructed from a series of hierarchical categories organized as main, sub-, and subordinated categories. This organization provides a means to make visible the ways in which the categories are related to one another and how they fit into the hierarchical order. The structure with sub- and subordinated categories also systematically organizes data and results from different observations. In the system used in this particular study, all of the main categories for the nursing staff have the prefix *care* (*omvårdnad* in Swedish), which functions as a way of linking the data to the nurses' patient module. Similarly, data stored in the physicians' modules have the prefix *medical*. The most common way of relating documentation from different professions to each other in the EPR is to divide it into separate modules for each particular profession. Even though the members of a particular profession are able to read the records of the other professions in the EPRs from this study, they are not permitted to create new entries. When accessing the EPR, the professionals initially have to choose records either from all professions or from just a particular selection. Moreover, EPRs regularly include a wide range of primary functions as well as complementary functions, such as the management of text, laboratory readings, referrals, and the results of examinations, tests, and x-rays.

A contested issue that is prominent in the research on information technologies for health-care purposes is whether or not such technologies should be regarded as determining what counts as relevant knowledge or if technologies are shaped by the social context in which they are used. Proponents of the first perspective have suggested that EPRs are based on a logic of standardization that functions as a form for organizing knowledge (Ericson & Haggerty, 1997; Rowley & Hartley, 2008). These researchers lean on Giddens (1990) in their argumentation that decision-making instruments, such as EPRs, tend to formalize knowledge-creation processes, and that built-in categories and classifications prescribe how topics and items should be related to one another and understood by professionals. In a similar vein, Postman (1993) claimed that there are ideological biases embedded in technologies of this kind because their structures, categorizations, and classifications attempt to construct and value skills and knowledge. This kind of argument has been taken even further by scholars such as Lyotard (1999) and Franko Aas (2004), who argued that, due to their category and classification systems, technologies maintain a certain logic that prescribes what knowledge is. Hylland Eriksen (2001) adopted an opposing position, arguing that technologies are nonacting tools for generating actions and activities. From this perspective, the foci of analyses rarely lie on the technology itself or its use but, rather, on social aspects of health-care work. The technology is thus seen as a highly flexible instrument available to be used in any number of different ways.

In the current study, based in the tradition of workplace studies (Heath & Luff, 2000; Luff, Hindmarsh, & Heath, 2000), a third perspective is adopted: a *technology-in-practice* approach. From this point of view, technology is analyzed as one of many actors at play in any given activity. Understanding the logic of decision making is thus based upon how, as used in everyday work, the categories are understood by the participants. Such an understanding can emerge only as a result of studying the practical use of such categories; it is not to be found embedded in the categories themselves. Rather, understanding depends on the knowledge of the professionals involved in making sense of the relations between categories and the information they embrace (cf. Bowker & Star, 1999). This means that a specific, locally relevant meaning cannot come into being without knowledgeable interpretative work by the professionals involved. Such work presupposes knowledge about how information is structured in the system (Winman & Rystedt, 2011), and, of particular interest in the present study, the specific meaning of categories and their relations in a particular context, that is, what Garfinkel (1967) referred to as the indexicality of categories.

The aim of the current study is to explore how access to structured information from multiple professions in EPRs features in the process of making decisions about patient care. More specifically, we wanted to closely examine the ways in which staff members make use of EPRs to retrieve information about their patients and how this subsequently is factored into the negotiations involved in collaborative decision-making processes. Further, we discuss the implications that the introduction of digital formats might have on decision-making process and the reconfiguration of the needs for professional knowledge inherent in such work. In addressing these aims, three questions have guided the analysis:

- How is information provided by EPRs selected and organized in the preparation for patient briefings?
- How do staff members transform information in EPRs into argumentative resources in the processes of decision making?
- How is the logic of decision making established when using EPRs in team rounds?

DATA COLLECTION

The data collection took place in a hospital ward at a medium-sized hospital in Sweden, where care was provided for patients suffering from stroke-related disorders. Both the data collection and data analysis were guided by qualitative ethnographic principles (Agar, 1986; Hammersly & Atkinson, 1995).

In order to gain a grasp of the workflow and the ways in which the work was organized (Jordan & Henderson, 1995), approximately 190 hours of observations were carried out. The observations, which were conducted by the first author over a period of 6 months, were documented in field notes. These field notes were transcribed the same or the following day and were used to guide subsequent observations.

After an initial observation period, the focus of the observations was changed from a general observation of the workflow to a focus on team rounds. These events were revealed as an activity where the EPRs played a critical role in organizing and coordinating work and where the staff on the hospital ward regularly met to form a holistic understanding of needs of further care. In other words, team rounds were arenas for interprofessional decision making.

The data corpus includes video recordings of the nurses' preparatory work prior to the team rounds. Here, a video camera was placed beside the nurse in order to capture how she interacted with the computer and how she made use of a notepad. A second video camera captured the occurrences on the screen. The purpose of this strategy was to capture the user interface and show how the nurse assembled information from the different modules and sections in the record.

Although originally five team rounds were observed, an additional nine team rounds were included in our observations in order to capture more detailed aspects. The team rounds collective involved approximately 90 patients. Each round lasted about 45 minutes and was audio recorded, and all of the field notes and audio recordings were transcribed the same day.

All data, including field notes from observations and transcriptions from audio recordings, were used to form the basis for analysis of the staff members' use of information as part of their decision making. The initial analyses from the observations showed that the technology was very concretely integrated in construing and juxtaposing crucial information concerning patient care. Therefore, field notes and the transcribed video recordings of the nurses' preparatory work were examined repeatedly in order to scrutinize how the nurses selected the information presented in the EPRs when preparing for patient briefings. The analytical focus was put on which pieces of information within a complete EPR were selected and how this information was organized in the subsequent briefing.

Our analysis also involved repeatedly listening to the audio recordings of the team rounds and reading through the transcriptions. Re-readings and notes in the margin of the transcriptions (Hammersly & Atkinson, 1995; Silverman, 2000) guided the further analysis in order to understand how arguments in the decision-making process were related to information provided by the record. Here, the focus was on structures and interactional patterns in the team rounds. In our initial analyses, we discerned a pattern of discrete phases in the process, which seemed to be sequentially ordered. This directed our focus toward the relations between the phases in the team round and how information from the different modules in the EPR impacted typical reconstructions of cases. The latter involved an analysis of the knowledge inherent in transforming the information into argumentative resources in the progression of decisions.

TEAM ROUNDS AS AN ARENA FOR DECISION MAKING

The team rounds were held once a week in a meeting room on the ward for the purpose of coordinating and organizing work activities. The staff of the ward (registered nurses, various physicians, physiotherapists, occupational therapists, auxiliary nurses, and psychologists) held such meetings as a means of making decisions about patients' future care. For each patient, the team was obliged to decide what can/shall be done with this patient, for instance whether the patient should be discharged or if she/he would still need further rehabilitation.

The team rounds were held in a meeting room located at the end of a long corridor of the ward. The meetings were held primarily in the morning, and participants sat around a large oval table. Participants from the same specialty, if more than one attended, usually sat together. Following a welcome by the doctor and a patient-consideration prioritization, each patient was discussed by order of bed number. The first step involved the nurse from the ward making a short presentation to the group about the patient. This patient briefing had to be succinct to fit

the time schedule, but it also had to include enough information for the staff to develop a general view of the case. Thereafter, the group started their discussion, with the goal of reaching a mutual agreement of the past, present, and future care and status of the patient, and make decisions about the patient's future. Viewed in this way, a team round consists of two phases: the patient briefing and the decision making. Analytically, these phases are inseparable from each other because they both are parts of an overall process of team round decision-making process, even if very different logics are in operation. By illustrating these processes separately, though, it becomes possible to reveal both their common and divergent features and to show how medical decision making is bound up with the EPR in use. Moreover, it shows how the technology constitutes a resource that can enable staff members to achieve collective understandings and to frame and formulate decisions in relation to their own profession-specific obligations.

Therefore, to make this analytical point, the results below are divided into two sections. The first section illustrates how the EPR is used in presenting a patient in a briefing. The multiple steps in the second section illustrate how categorized information in the EPR is used in the medical representation (i.e., how to understand the case), and how this serves as a means in a process of negotiation.

The general pattern in the team rounds comprises five phases: (a) presenting the case, (b) framing the main problem, (c) elaborating the case, (d) agreeing about the case, and, finally, (e) making the final decision. In order to illustrate the reasoning of the staff members in each of these steps, one case at a team round will serve as an example. The chosen case is typical of a general pattern that was found in the analysis of all 90 cases dealt with in the team rounds. Below we will follow the case of Bertil (a pseudonym) from the nurse's briefing until the point where the team has recast his problems into a solvable case and aimed at a final decision. As will be demonstrated in the section immediately below, carrying out a patient briefing demands that the nurse knows what the other team members expect and need for meeting the objectives of the team round.

Presenting the Case

The case presented here concerns a relatively new patient (Bertil), who several of the participants at the team round had not met. This implies that the nurse could not assume that her colleagues knew anything particular about the patient in advance, or, at best, that she must assume that such knowledge would vary among the staff members involved. As we will show by analyzing Excerpt 1, the nurse tried to present Bertil's case in a way that was relevant and comprehensible to everyone present.

By looking more closely at the preparation for the team round (Excerpt 1), it is possible to see it as a process of making information intelligible. During the preparatory work, the nurse looked for relevant information in the EPR, and she knew where in the modules of the different professions the information sought was located. In addition, she knew how the information within these modules was organized into different categories.

The data available in the EPR about this specific case corresponded, overall, to eight printed pages of information created by the professionals. By selecting and reorganizing the information available, the nurse ended up with a small selection of notations on her notepad.

[Verbatim translation from Swedish]	**Physicians´ Record**	**Nurses´ Record**
(a) Yes, then we've got Bertil Karlsson in [room] five two, born [in 19]35.		General Other info
(b) Bertil came here on January 14 [feeling] poorly with [a] weak left side and lack of vision.		Care anamnesis Contact reason
(c) He got the increase here in-- wasn't it when he was at Kava before he got here, or, well, Ward 4, and then he became substantially worse .	Admission Reason for admission	
(d) And then it subsided a little… has ...and then--it seems--became worse.		
(e) He was in over Christmas, too, when he had had a Tia there.		Care-anamnesis Health record
(f) … is waiting for a reply from Gothenburg [hospital] regarding Carotis; he has a Carotis Stenos.		Care anamnesis Care experience
(g) If there's something you would operate on--then it is probably the, the thing which blasts the clots then.	Status Additions	Admission Consultants

Excerpt 1. The source category in the EPR from which the oral briefing information originated. *Note*: *Kava* is the ward for surgical emergency care (*Kirurgisk akutvårdsavdelning*). *TIA* stands for Transient Ischemic Attack, a transient episode of neurologic dysfunction caused by loss of blood flow. A Carotis Stenos is when the blood vessel in the throat is clogged.

Such a reduction is necessary because a patient briefing is useful only if it is based on a specific amount of relevant information sufficient for the team to use as a point of departure.

By sorting out data such as "weak left" and "lack of vision" (Excerpt 1, b) from the EPR, the nurse transformed information about the patient into a shorthand representation that was relevant for the purposes at hand. The complexity of giving a patient briefing and the knowledge that is needed in the preparatory work can be seen by tracing the various data in a narrative based upon its location in the EPR.

The sequencing of talk in Excerpt 1 can be understood in terms of the way a patient briefing is traditionally performed. The overall pattern and the historicity of this activity have a specific sequential order, which is maintained in the briefings. This well-established narrative pattern (Montgomery Hunter, 1991) is generally used in team rounds as well as in other situations as a means of organizing information when staff members give oral reports to their colleagues. The order of information is generally presented as follows: (a) the patients' date of birth/registration, (b) symptoms, (c) former health problems, and (d) previous, current, and planned treatments.

The briefing is not a complete description of the patient's situation, nor is it supposed to be. Instead, it is a way of defining a case that could be acted upon (Timmermans & Berg, 2003). However, knowing what to include and how to actually construct the patient briefing involves

not only knowing what data to include for the purposes at hand, but also where and how to look for relevant information. As is apparent in Excerpt 1, the briefing does not follow the structure of the EPR, but comprises different pieces of information in the categories and subcategories in the nurses' and physicians' modules. This reconstruction of the case implies an ability to anticipate, from the perspective of the listeners, what will be perceived as relevant content (Montgomery Hunter, 1991). According to Montgomery Hunter, the patient briefing might seem incomprehensible to the untutored listener, but it is nevertheless an essential part of the decision-making process. This briefing, in the form of a narrative, eliminates irrelevances while highlighting what is essential and related to the overall aim of the round, which is what can/shall be done with this patient. This briefing illustrates how decision making is an interpretative activity founded upon the staff members' understanding of the patient.

The Decision-Making Process

Although the briefing provides a recast version of the patient's problems, it is nevertheless closely connected to the content of the EPR. It is sufficiently open to provide opportunities for the team members to start their deliberation. The initial phase of the patient briefing is characterized as a story that is comprehensible and sufficiently relevant for the colleagues assembled to engage in the activity at hand. By selecting and sequencing information from the EPR modules for each profession into a locally meaningful narrative, the patient briefing now constitutes a ready tool for the participants to collaboratively formulate what the case is about or, as Montgomery Hunter put it, to "search for a clue that will unlock the mystery of the patient" (1991, p. 4). This means that there is an inseparable relation between the historical way of reconstructing a case and the way staff members frame and deal with any particular case. In the sections that follow, we will further scrutinize the next phases of team rounds by continuing to follow chronologically the case of Bertil.

Framing the Main Problem

All reconstructions of cases in patient briefings can be seen as selections and transformations of information from patient records which, in turn, not only reconstruct the case, but also the patients' needs and the team's responsibilities and tasks. As will be seen in this particular example, there is coherence in the topics between the patient briefing and the outcome that follows, that is, the process of decision making.

It is not possible to have a fixed answer regarding what to do in a context of deliberation, which is the essence of the team round. Therefore the main characteristic of the team round is its interactional nature, where interprofessional teams arrive at joint decisions. By analyzing Excerpt 2, we further examine the ways in which the physician recycled the information retrieved from different professional knowledge domains provided in the patient briefing. Here it becomes clear how information originating in the EPR is picked up and used for formulating arguments.

The physician's first utterance in lines 158–160 can be conceived as anticipating a response to the overall question of the team round—what can/shall be done with this patient—which is embedded in the situation and was clarified during the patient briefing. Thus, the first utterance in this part of the team round works as a preliminary reconstruction, providing a relevant description upon which to proceed.

158	Physician	Well, then there is not much to say about--Bertil--then.
159		We´ll have to wait for Gothenburg [hospital]. We haven't had any
160		response yet.
161	Nurse	Hmm [affirmative]
162	Physician	We can't really do anything at all until we know more.

Excerpt 2. The first sequence in the team round following the patient briefing.

These introductory utterances from the physician function as a part of a continuing chain of reformulations of information. They derive from the Consultants subcategory within the Registration category in the EPRs cited in the nurse's patient briefing, "is waiting for reply from Gothenburg regarding Carotis" (Excerpt 1, f), to the physician's first utterances, "Well, then there is not much to say about--Bertil--then. We'll have to wait for Gothenburg. We haven't had any response yet" (Excerpt 2, lines 158–160). These reformulations impact the direction of the subsequent elements of the decision-making process in that they constitute a starting point for subsequent reasoning.

The physician's conclusion, in line 162, that "We can't really do anything at all until we know more" constitutes a formulation of the patient's problems in relation to the staff/hospital's responsibility. Although the patient may have been experiencing severe problems in day-to-day life, the institution was not obliged to do anything with its available resources, methods, and knowledge at that particular instant. This matter was pointed out by the physician in line 162, when she emphasized *we*, referring to the team, and, *until*, which specified the then-present point of time. As can be seen, the physician almost formulated a preliminary decision, which means that she framed the situation as an administrative question relating to the institution's obligations and the possible discharge of the patient. This first sequence in the team round presumed access to information from various professionals and from different activities. When paper-based records were used, each profession kept its own records, which meant that if the records were drifting (i.e., if someone had taken the record out of the archive), the information was drifting as well. In this particular case, and in all other cases when EPRs are available, staff can easily access patient records from all of the participating specialties. So, even though the utterances in Excerpt 2 might seem trivial or self-evident, they presume access to information that is independent of place and time, that is, information provided by the EPR.

Elaborating the Case

The activity of the team round cannot be reduced to a matter of merely sharing information. To simply share information would not, in itself, make transparent the implications that the information might have for a particular course of action in terms of how, why, and when to act. In other words, the range of options that are possible or appropriate may not always be exhaustively encapsulated by what is officially prescribed. Moreover, sharing information also involves providing professionals with opportunities to discover the current state of care, namely, the particular circumstances of each individual patient and issues concerning how to

respond to present and future institutional responsibilities. Because the team round took place at a ward for stroke rehabilitation, the staff members had the additional responsibility to account for ongoing/future rehabilitation, and this also influenced the ultimate response to the question of what can/shall be done with this patient.

The institutional responsibility and its inclusion of a rehabilitation perspective are clearly evident in Excerpt 3. Here the physician continued to elaborate the case by turning to the physiotherapists and asking, "Or do you think there's something that you can see?" (line 163), which can also be seen as an indication of concern to abide by institutional obligations.

The main question is still what can/shall be done with this patient and, by reformulating the case, the physician is expecting to clarify both the nature of the problem and possible courses of action. Therefore, this question does not stand by itself but, rather, is a followup based on the physician's own conclusion, articulated in lines 158–160 and 162 of Excerpt 2. By reconstructing the case in this way, the physician clarified both problems and possible courses of action. In posing the question in line 163, the physician addressed and defined two possible ways for the physiotherapist to respond: to concur with or to distance herself from the proposed course of action. And just as the questioner's interest is revealed in the formulation of the question, the response can be seen as an answer to the physician's embedded stance (Hurley, Birch, & Eyles, 1995).

The physiotherapist´s utterance in Excerpt 3, lines 164–165, was both a response to the pronounced question (Excerpt 3, line 163: "Or do you think there's …") and to the implicit embedded question, "Do you agree or disagree with my preliminary conclusion?" In the clause that follows, "…but it's nothing that can be worked on …" (Excerpt 3, lines 164–165), the physiotherapist made clear that she understood and aligned herself with the position taken, which also correspond with her entries in the EPR.

However, the problem with the hand brought up by the physiotherapist was not new information to the physician because it was entered into the physiotherapy module in the EPR. In addition, a loose translation of the physiotherapy's EPR module noted, "Moving fingers: The patient experiences that the left hand's digits [fingers] 3–5 are a little difficult to control." Therefore, when the physician asked, "Is that *objective* …?" (Excerpt 3, line 166), it can be seen that the question is a reformulation of, and has its starting point in, the EPR. The question can be hand. *Objective*, as opposed to *subjective*, reporting is a positioning used to classify the information and, thereby, to recast the understanding of the case and classify the information. Here, *objective* simply provided the clinicians' observations, while *subjective* was used for something that the patient told the clinicians that he had experienced.

163	Physician	Or do you think there's something that you can see?
164	Physiotherapist	Well, he, he could feel a bit under his hand but, but it's
165		not something that can be worked on, like--
166	Physician	Is that *objective* or is he--?
167	Physiotherapist	When he did like this [clenching her fist] he was a
168		bit slow with these two fingers here.
169	Physician	But there's no *obstruction* there [points at fingers]?
170	Physiotherapist	No.

Excerpt 3. Elaboration of the nature of the problem and continuation of team round evaluation.

The predetermined path of outcome is pursued by asking, “Is that *objective* ...?” (Excerpt 3, line 166), in that the question itself selects the information that is in line with the implicit position in the previous question. If the information is objective, the institution now has a responsibility and, consequently, something needs to be evaluated. If, on the other hand, the information is subjective, it is likely to create a problem in relation to the obligations of the rehabilitation ward.

Berg (1992) argued that quotations, question marks, or the addition of information of a subjective nature to medical records is a way of downgrading the importance of the data. By referring to subjective domains, the physiotherapist indicated that she had noted that the patient experienced a problem but, simultaneously, stated that she herself could not see the problem. While the notation can be seen as an instance of downgrading, it can also be seen as a way of positioning hospital obligations in relation to the emergent findings. If the patient (Bertil) drew attention to the fact that there was a problem with his hand, it would be the physiotherapist’s responsibility to evaluate the complaint and enter her observations into the EPR because such a problem might be of importance at some future point in time. From this point of view, it is therefore reasonable to add in the EPR that “the patient experiences that…” (a notation in the EPR made earlier by the physiotherapist). At the same time, the additional information can be seen as a way of questioning its relevance for further rehabilitation.

This elaboration of the case is a typical example of how information from different sources is used and combined in novel ways in new situations. The information, which originated from the nurses’, physicians’, and the physiotherapists’ separate modules (see Excerpt 1), as well as from the primary patient briefing, was linked together to constitute a more comprehensive foundation than any of the separate modules in isolation could have. Indeed, it is the transparency between different professions’ submodules in the EPRs that made it possible for the physician to even ask the questions in the way that they were posed in the Excerpts.

In line 169 (Excerpt 3), the physician once again asked a question with an anticipated answer: “But there’s no *obstruction* there…?” By posing these questions (lines 166 and 169), the case had been recast and all of the necessary information was at hand for the reformulation of the initial concluding decision (Excerpt 2, line 162)—now, additionally, with the extended argument that the symptoms were subjective and not relevant for the institution.

Agreeing on the Case

In Excerpt 4, the physician once again suggested a consensual conclusion to how to understand and frame the case and how to proceed with it. This was made possible by the physician’s cohesive positioning of information derived from different categories and submodules in the EPR and by utilizing the physiotherapists’ own conclusions.

A possible problem arose though when the physiotherapist said the patient’s problem was “--not something that can be worked on--” (Excerpt 3, line 165), that is, not trainable (one should remember that this was a stroke rehabilitation ward). This could appear to contradict both to the other information provided and the preliminary conclusion. When information about the patient is contradictory, questions can be presented in various ways. Thus, by asking, “But there’s no *obstruction* there?” (Excerpt 3, line 169), instead of asking, “Does this constitute any obstacles for the ability of move?” or “How does this affect the ability of move?” the question itself contains a counteract. As Berg (1992) put it, this can be seen as an

173	Physician	Hmm no, so in terms of rehabilitation, he doesn't really need to remain
174		here either... We can't help him with anything either… so this thing with
175		his loss of vision--
176	Physiotherapist	It is more of working with his motor coordination and stuff--
177	Physician	Hmm [simple acknowledgement]
178	Physiotherapist	--that which works.
179	Physician	But he copes.
180	Physiotherapist	Hmm [simple acknowledgement]

Excerpt 4. Continuing the discussion.

attempt to regain alignment in the construal of information. Therefore, the question itself is embedded with a predetermined answer, shaping the exposition of the patient. Then, when the physiotherapist reformulated her first conclusion (Excerpt 4, lines 176 and 178), she actually recast the problem in terms of being trainable. This argument, though, is disregarded by the physician when she said, "But he copes" (Excerpt 4, line 179). This was actually a new argument based on the earlier overall conclusions and on information from the physiotherapists' module in the EPR. So, even if Bertil was trainable in some respect, he could still manage on his own, which means he was no longer an obligation for the present ward.

Making the Final Decision

Because the institutional perspective prevails in the recasting of this case, the outcome is neither an open nor an unprejudiced process. It is, however, rendered visible in Excerpt 4, in the sense that the physician not only displayed knowledge of how to use information in the EPR and of what to ask, but also demonstrated knowledge about how to reconstruct the problem.

When taking a closer look at the final conclusion in line 183 (Excerpt 5), it obviously was not entirely new. Indeed, it appears as an answer to the very first question that, primarily, was articulated in the form of a statement: "We can't really do anything until we know more"

183	Physician	…No because then he really ought to be able to go home.
184	Physiotherapist	Hmm [simple acknowledgment]
185	Physician	No… because we don't normally keep them… only if there is
186		some type of--I mean he's been in bed here a whole day… We
187		know that he has
188		functions… he has even been on doppler.
189	Physiotherapist	Hmm. [simple acknowledgement]
190	Nurse	He's got his eyes [examination] next week.
191	Physician	Yeah, but--
192	Nurse	Hmm [simple acknowledgment]
193	Phys.	But there is nothing, nothing more, so without… no, so I
194		suggest that he goes home today.

Excerpt 5. The final decision is justified with arguments from various perspectives.

(Excerpt 2, line 162). The questions during the team round all corresponded well with the predetermined answer to the overall question of what can/shall be done for this patient and, as can be seen, the team round was performed in a way that simultaneously shaped the outcome.

The final conclusion suggested in line 183 (Excerpt 5) was based on both administrative and medical considerations. In lines 185–188 (Excerpt 5), the physician summed up the arguments for the decision by referring to the organization's routines: the patient's health status and the fact that necessary examinations had been carried out. The decision was thus firmly placed among the cases of normal procedures in terms of institutional routines and decision making. In lines 193–194 (Excerpt 5), the physician made it clear that, with the information at hand, there really was nothing the team could, or indeed was obligated to, do. Thus, based on these reasons, she proposed that the patient be discharged. As is apparent in Excerpts 2–5, several arguments were used in the team round, all of which had a substantial impact on the final decision of how to understand this patient, his needs, and the nature of the interventions that should follow. These arguments all originated from the EPR and illustrated how the EPR contributed to structuring and recasting the case into a relevant representation of the patient, as well as the knowledge needed to achieve this.

DISCUSSION

The results demonstrate the general structure of the decision-making process and how the information originating in the EPR undergoes *a series of changes throughout the team round.* The case of Bertil, as originally constituted in the EPR, was first transformed into a brief presentation, which in turn was both counteracted and recast before the team made its final decision (Figure 1).

In contrast to Lyotard (1999) and Franko Aas (2004), our argument is that databases like EPRs do not have a built-in superior logic determining their use. Instead, the logic of decision making is found in the activity itself, not in the information structure. The current study shows how standardized information prestructures the ways in which problems are understood, and how it functions as a significant resource in decision making. Furthermore, it is apparent how

Presenting the case	Framing the main problem	Elaborating the case	Agreeing on the case	Making the final decision
Selecting and reorganizing information from the modules of all professions into a coherent narrative.	Reconstructing the case in terms of the institution's responsibilities: "What kind of problem is this?"	Inviting negotiations: "Are these symptoms subjective or objective?" Ruling out alternative interpretations.	Putting information from the EPR and the opinions of team members together.	Anchoring the decision in organizational routines and the institution's responsibilities.

Figure 1. Presenting, counteracting, and recasting the case in the decision-making process.

information is flexible in its use and open to different interpretations. The idea that the EPR is a complete representation of the totality of information is counteracted by this study. Even though the EPR functions primarily as a formulation of how things are concerning the patient's identity, condition, needs, and ongoing treatments, the presentation of the case (Phase 1, Figure 1) nevertheless also leaves the story open for negotiation. Moreover, the analysis points to the professional competences involved in displaying the situated meaning of the different categories. Thus an understanding of the indexicality of categories lies at the core of the team members' knowledge; they will draw on this understanding in formulating relevant arguments. It is thus of vital importance to capture the characteristics of this knowledge and how it is intertwined with the use of EPRs.

Professional Knowledge

Tracing information back to its source (Excerpt 1) reveals that creating a concise and relevant briefing presupposes various kinds of knowledge. It involves, first, knowledge about how information is categorized and classified in EPRs; second, knowledge about the different professional domains; and third, knowledge about the purpose of the activity itself. In other words, it is not simply a question of stacking information in an arbitrary manner, as suggested by Hylland Eriksen (2001). Information systems, such as EPRs, cannot be used any which way. Instead, their competent use relies on knowledge about what nurses are accountable for in the team round. When the nurse is preparing for and conducting the patient briefing, she/he knows what the intended audience expects: not a complete reconstruction of the case but, rather, a short and adequate summary structured in a recognized pattern that can be seen as a descriptive, but not a deterministic, reconstruction. A briefing is thus a construction in which every omission of information, rightly so, leaves room for individual understandings of the patient's problems. As displayed in both Excerpts 1 and 2, the information in the EPR is transformed into a narrative that is shaped both by the information itself and by the context. In this briefing, the information from the EPR was transformed to fit a certain situation. The nurse's briefing thus was based on selected and reorganized information, which then was modified in view of other pieces of information and in relation to the purpose of the team round, that is, in arriving at a joint decision.

Making practical use of the information in EPRs, therefore, is hardly a matter of simply computerizing and sharing existing patient record systems. Instead, using EPRs in team rounds demands that practitioners are sensitive both to each other's perspectives and to the ways in which the activity unfolds turn by turn (cf. Måseide, 2007). In line with the current case, the medical staff knew that their colleagues were actually supposed to draw inferences from the particular remarks in EPRs. Or, as Heath and Luff (1996) put it,

> They can rely upon those inferences not only to include information which might otherwise seem relatively trivial, but to exclude particular items (or even categories of object) knowing that any competent reader would be able to make sense of the entry and retrieve the relevant information. (p. 356)

Figure 1 is an example of how medical conditions, such as coordination and moving fingers, constitute the categories within the EPR that are inherently indexical and thus relate to a specific set of institutional activities. As part of such institutional activities, categories are

based on historically generated forms of knowledge and acting. The categories from the EPR (Figure 1) were used by the physiotherapists in their examinations and are further noted by the physician in the team round (Excerpt 3, line 169). Although categories mediate information, their specific meanings are construed in situ. Nevertheless, because the categories are invoked in everyday work, they also support norms and routines. For instance, when nurses prepare patient briefings, their experiences from doing team rounds in this setting become resources even before they start to search for information about patients. These activities involve historically established knowledge of what is considered relevant and necessary information, together with knowledge of how to structure a medical narrative (Montgomery Hunter, 1991). As Mishler (1984) pointed out, categories and remarks can be viewed as re-representations of the professionals' knowledge. How team members or, in the current case, the nurse reorganizes and restructures information from the EPR into a short oral briefing becomes a reflection of the understanding and knowledge in and about situations. Such knowledge appears in the current case as the use of categorized information in the EPR and implies knowledge about how to handle the technological system in which categories are embedded. Of course, knowing how to handle categories also involves knowledge about the contiguous activities that form parts of the context. From this point of view, categories can be seen as knowledge bearers in that they contain specific information not only about the content, but also how they are interrelated with and are adjusted to other categories. "Is that *objective* …?" (Excerpt 3, line 166) demonstrates how categories in the EPRs have a constitutive role for recasting the case. Moreover, it shows how categories are not affixed to specific settings, but instead can be used in new combinations in new situations. This can be viewed as indexicality in the use of categories, which simultaneously constitutes the sensemaking processes necessary to maintain and continue the process of the activity.

A significant aspect of how EPRs work for specific purposes is that the categories that form their structure provide resources for prestructuring a pathological reality. When, for example, a physician asks questions, he/she makes relevant a set of possible answers and therefore also shapes the patient's historical data (Prottas, 1979, pp. 9, 161). This provides an example of how information obtained in a decision-making activity can be recast into pre-embodied patterns that are founded on the predefined structures. The categories that form the basis for EPRs are thus both constitutive and perspective-setting in that they transform the understanding of the problem and how it should be handled. From this it follows that EPRs function as stabilizing factors that create expectations of knowledge and processes recognizable to the actors. In other words, knowledge can be seen as being shaped and transformed by EPRs as it becomes part of such settings (cf. Agar, 1986; Bryman, 1988).

The abilities of team members to recognize and ascribe locally relevant meanings to categories indicate how competent use of EPRs is bound up with the indexicality of categories (cf. Garfinkel, 1967). This is rendered visible in this case through the physiotherapist's notation about the patient's experience of a problem in moving his fingers, which is stacked under the Coordination subcategory. From one perspective, this category mediates expectations connected to the responsibilities of the physiotherapist and points to the activity where the patient is examined. The notation can then be seen as a status report which, simultaneously, is also a response to the expectation of examination. Moreover, as can be seen, it was picked up from the EPR by the physician and used in the team round. The notation then was used to formulate an answer to the question of what can/shall be done with this patient. One specific goal of the team round is to come up with a plan for further action. So the Coordination category had, at least to

some extent, affected the physiotherapists' actions in the past (sufficiently enough to require notated information), which in turn was picked up on by the physician in the then-present situation in addressing activities in the future. This means that the open-endedness of categories also involves time, referring both to previous activities and in projecting future consequences. Moreover, EPRs, and the category system they are built on, bring together multiple activities conducted by various staff members for different purposes and which constitute the necessary coordination for making decisions decisive for patients' future care.

Institutional Implications

The ways in which categorized information is brought to life and becomes rational has to be understood in relation to the institutional context in which it is to be used (Sacks, 1992). This means that the logic of decision making can be found at the intersection of the ongoing activity and the EPR (the categorized text about the care work). This is evident in line 169 (Excerpt 3), where the physician replicated and asked, "But there's no *obstruction* there…?" when the physiotherapist framed the understanding of the situation into an administrative question of whether or not the patient should be discharged (cf. Mäkitalo & Säljö, 2002).

It is widely accepted that there is a need for standardized terminologies and information structures to enable different health-care professionals to share information (Timmermans & Berg, 2003). Even though we concur with this assumption, we nevertheless argue that working across professional boundaries also presupposes knowledge of the tasks and responsibilities of others, as is illustrated, for example, by the nurse's use of information from multiple modules in the briefing studied here (Excerpt 1). It is in the process of knowledgeable conduct that information in EPRs is brought to life in a way that makes it accurate, available, accessible, effective, and, most importantly, usable (Berg, 1996). In doing this, no fixed hierarchy exists, meaning that a certain category of information does not necessarily count more than another. Nor does information in the EPRs, in principle at least, necessarily overrule contextual factors.

The results demonstrate how the process of decision making within a particular institutional setting presupposes extensive knowledge of the indexicality of categories, something that originates in the participants' shared institutional history. This indicates the possibility that making sense of standardized information by professionals in different institutions—with different professional languages, obligations, duties, routines, and so forth—may be a much more demanding task than has been perceived previously (cf. Mäkitalo, 2002). Our contention is that the efforts to facilitate information sharing need to account for the local interpretative work needed, and for the knowledge embedded therein.

On the one hand, the increasing attempts to formalize and standardize terminology and categories can be seen as a way to remove ambiguous information that could otherwise undermine overall usability and reliability. However, on the other hand, the meaning of information is socially and temporally situated. Because categories are bound to activity (Sacks, 1992) and embody predicates for obligations and rights in specific institutional contexts, participants not only use categories to make sense of and progress with activities, but also use them as waypoints for action. This implies that personal knowledge about the context in which needs for information and understandings arise is also of consequence for the possibilities of EPRs to support interprofessional decision making (cf. Tjora & Scamnler, 2009; von Krogh & Nåden, 2008).

CONCLUSION

One major conclusion is that, in comparison with paper-based records, EPRs could serve as an important resource in practices of decision making and provide an additional layer of transparency and accessibility to information. Consequently, EPRs may enhance the possibilities for crossing professional boundaries and facilitate collaboration (Martin et al., 2009). However, EPRs may also support the reproduction of the institutional order. Because the structure of EPRs is maintained by historically established categories, a general conclusion is that they can also contribute to a reification of the institutional history. This means that the structure in the EPRs, to some degree, must inevitably be seen as a historical script through which the past is preserved and a continuation into the future is constituted. This means that EPRs are highly flexible technologies and that the constraints and possibilities for their productive use are dependent not simply on their design. In addition, as suggested in the present study, the staff members' knowledge about how to bridge the standardized categories with their local meaning is decisive for understanding some of the basic conditions necessary for advocating that EPRs can support interprofessional collaboration.

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THE PROCESS OF REMEMBERING WITH THE FORGOTTEN AUSTRALIANS: DIGITAL STORYTELLING AND MARGINALIZED GROUPS

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Abstract: *Digital storytelling projects have proliferated in Australia since the early 2000s, and have been theorized as a means to disseminate the stories and voices of "ordinary" people. In this paper I examine through the case study of a 2009 digital storytelling project between the Australasian Centre for Interactive Design and a group identifying as Forgotten Australian whether digital storytelling in its predominant workshop-based format is able to meet the needs of profoundly marginalized and traumatized individuals and groups. For digital storytelling to be of use to marginalized groups as a means of communication or reflection a significant re-examination of the current approaches to its format, and its function needs to undertaken. This paper posits new ways of utilizing digital storytelling when dealing with trauma narratives.*

Keywords: *digital storytelling, memory, participation, social inclusion.*

INTRODUCTION

The human capacity to tell stories is a skill that can be considered both natural and learned. Storytelling and oral history can be found in all human societies; we humans seek to understand ourselves and each other through stories. Individual and collective memories collide in stories, as storytellers and story listeners seek to reconcile and construct what Kansteiner called the "collectively shared representations of the past" (2002, p. 182). Personal narratives form the building blocks for public narratives and, as Harter, Japp, and Beck maintained in *Narratives, Health and Healing*, "narrative is a fundamental human way of giving meaning to experience" (2008, p. 3). As a dynamic practice, storytelling, in all its forms, must be nurtured and developed if it is to contribute to the lives of individuals and communities.

Within the suite of methods for telling stories, digital storytelling has emerged as a useful and efficient way for stories to be collected and shared. As a process, it allows stories to be told in ways that incorporate visual and audio tools to enhance the power of the story. Additionally,

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digital stories can be shared widely and quickly through digital technology, reaching audiences previously unattainable for "ordinary" storytellers. Thus far, digital storytelling has been theorized and practiced within a specific set of boundaries, and the limits of those boundaries have not been critiqued in any significant way. As a result, digital storytelling—as a means of connecting marginalized and mainstream communities through stories—remains underutilized, and its flexibility as a medium for disadvantaged groups and individuals relatively untested. Through the analysis of the case study in this paper, I explore the limitations of digital storytelling for particular cohorts. Furthermore, I ask whether the conventional framework of digital storytelling is necessary, and if not, how opening up this process can make it accessible to hitherto unrepresented parts of society.

The recent apologies to groups known as the Stolen Generation of Indigenous Australians[1] and to the Forgotten Australians[2] have drawn attention to an emerging intersection between the affordances of digital technologies and the recognition of the stories of marginalized people. Researchers have identified the potential of digital storytelling in these contexts as a means for inclusive co-creation to assist in the representation of multiple voices and viewpoints on the part of those affected by these issues (Burgess, 2006; Hartley, 2010; Klaebe & Burgess, 2009). The digital storytelling project that forms the basis for this paper was conducted in 2009 with a group of Forgotten Australians, in the months leading up to an apology delivered in the Australian Parliament in November of that year. In the project, I investigated the traditional paradigm for digital storytelling and its inadequacy at times to reflect the trauma of the participants, and to incorporate the sometimes incoherent narratives they created. However, it became evident in this project that the process of co-creating a digital story could be repurposed and reimagined by some of the participants to build a story that they believed authentically re-presented their experiences. Thus, it pointed to the possibility of using a new conceptual framework for digital storytelling in particular contexts.

Digital Storytelling in Australia

The number of digital storytelling initiatives and projects in Australia has increased rapidly since the early 2000s. The initiatives and projects have been and still are utilized by various public and community organizations for a variety of reasons. A digital story is generally a 2- to 4-minute multimedia story in which photographs, film, and drawings are used to convey a personal story, personally narrated by the storyteller. Hartley and McWilliam (2009, p. 1) defined digital storytelling as "a workshop based practice in which people are taught to use digital media to create short audio visual stories, usually about their own lives." Digital storytelling can be classified into three broad types: (a) historical (collecting public histories of community and place), which is the dominant type used by museums and public institutions in Australia; (b) aspirational (empowering storytelling, particularly by marginalized storytellers); and (c) recuperative (helping storytellers overcome adversity; McWilliam, 2009, p. 39). Most digital storytelling projects utilize aspects of all these types so that the story comes together in a cohesive, palatable, and enjoyable whole, to which the audience understands how to respond.

Much has been and continues to be written about digital storytelling as a site for participation within a culture and as a means to improve digital literacy in segments of the society traditionally underrepresented as participants in the digital culture (see Burgess, 2006; Hartley, 2009; Hartley & McWilliam, 2009; Lundby, 2008; Meadows, 2003). Within this context, the scope and

definition of digital storytelling are increasingly up for debate. Specifically because digital storytelling fills "a gap between everyday cultural practice and professional media" (Hartley, 2009, p. 122), its potential has been championed extensively, and it has become a site of competing agendas. Nick Couldry (2009, p. 374) suggested that digital storytelling means that a whole range of personal stories now are being told in potentially public form using digital media resources. What this means to the creation of digital stories may be, however, an increased emphasis on appealing to a potential audience rather than in fulfilling the intentions of the creator. As a means of creating narratives, digital storytelling has proven to be a significant mode, due in part to its ability to reach a large number of people relatively easily. The audience for most digital storytelling projects is limited only by the wishes of the storytellers. Stories can be burned to compact discs and distributed or sold within the community, broadcast via a public event, or uploaded onto a Web site, such as the video sharing site YouTube, for wider access. The number of viewers varies, depending on the level of interest in the issues explored within the stories, the cohort creating the stories, and the conditions under which the stories were created. For example, a series of stories created by a large public institution, such as a library or museum, has different potential for audiences than stories created by a small community organization.

Quite rigid conventions have grown up around the model of facilitating and creating digital stories, which add to the appeal of stories for certain groups in society, yet simultaneously detract from the ability of other groups to produce digital stories, particularly those who perhaps would benefit most from the opportunity to tell their stories. Traditional digital storytelling workshops operate on the notion of expert facilitators who co-create the stories with the participants. There is also an assumption that participants arrive with a store—tangible and intangible—of memories and mementos from their lives that they can use to make a digital story, and that they have at their disposal all the necessary accoutrements to tell their story coherently and compellingly.

This form of digital storytelling is described by Jean Burgess as a movement

> … explicitly designed to amplify the ordinary voice. It aims not only to remediate vernacular creativity, but to *legitimate* it as a relatively *autonomous* and worthwhile contribution to public culture. In this model of Digital Storytelling narrative accessibility, warmth, and presence are prioritised over formal experimentation or innovative "new" uses for technologies. (Burgess, 2006, p. 141, italics in the original)

The rise of digital storytelling in part mirrors the broad shift toward a more participatory online culture that privileges user-generated content and ordinary stories over content from official sources. The origins of digital storytelling lie in a response to the absence of ordinary voices in mainstream media and grew with the increasing affordability of digital technologies. As Daniel Meadows, one of the pioneers of digital storytelling, claimed, "No longer must the public tolerate the media being done to us. No longer must we put with professional documentarists recording us... keeping only the bits that tell our stories their own way, and more likely, at our expense" (2003, p. 192). The potential for social inclusion and participation, along with the promise of self-representation, is implicit in the discourse around digital storytelling. "The ability to express oneself in digital media and in the case of digital storytelling using digital video editing have become a central literacy for full participation in society" (Lambert, 2009, p. 85).

Explicit governmental directives in Australia define the role of digital technology in the efforts to encourage the social inclusion of and participation by marginalized individuals and

groups. The Australian Department of Broadband, Communications and the Digital Economy (2011, Digital Media Literacy section, para. 1) has stated, "Digital media literacy ensures that all Australians are able to enjoy the benefits of the digital economy: it promotes opportunities for social inclusion, creative expression, innovation, collaboration and employment." The aims articulated by Lambert (2009) and the philosophy of digital literacy and social inclusion lay at the heart of the digital storytelling project described in this paper. However, the outcomes and benefits of the participants were much more amorphous.

The Forgotten Australians

In November 2009, the Australian Parliament delivered a bipartisan apology to the Forgotten Australians for the pain and suffering they experienced previously in church- and state-run institutions. The stories of the Forgotten Australians began to make their way into the consciousness of the Australian public through documentaries by Australia's national broadcasting service and articles in the mainstream media, in the lead up to the apology. Like most large groups, the Forgotten Australians involve diverse demographics: Those identified as part of this group include successful and well-known Australians as well as ordinary Australians, many of whom have struggled significantly as a direct result of their childhood experiences. The now-adults affected by this project were considered to be individuals marginalized quite profoundly within the mainstream society. A number of them lived with mental illness, the majority lacked stable housing, and all had been severely emotionally, physically, or sexually abused as children in state- or church-run institutions.

The apology to the Forgotten Australians was preceded by the public apology to the Stolen Generation on the 13 February, 2008. The apologies to the Stolen Generation and the Forgotten Australians were the result of a number of Senate inquiries, leading to government reports: *Bringing Them Home* (Commonwealth of Australia, 1997), and *Forgotten Australians* and *Protecting Vulnerable Children: A National Challenge* (Senate Community Affairs References Committee Secretariat, 2004, 2005, respectively) and many years of advocacy and activism by community groups and individuals that included the use of personal stories, the digitization of records and, as the apology drew closer, a number of digital storytelling projects. In this paper, I discuss one of those projects that centered on the Forgotten Australians.

METHOD

The Participants

In August 2009 I was funded by the Australasian Centre for Interactive Design (ACID) to conduct a series of digital storytelling workshops in conjunction with the Micah Projects, a community-building and social justice organization based in Brisbane. Micah delivers services for people experiencing homelessness, runs programs for young mothers, and is responsible for the Historical Abuse Network, which is a network servicing the Forgotten Australians. After some discussion with the CEO of Micah, it was decided that the clients involved with the Historical Abuse Network would benefit most from this project. At the end of the project the stories were burned to DVDs and given to the participants. There also was a

function at the State Library of Queensland for the staff of Micah and the family and friends of the participants to view the stories.

Many of the participants had been involved in the 2003 Senate inquiry into the treatment of children in institutional care. In the intervening years, they had told the story of their abuse many times in official contexts and provided statements of harm for the inquiry. However, for this project, I wanted to encourage the participants to create stories that allowed them some agency in their own lives, and to reclaim some of their story from the official framework of abuse. Digital storytelling was one tool to accomplish this.

I put out a call within the Historical Abuse Network to gauge the number of clients who might be interested and to organize times for the workshops amid an already busy schedule of activities by the Network. Initially 20 individuals expressed interest. Eventually eight people completed stories by the required the deadline, with my assistance. The participants—except one—were individuals actively involved in other programs offered by Micah, such as job seeking skills, cooking, yoga, and theatre. The participants were between 45 and 65 in age and divided equally between women and men. The workshops ran two afternoons a week for 12 weeks. For the purpose of this paper, the names of the participants have been changed to ensure anonymity, which was explicitly guaranteed at the start of the workshops.

The Workshops

A number of complexities were inherent in this project, some of which were specific to this particular cohort and some specific to all marginalized individuals and groups. Two of the significant features of traditional digital storytelling workshops are the expectation that the "authors" will bring with them photographs and keepsakes from their lives to use in the stories, and that participants engage in a "story circle" to share stories and refine the narrative they wish to use in their digital story. Many of the participants did not have photographs of their childhoods or of their families; some did not know how old they were (in many institutions all birthdays were celebrated on a single day, and consequently most lost track of their age and birth date), or had not had contact with their biological family for decades, resulting in few keepsakes. These hallmarks of legitimate biography were absent from their pasts as well as their contemporary lives. The combination of these factors meant that, for many, the ability to create a coherent narrative about their lives or to feel ownership over their lives had been seriously compromised. We soon discovered, however, that by using digital technology to create sounds and images for the digital story, we were able to create a materiality out of memory for the participants.

In "Orphaned Memories, Foster-Writing, Phantom Pain: The Fragments Affair," Ross Chambers (2002) suggested a connection between the state of being orphaned and the fragmenting of a life narrative. When orphaned, the subject is no longer tethered to anything but memory and a phantom pain where the family used to be. Many of those involved in the project had been told that their parents were dead or they had been abandoned by their parents, when in fact they had been forcibly removed from single mothers or disadvantaged families. The process of making the digital stories became, then, as much about *remembering* as about telling their stories. It soon became apparent that remembering was in itself an onerous task, and the participants were not interested (as they may have been initially) in framing their digital stories in a positive or uplifting way. Rather, they began to see the

stories as being about survival and protest; many still felt they were waiting for justice or redress for the abuse they suffered. The date for the public apology had been announced and the participants seemed to feel a sense of urgency to tell their stories as authentically as possible before the apology drew a line under this chapter in Australian history, perhaps providing the "definitive word" on the Forgotten Australians. This meant that the stories of these eight individuals began to move further away from "tales of everyday life as experienced by ordinary people" (Hartley & McWilliam, 2009, p. 3) that comprise the majority of digital stories created in a workshop process, and more toward a digital representation of memory.

Digital storytelling workshops generally begin with a story circle that involves "limbering up exercises ... to tap into the people's implicit narrative skills" (Hartley & McWilliam, 2009, p. 3) and to hone the stories with the feedback of the other participants. This process proved impossible with the Forgotten Australians. Most of the participants actively resisted sharing their stories with one another even though there was a shared narrative. One factor was that most of the participants were seeking compensation from various government and Church bodies for their ordeals. At the time of the workshops, some individuals had received monetary compensation, and a degree of bad will appeared between those who had and those who had not been compensated. To further complicate this issue, there were also discrepancies in the amount of money people had received. Consequently, one of the fundamental elements of a digital storytelling workshop was unable to be utilized in this project due to mistrust among some participants that the details of their stories would be stolen and used by others in compensation claims. Thus, the prescriptive nature of established digital storytelling workshop protocols proved somewhat unrealistic for this project. As a result, the organizers needed to quickly adjust their expectations regarding two key components: participants being able to provide mementos and willingly taking part in a story circle to polish their scripts. Moreover, I realized that my quite fixed ideas about narrative digital stories and the best way to tell a story seemed to be at odds with the aims the participants had for their own stories.

As it became clearer that the foundation of the stories was memory rather than a narrative arc, it became imperative to embrace the fragmentation, inconsistency, and incoherence of the memories, and to incorporate these aspects into the digital stories. The stories in this workshop had moved further away from the kinds of digital stories typical of state and national libraries or museums that I had done previously. Rather, the stories had much more in common with what is referred to in psychology and health frameworks as chaos narratives. A chaos narrative embodies a sense of disconnected events and is characterized by a lack of closure and the presence of day-to-day uncertainty (Harter et al., 2008, p. 4). Often such stories seem too incoherent to be told and too painful to be heard by others, as was certainly the case with some of the stories created for this project. Kansteiner (2002, p. 192) claimed that the use of visual images in memory construction is due to their "exceptional ability to close, and at times even obliterate, the gap between first-hand experience and secondary witnessing." In this way, the technology inherent in digital storytelling became an integral part of the memory making for the participants: The capacity to incorporate pictures, sounds, and one's own voice into the stories added dimensions and authenticity to the stories that were often absent in the written forms. Digital storytelling allowed inexperienced storytellers to intimately convey the nuances of their memories in an innovative way.

Aesthetic and thematic assumptions about the coherency and essential integration of images and words in digital stories abound, arising from the proliferation of digital storytelling projects associated with museums, universities, historical societies, and other mainstream organizations. However, as this project uncovered, digital storytelling also has within it the capacity to produce works that are more unstable and liminal. And although these types of stories may have a more limited audience, they might be more powerful and more useful for their creators.

The Stories

For this section I have chosen the stories of three participants: Simon, Enid, and Tony. These three were selected due to the ways in which they engaged with their own narratives and the technology. Many of the other participant's interest in the process waxed and waned over the 12 weeks of the workshops, but Simon, Enid, and Tony attended every workshop and showed unusual commitment to finding ways for themselves—and challenging me to facilitate their efforts—to express their stories in an authentic way.

Simon, a man in his late 40s, came to this project with a recognized talent for photography and a high level of digital literacy. He was adept at Photoshop, a computer program for editing photographs, and was the editor and designer of the Historical Abuse Network newsletter. He was also the most reluctant to participate and the most vocally critical of the proposed workshop in the first few weeks. Like many of the clients of Micah, Simon had witnessed numerous researchers and community arts workers come through the organization. In Simon's words, they would "put something on—a play or whatever—gets us to tell them our stories and leave again, leaving us with nothing."[3] I assured him that the participants retained ownership of their digital stories, and that my goal was to assist whoever was interested in finding a way to tell his/her story in his/her own words.

In his digital story, Simon used photographs he had taken of the geographic areas where he had worked as a sex worker in his late teens and early 20s. These photographs featured distorted landscapes, broken machinery, and menacing urban streetscapes. The script was a third-person treatise on child abuse and child development. The result was a 5-minute digital story that was extremely disturbing and unsettling to watch.

During the making of the story, Simon said, "I'm not going to make a happy story. You know, one where I talk about how great Micah is, and now my life is ok. So, if that's what you want, I won't bother." Throughout the process, Simon consciously and deliberately reimagined the conventions of digital storytelling to produce a piece that he believed reflected him and his experiences. Through the images of broken toys, burnt out cars, dilapidated buildings, and a church altar, with a voice-over of Simon speaking about theories of childhood development and brief, unrelated details of his own abuse, it is impossible to not feel uncomfortable. And, in the end, Simon created the most honest and searing portrayal of his life possible with the tools. But more importantly, the viewer is left with an impression, an echo of how Simon remembers his life. Rather than watching a narrative telling us about his life, the viewer instead experiences Simon's memories and, perhaps, a brief glimpse into the suffering and grief he continues to endure. Thus, the story he created was more a digital process (of remembering, sharing, and even healing) than a digital product.

Simon was the most hands-on of all of the participants in creating his story: He produced his digital story primarily independently, with only some periodic feedback from me about images or some assistance with the script. Other participants, such as Enid and Tony, were far more reluctant to engage the technology in any significant way, and consequently pushed into the background the aim of increasing the participants' digital literacy. A regular client of Micah for many years, Enid, in her 60s, had been involved in the Historical Abuse Network since its inception. She (with her twin sister, who died at age 3) was in the care of the Sisters of Mercy from age 2 until she was placed in a foster home at age 12. When we began the workshops, Enid wrote prolifically, filling two large notebooks with stories and disjointed anecdotes. However, she found it difficult and frustrating to distill her ideas into a 2- or 3-minute script for a digital story. On the written page, Enid was able to digress in her storytelling, to write snippets of events that could be threaded together to eventually create a clear narrative. But for the digital story, she was asked to create a short, logical script. More than once during the scripting process, Enid said to me, "Just write the script yourself from what I've written in the notebooks. Make the story up from that." The temptation to take her up on the offer was strong because our scripting sessions often resulted in both of us feeling exasperated. Enid believed the version of the stories she was presenting made sense, although they moved back and forward in time and often seemed to leave important details out. I thought the anecdotes wandered around the story that needed to be told, and worried that anyone watching would become bored and confused.

By the end of the workshops, Enid had made three digital stories; she was the only participant to make more than one story, as well as the only participant to make a story about anything other than her direct experiences of being in institutionalized care. One of the stories Enid made was about regularly catching a bus around the city and, specifically, seeing an elderly Sister of Mercy (nun) on the bus some years ago. Eventually the nun remembered Enid as one of the children who had been in her care at a Catholic orphanage. The nun was able to give Enid a photograph of her and her twin sister when they were toddlers. Until then Enid believed that no photographs of her and her sister together existed. The photograph was quite degraded in quality, but was the only photograph Enid possessed that predated her adult life; we used it as the final image in the digital story. To create the story about the nun and the photograph, she drew a series of pictures that showed the sequence of events: Enid literally storyboarded her memory. The digital story had an almost childlike, whimsical quality that was especially poignant when combined with the very moving, although disjointed, words spoken over the images. Similar to Simon's story, Enid had created a digital story that bore little resemblance to stories found in most digital storytelling workshops, but it was able to evoke feelings and memories in way that a conventional narrative could not. Her story may not have been especially interesting or entertaining to the viewer but it was authentic to her memories and her experiences.

Perhaps one of the most heartbreaking stories was Tony's. In 1956, when Tony was six, his father killed his mother in the family home. For a number of months after Tony's father was taken to prison, Tony and his two brothers lived alone. Eventually, the boys were sent to St. Joseph's Orphanage at Neerkol. When he turned 12, Tony was told he was going to work on a farm. Excited, he arrived at the now notorious Westbrook, a juvenile detention center that came under particular criticism during the first Senate inquiry for its brutality toward children. After years of horrific abuse and neglect, Tony escaped from Westbrook by stealing a car. When he was caught, he was sentenced to Boggo Road Goal, a maximum security adult prison that was

finally closed down in 1996 after an investigation found that the facility, built in 1883 to cater for 40 prisoners, was housing 187. Although the conditions in Boggo Road Goal were nationally recognized as being substandard, Tony stated in his story that it seemed like paradise to him after the years in Westbrook.

Tony's literacy level was quite low; consequently, he told me his story orally over a couple of weeks. I turned our conversations into a short script, which he approved. Because of my involvement at this level of writing, the narrative of this story was the most polished and resembled the dominant form of digital storytelling of all those created in this project. However, when it came to recording the voice-over for the stories, Tony struggled with reading the script, although this improved through practice and coaching. More problematic, however, was that he found it difficult to speak without putting his hand in front of his mouth. It was as though he was constantly unsure of his right to speak and was trying to dilute his own voice by muffling it. The finished story is a hesitant, halting narration over stock images of farms, food, and trains. Tony's voice has none of the warmth or accessibility described by Burgess (2006). What it does have—in every breath, every pause, and every stumbled-over word—is the sheer horror of Tony's life. Like Simon and Enid, Tony was unable, and unwilling, to work within the formal guidelines of digital storytelling. Instead, he and the others used the tools to make sure that their voices were heard, and that their stories could be understood in the context of their own lives.

RESULTS

Scattered throughout the stories created by the Forgotten Australians are ghosts: Ghosts of families lost, the children they used to be, stolen childhoods, caregivers who did not give care, and, most powerfully for these participants, the ghosts of futures they cannot dream because of their past. In retrospect, I see the digital stories as a way for the participants to transfer the loss they feel into a haunting of others (Chambers, 2002, p. 95), so that instead of the abuse they suffered haunting only them, these survivors are able to haunt the consciousness of all those who experience their stories. Many participants voiced a hope that, by telling their stories, the process might ensure that what happened to them would never happen again. This sentiment was made even more trenchant by the fact that the official apology in the Parliament was looming as the workshops were drawing to a close, and a number of the participants traveled to Canberra to be part of it.

The narrator's voice in digital storytelling is the key to the appeal and immediacy of it as a form of communication. Burgess (2006) identified the digital storytelling voiceover as representing what Michel Chion called the I-Voice:

> To solicit the spectator's identification, that is, for the spectator to appropriate it to any degree, it must be framed and recorded in a certain manner. Only then can it function as a *pivot of identification*, resonating in as if it were our own voice, like a voice in first person. (1999, p. 67; italics in the original)

This attention to voice recording was another aspect of mainstream digital storytelling that proved difficult to recreate in the project with the Forgotten Australians. The location where the workshops were conducted was noisy and unpredictable because it served as a drop-in center for a number of clients. We struggled to find a place where the participants felt comfortable,

that is, anywhere off-site that was relatively quiet. In one instance, we recorded the voice-over for a story in the toilets of the center to escape a loud argument in the main room.

Another obstacle was the reluctance of any of the participants to practice their voice-overs or to repeat the process more than a couple of times. As a result, several stories contained mistakes and background noise in the finished product. However, such cases absolutely placed the participant and the setting in the mind of the viewer. As a result, rather than creating something universal, the story became utterly individual.

CONCLUSION

In the fields of narrative therapy and life writing, the ability to create a coherent, linear, or insightful narrative of your life and experiences is considered a sign of mental and emotional stability and maturity. According to Pennebaker and Seagal,

> Once an experience has structure and meaning, it would follow that the emotional effects of that experience are more manageable. Constructing stories facilitates a sense of resolution, which results in less rumination and eventually allows disturbing experiences to subside gradually from conscious thought. (1999, p. 1243)

This belief that creating a structured narrative of traumatic events in the hope of providing some closure or healing was implicit in my approach during the workshop. Whether or not this belief is legitimate is not the focus of this paper. What I have endeavored to explore are the stories created within this project, and the ways in which their incoherence and messiness were perhaps just as potent and as important as any of the structured, clear, and resolved digital stories created within traditional workshops. This case study revealed that, as a tool for marginalized groups and individuals, digital storytelling remains a process for exploration, to be continually opened up and examined so that it can align with the needs of its users, rather than continue to be constrained by the tropes and models already associated with it. The workshops can be a restrictive aspect of digital storytelling in which participants not only are schooled in the skills needed to make a digital story but also instilled with the expectations of what digital stories "should" look and sound like. On the other hand, those same workshops also can be an exercise in discovering new user-generated approaches to digital storytelling. What this case study also revealed was that digital storytelling holds within it the capacity to produce neat, friendly, and normative stories even when the subject matter may be confronting, and that, as the participants in the Micah project proved, the process has the ability to be deconstructed by individuals to produce truly unique and profound stories of their lives.

ENDNOTES

1. The Stolen Generation comprises the Indigenous Australian (Aboriginal and Torres Strait) children who were removed forcibly from their families between 1909 and 1969, as part of an official government policy. "Under the White Australia and assimilation policies Aboriginal and Torres Strait Islander people who were not 'full blood' were encouraged to become assimilated into the broader society so that eventually there would be no more Indigenous people left" (Reconciliation, 2012, Forced Removal, para. 3). This aim was carried out by placing Indigenous Australian children in institutions or with white families.

2. As cohort, the Forgotten Australians are defined as children removed from their families or orphaned, or child immigrants from the United Kingdom, who were placed in institutions between 1930 and 1970. A majority of these children were abused or neglected while in institutional care. It is estimated that approximately 500,000 children were placed in out-of-home care during this time. Before the creation of the single parent's pension by the Whitlam government in 1970, children were often removed from single mothers or abandoned by their mothers and placed in church-run institutions. "The child migrants from the United Kingdom were shipped to Australia, Canada and New Zealand. Many child migrants, British boys and girls, were sent overseas by specialist agencies such as the Fairbridge Society, established specifically for the purpose of migrating young children to populate the empire with "good, white British stock." Well known national charities, such as Barnardos, which provided a wider range of child care services, along with the Church of England, the Methodist Church, the Salvation Army, and the Catholic Church, played major roles" (Child Migrants Trust, 2012). The conditions in the overwhelming majority of these institutions were brutal, and the subsequent Senate Inquiry was scathing in its criticism of all parties involved. The UK, Canada, and Australia have all issued public apologies for the roles of their respective governments. For more information, see http://www.onlineopinion.com.au/view.asp?article=2531, http://www.clan.org.au/page.php?pageID=1, and http://www.micahprojects.org.au/categories/view/95/lotus-place.
3. Comments from the participants were taken from the notes I collected during semistructured interviews held with each storyteller, or from notations made as part of the digital storytelling process.

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MAKE IT INTUITIVE: AN EVALUATION PRACTICE EMERGENT FROM THE PLANS AND SCRIPTED BEHAVIOR OF THE COMPUTER COMMUNITY OF PRACTICE

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Abstract: *The catch phrase today for system designers is to "make it intuitive," which begs the question, what is intuitive? The action research discussed in this article was the final stage of the application of grounded theory to user data that provided survey categories (criteria) for system acceptance. A theoretical rationale from the discipline of human–computer interaction was proposed to provide a consistent and repeatable interpretation of the users' responses to the survey and directly align the responses to software design considerations. To put this work into context, I discuss in this article a case study on the use of the survey to monitor the user experience during the upgrade of an enterprise system and the subsequent implications and outcomes of applying the theoretical paradigm in practice. As such it may provide food for thought on survey design for elicitation of user requirements for information and communication technology systems.*

Keywords: *Survey, interaction design, community of practice, user experience, intuitive.*

INTRODUCTION

In this article I discuss a survey for assessing system acceptance and the user experience (UX) from the pragmatic perspective of a human–computer interaction (HCI) practitioner. There is a plethora of HCI-related surveys and, more often than not, the analysis of the participants' responses to a survey results in a numerical index or a summarized qualitative description. It can be difficult to relate this type of analysis result back to the users' perceptions of the system, or derive any useful design and development concepts or clear direction on how to proceed in response to the solicited user feedback. The survey discussed in this paper has 12 criteria that emerged from a grounded theory analysis (Dick, 2005; Glaser, 1994, 1998) of notes taken during interviews with users. The goal of the analysis was to make sense of the users' responses to legacy surveys that had no assessment rationale.

The survey is the final stage of a grounded theory, data-driven investigation into the survey question grouping classifications that are the emergent theoretical constructs. An HCI theoretical

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rationale (Lehane, 2010, 2012, in press) was developed to explain the emergence of these criteria, and it is used to interpret the users' responses to the survey in terms of HCI design concepts. Central to the theoretical rationale and the subsequent interpretation is the concept of leverage of prior knowledge, which is expressed as previously learned or scripted behavior patterns. The survey was used as an adjunct to industry-standard project management practice during the regular upgrade of an enterprise system. Its use to monitor and recommend interventions in the roll-out of the system was an action research project that was the basis for a doctoral study. The doctoral study was conducted independent from but in conjunction with the management practices of the system upgrade. The purpose of the survey was to provide a general indication of the users' system familiarity, based on their current usage and the leverage of prior knowledge and experience.

Activity theory has a three-level abstraction hierarchy to contextually describe human activity. Activities are long-term formulations with an objective that typically requires several actions or chains of actions to be achieved. Actions can be operationalized by habituation, wherein the action is a scripted and skilled behavior requiring minimal cognitive resources. Actions then become a series of operations (Bødker, 1991; Nardi, 1996a; Suchman, 1987; Vygotsky, 1978). Operations can be undertaken as conscious actions by conceptualization of the skilled behavior. This concept of levels can be applied recursively in a drill-down analysis of an activity. The example in Table 1 (Kuutti, 1996, p. 33) shows the hierarchal structure of an activity and its components.

Operations are the level at which intuitive use of the screen artifacts occurs. Thus, the concept of intuitive computer use by a community of practice (Vygotsky, 1978) provides the rationale for the interpretation of the responses to the survey (Lehane, 2010). When a survey criterion receives a low appraisal, the means to resolve that issue has already been identified. This is due to the concept that the interaction design is based on scripted behavior (Bødker, 1991; Suchman, 1987), which is viewed as the key concept for consideration of intuitive design and the subsequent resolution of arising use issues. When the survey responses are viewed as a time series comprising a benchmark, the transition(s), and familiar use, UX is presented in terms of HCI design concepts. The strength of the survey is that the time series of responses can show changes in high-level user perceptions; after a shortfall has been identified, the associated remedial program then can be implemented.

The enterprise systems discussed here were implemented with little or no customization: The functionality of the software was not modified to mirror the organization's existing business processes. In such situations, usability engineering (Nielsen, 1993) concepts are not applied at the activity level as a learned behavior; they are applied at the action level as the conscious operationalizations of the scripts, which establish the users' expectations for interacting with the system. This subtle variation, observed in the user interaction with large enterprise systems with no or limited customizations, is included in this investigation.

Table 1. The Structure of an Activity.

Term	Product of	Example
Activity	Motive	communicate with a friend
Action	Goal	to send an e-mail
Operation	Condition	produce the e-mail by using a computer's mouse and keyboard

The Context of the Upgrade Projects

In this article, *human–system integration* is used to bring together the workforce and all the other systems, including the information and communication technology (ICT) systems, that constitute the workplace, with the end result being a workplace with effective and efficient processes and procedures. *Enabling technology* is the term used to encompass this ensemble of software applications, supporting ICTs, people, cultures, and task-associated processes and procedures. To produce usable ICT systems, analysis and design now seek to employ the broader human–system integration perspective of enabling technology. In addition, the UX described here relates to the use of large enterprise systems with little or no customization. There is a sound business rationale for implementing systems with little or no customization: the very high cost of ongoing customization in subsequent version/upgrade releases. Because of this constraint, it is likely this practice will be the norm rather than the exception in the future. As a consequence, niche applications are often interfaced with the enterprise system as a specialized functionality to meet a required business capability, for example, e-mail.

Conceptually, system designers talk of usability and usability engineering concepts in response to a learned behavior (scripts), which is at the activity (process) level of an interaction. Scripts are conscious decisions based on the long-term memory of a familiar sequence of actions required to complete a process. Where this article differs from other research is that it considers usability and usability engineering concepts not only from the familiarity perspective, but also from the perspective of being introduced to new or unfamiliar software and learning how to use it.

In such situations, then, usability engineering concepts are not applied at the activity level as a reflection of a learned behavior. Rather, they are applied at the action level as the conscious operationalization of the scripts that establish the user's expectations for interacting with the system. At the operation level of an activity, behaviors are the unconscious operator executions that accompany skilled use of computer screen artifacts. This reflects the subtle differences between the user's and the developer's interpretation of the terminology. The developer thinks in terms of familiar use, while the UX is with new and unfamiliar software.

Similarly, the HCI professional perspective is to define a business capability as an activity, and then develop functionality with good usability to facilitate that requirement. Utility is a valued assessment of the functionality, and usefulness the fit-for-purpose assessment of that functionality. This perspective is readily applied to Web development or screens that are custom designed to support behavior that successfully fulfills a motive. However, when dealing with large enterprise systems with no or limited customizations, such as the project presented in this paper, the case studies present a subtle variation, which is the user perspective as interpreted by this author.

In such systems, a screen can be used to accomplish a number of functions, each of which requires the observable behavior of various cognitive activities. A single screen is not designed to accomplish one task as a business process. Rather, it presents a number of artifacts that may or may not relate to any number of the organization's business processes, as understood by the individual user. In other words, a number of people could access the same screen and, using different menus and menu items, undertake completely different business processes. Consequently, to meet the design concept of functionality, the user has to develop the interaction design for each of their organization's business processes.

For the production of the required work output, the user has to assemble the artifacts into an effective and efficient operational sequence, based on the usability of the artifacts' affordances. The derived sequence of actions across a number of screens then defines the activity as a business process. This activity then represents the functionality of the system that supports the process. Finally, the work is assessed as either satisfactory or not; a satisfactory assessment confirms that the system is useful in supporting the user.

Conceptually, usability for the user traditionally has focused on the individual screen artifacts and their affordances as usability indicators with efficiencies of use. The individual artifact interactions were sequenced by the affordances of the successive artifacts so as to build up an interaction design that provided the required work outcome as a process, which was then considered the functionality. For the user, artifact usability and utility came first, with the functionality based on the emergent interaction design.

The screen artifacts and their affordances shaped the learning activities, which later were integrated and sequenced into a process. Vygotsky's (1978) zone of proximal development best characterizes this learning situation, and Nielsen's (1993) usability, both the term and the criteria, best accommodate the users' descriptions of these interactions. Additionally, from Nielsen, utility is a value assessment and those values are the functions attributed to usability (such as easy to learn, use, remember, and recover from errors). Consequently, utility is a value assessment of the usability characteristics (affordances) of the screen artifacts.

In addition, the user interpretation of the HCI term *functionality* was best expressed in human factors terminology and concepts. The users described functionality as the computer software functions programmed into the software to support them in their work. By definition from human factors (Wilson & Corlett, 1995), function allocation is the division of labor between humans and machines. Humans are assigned tasks and machines allocated functions. For the users, functionality was the set of functions programmed into the software and subsequently accessed as a process by the users in the course of doing their work. Therefore, for the users, functionality did not necessarily represent a specific business capability or work outcome, as it did for the developers.

From an interaction perspective, the users' descriptions of functionality, as a set of functions programmed into the software, were a utility assessment, a valued judgment on the characteristics of the usability of the artifacts (i.e., easy to learn, use, and remember). However, when the users described their work using the software, their descriptions aligned with the HCI concept of functionality, which is associated with the design perspective of the usability of the technology at the process level. Thus, it was an assessment of how well the software supported, as opposed to hindered, them in their work—an assessment on the software being fit-for-purpose. Whenever the system helped and the software functions supported them well, the users' descriptions aligned with the usability engineering concept of usefulness.

Consequently, based on the users' descriptions of their use experience, this project's grounded theory-derived abstraction hierarchy for usability engineering criteria was system acceptance, usability, utility, functionality, and usefulness. System acceptance is the least tangible concept and, consequently, the most abstract to assess; usability was the most physical and, thus, the least abstract concept. The survey questions regarding utility and usability reflected the physical function level of the system's abstraction hierarchy. These questions were used to confirm the users' responses to questions on the more abstract criteria of functionality and usefulness.

The theoretical concepts for system acceptance that aligned with the emergent construct were drawn from usability engineering (Nielsen, 1993) and activity theory (Hasan, Gould, Larkin, & Vrazalic, 2001; Leontiev, cited in Nardi, 1996b; Vygotsky, 1978). The activity theory elements, collectively, were called the use-community concepts. The theoretical rationale for the operationalization of activity theory (Lehane, in press) is summarized in Table 2.

The use-community criteria were grouped according to the use-community practice and the context of that practice. The use-community supporting use-practice criteria relate to the users' interactions with the ICT system, based on expertise gained from experiences using other systems, that is, the praxis of the use-community. Ordered from the physical form to the abstract, the use-community supporting use-practice criteria are the tools, distribution of community praxis, and the acquisition of praxis. Tools are the physical objects. The distribution of praxis involves the physical objects and their dissemination across people, time, and location. The acquisition of praxis is the high level internalization of concepts acquired through observation and physical activity in using the tangible objects.

The use-community ecological criteria are considered integration issues between the enabling technology and the other systems in the workplace. These other workplace systems contextually influence the affective, behavioral, and reflective responses of the persons using the software. The use-community ecological criteria, from the physical objects to most abstract, are hardware, human factors, and support for work-in-context. The hardware constitutes the physical object(s). Human factors revolve around the quality of the interactions with the physical objects. Support work-in-context is how well the outcomes produced by those interactions with the physical objects comply with the motive for the situated activities.

Use-community criteria are concepts fundamental to activity theory and relate to the users' whole-of-life computer experiences. As such, they provide information on how much of that experience is leveraged by the interaction design in making the system intuitive.

Table 2. Survey Criteria.

Criteria	Key Concepts
Usability Engineering Criteria	User Acceptability ▪ System Acceptance ▪ Usefulness ▪ Functionality ▪ Utility ▪ Usability
Use-Community Criteria	Support Use practice ▪ Change management and system upgrade issues (tools) ▪ Familiarization with the use-community ▪ Familiarization with the use-practice (specific aspects) ▪ Training system documentation (explicit practice) ▪ Training in the technology-situated work (tacit practice) Ecological Criteria ▪ Work in context: using application as one duty in many ▪ Hardware: the physical objects of the system (tools) ▪ Human factors: ergonomics, workplace health and safety, and emotional perceptions

Cognitive HCI provides case studies of these experiences but in a nonstructured way, which precludes analysis, design, and evaluation of the integrated system. I propose (Lehane, in press) that activity theory, by subsuming the appropriated HCI paradigms, theoretically provides an overarching theoretical rationale and, consequently, structures contextually those paradigms of cognitive HCI. I believe, as indicated within that paper, that subsuming cognitive HCI into activity theory is central to understanding the UX.

In the remainder of this article I discuss the survey, the rationale for using it, and the theoretical considerations this encompasses. To contextualize the use of the survey, the next section introduces the survey and its use in a case study. This is followed by an overview of the development of the survey as the final step in an action research project that utilized grounded theory to seek and confirm emergent theoretical constructs in the data.

The concept of scripted behavior has been well documented in the discipline of HCI. Suchman (1987) held that every course of action was dependent on its material and social circumstances. Scripts were used in the discussion of how experienced personnel, such as fire fighters, plant operators, and air controllers, analyze and respond to known and, in particular, unfamiliar situations (Jones, 1995; Kontogiannais, 1996; Pawlak & Vincente, 1996). The premise of scripts was an emergent concept from the research data and was fundamental to the development of the theoretical rationale used in the discussion to explain the observed user behavior as intuitive.

From this perspective, one of the objectives of analysis is to seek out as many as possible of the already established scripted behaviors required by the new system. An objective of design, then, is to re-establish on the computer screen the context that triggers the scripted behaviors and produces the expected outcomes based on the users' previous experience. On this basis, I call *intuitive use* successful user interaction with the new system by means of screens designed on the premise of prior knowledge and experience with the old system.

The Survey and Graphs

Prior to the case study, it is necessary to introduce the basic concepts behind the survey and the presentation of the users' responses in the graphs. The System Acceptance Indicator (SAI; Lehane & Huf, 2005, 2006) survey contained 25 questions about the positive and negative aspects of system use. Each question was assigned a value from 0 to 4. In odd-numbered questions, 4 represented *strongly agree* with a positive aspect of use, whereas 4 represented *strongly agree* with a negative aspect of use in even-numbered questions. Even-number questions require adjustment so that a score of 100, a perfect score, represents strongly agree with odd-numbered questions and strongly disagree with even-numbered questions (see Table 3). The global index for one survey is the summation of the values assigned to the response to each question; the SAI global index for a survey campaign is the average of the individual indices. This is similar to the way that the system usability scale (Brooke, 1986) works: The questions are grouped and responses averaged for graphs during the analysis.

In the case of the survey being computer generated with a numeric value consistently assigned to the Likert Scale from *strongly disagree* to *strongly agree*, the example user gave all questions on positive use a score of 4 and all questions on negative use a score of 0. After adjustment, as depicted in Table 3, the user rated the system highly and awarded a perfect score of 100 (25 x 4).

Table 3. Example Adjustment to an Individual Survey Response.

Question	Aspect of system use	User response	Adjustment of response for graph (in a spreadsheet)	Adjusted value used for calculations
1	Positive	4	Odd number no adjustment to user response	4
2	Negative	0	4 –user response	4
3	Positive	4	Odd number no adjustment to user response	4
4	Negative	0	4 –user response	4
5	Positive	4	Odd number no adjustment to user response	4
…	…	…	…	…
25	Positive	4	Odd number no adjustment to user response	4
				SAI = 100

The SAI provides three measures. The first element is a global index as a number between 0 and 100. Fifty is the value of the global index indicating a neutral disposition towards the system. Zero indicates a system that is perceived unfavorably for all questions and 100 is the score for a system that received the maximum of favorable responses.

The second measure is the graph for the data determined by the technology acceptance model (TAM; Lehane, 2012; Lehane & Huf, 2005, 2006), which is a 12-element presentation of the users' perceptions of the system. An example of this graph follows in Figure 1. The criteria for this graph are expressed in analytical terms for technical consideration of the results by the system developers.

The five criteria from usability engineering describe immediate use:

- *System acceptance* is how well the users relate positively to the system.
- *Usefulness* is how well the overall system supports users in achieving their objective(s).
- *Functionality* is how well the system's functions support the designed activities.
- *Utility* is how efficient the system is in facilitating the actions.
- *Usability* is how effectively the actions can be operationalized.

The seven concepts identified as the use-community criteria compare the use of system against previous use knowledge and experience:

- *Support for work-in-context* (Support_WIC) is how well the system integrates into the extant workplace systems.
- *Active user* is the level of proactive interaction initiated by the user.
- *Distributed cognition* is how well the praxis of the domain's community of practice was transferred to the software (i.e., does it have a familiar look and feel?).
- *Affordance* is how well the context of that praxis was embedded in the artifacts (i.e., was use intuitive?).

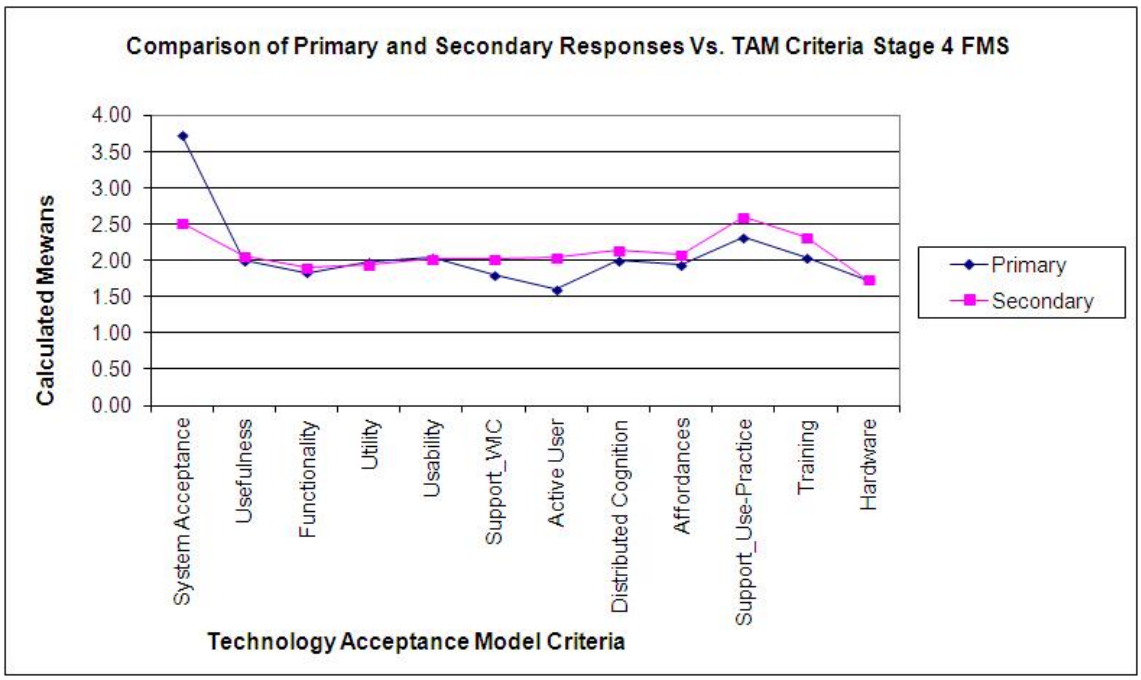

Figure 1. A graph of the technology acceptance model.

- *Support for use-practice* is the level of immersion of the user into the community of practice (e.g., an accounting background for a finance officer ensures comprehensive contextual knowledge).
- *Training* is the formal training and its cognitive and behavioral artifacts used to transfer use-practice from experts to novices.
- *Hardware* is concerned with issues related to the situated technology (i.e., computers and network).

The third measure is the SAI graph, wherein the survey responses are regrouped to a 10-element graphic presentation of the users' experience in nontechnical terms. The SAI graph is used as the basis for discussions with the business users of the system being surveyed. Again, an example from the case study of the Financial Management System (FMS) follows (see Figure 2). The TAM technical criteria of active user and distributed cognition are grouped in the SAI graph as EZ2Learn, while affordances and support for use-practice are combined as EZ2Use. EZ2Learn is an indication of the active user's ability to leverage prior knowledge through the use of distributed cognition. EZ2Use is an indication of the affordances and use-community praxis facilitating recall and operationalization of activities. Conceptually these two categories are associated with and provide an indication of the "look and feel" and how intuitive the software is to use.

The individual survey responses, after adjustment, are collated to compile the collective response to the UX. The survey ratings scale of 0 to 4 now covers the range of the collective response from strongly negative to strongly positive. The guide for interpreting the scale is

- 0 – total rejection
- 1 – poor response < 1.5 indicates a criterion to be looked at

- 2 – normal expectation, no significant influence
- 3 – good response > 2.5 indicates a criterion that was well received
- 4 – full acceptance.

The SAI was designed to provide a global indication of user satisfaction and identify the users' rationales for reaching that decision.

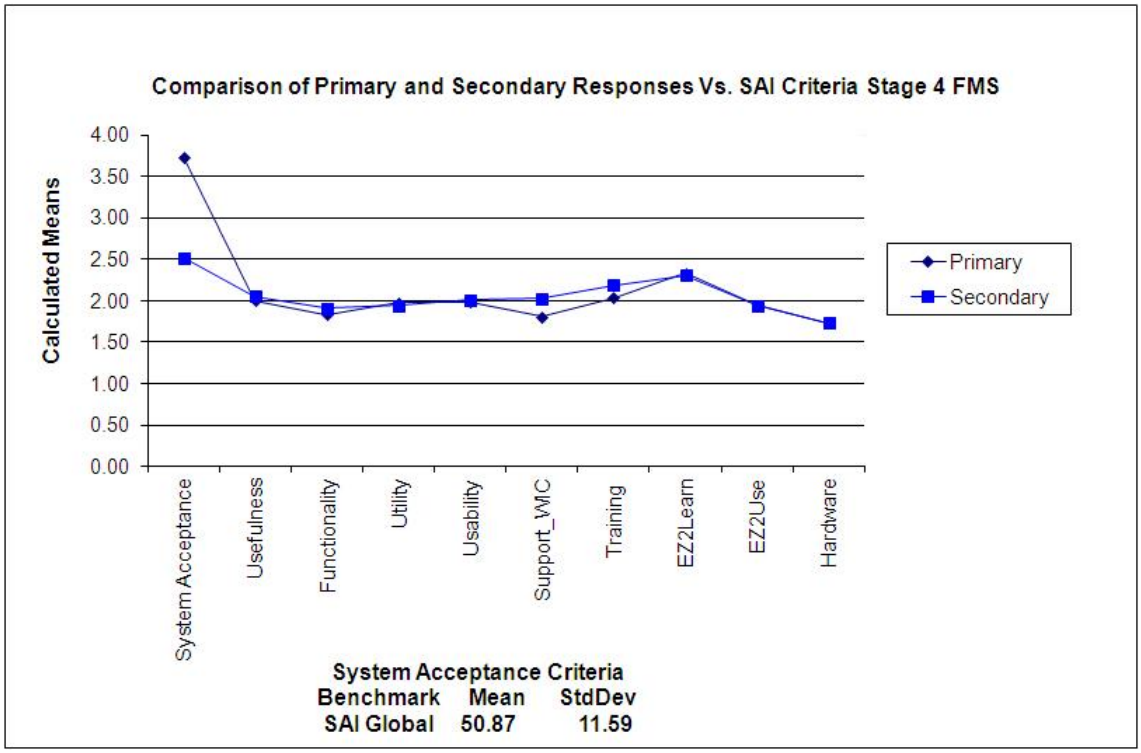

Figure 2. A graph of the System Acceptance Indicator.

A CASE STUDY

The case study was undertaken at a regional Australian university. Regional universities have their principal campus located outside the metropolitan areas of the states' capital cities. The upgrade of the enterprise system was a normal business requirement to keep the operating system current with vendor support. As an enterprise system, it is installed in many organizational units and is considered mission critical to the operations of the university.

Two focus groups were established for the research project: a managers' focus group and a day-to-day users' focus group (Bauer & Gaskell, 2000; Wilson & Corlett, 1995). Twelve managers, one from each of the university's faculties and other operational divisions, were invited to attend the meetings; all attended. One day-to-day operational user from each faculty and operational division was selected from the staff who volunteered to be on the focus group. The selection of members for this focus group was based on their experience (at least one year) and ability to articulate their experiences. Both focus groups reflected the university's employment policies; age groups and both genders were appropriately represented.

The research project was an action research project, and integral to action research are interventions. Interventions are recommendations that will improve some aspect of the system presented to and implemented by the owners of the system being investigated by the action researcher. Therefore, two stakeholder groups also were involved in the case study: the system upgrade project management board and the system users' management committee. Meetings were held with each stakeholder group separately at each stage of the research project. The purpose of these meetings was to present user issues as reported by the focus groups, the results of the SAI survey (which is fully described in Lehane, 2010), and recommendations to resolve arising problems. In this case study, the intervention of interest is reported in Stage 3 of the system upgrade.

As was stated in the Introduction, the SAI survey arose from previous work that identified the 12 criteria used to categorize the survey questions. On this basis, the survey was designed to assess the data-derived emergent system acceptance criteria in the users' terms of reference. The purpose of a survey is to elicit the users' assessments of a particular software application in meeting their use requirements within the system of systems that constitute the workplace. Each instance of use identified by a survey allows evaluation of the users' subjective assessments of the system as being fit for a purpose and the users' rationales for making that judgment. Over time and a number of survey campaigns, a picture emerges that presents, in HCI terms, the UX from first contact to habituated familiarity. The theoretical rationale for the interpretation of the participants' response to the survey and the emergent construct of HCI concepts used to structure the survey criteria are explained in Lehane (in press).

The assessment in this case study was conducted in four stages over a 14-month period, beginning in 2006. The first stage, prior to the introduction of the new system, benchmarked the existing version. The second stage, an appraisal after the transition period, was conducted as nearly as practical 2 weeks after the roll-out of the new system. The third stage, at the end of the consolidation period, was undertaken about 3 months after the roll-out. The final stage was a long-term assessment, undertaken after 12 months of use in the workplace.

The benchmark set the status quo for the system and was used as the reference against which the new version was compared. The second appraisal was used to evaluate the UX upon the release of the upgraded software. It assessed the change-management practices within the upgrade project, as well as evaluated the introduction of the actual technology and the extent to which this introduction was supported. Typically in these contexts, support leading to familiarization is a communal and collaborative activity, enhanced when an individual's learning experience is assisted by expert intervention. In activity theory, which draws on cultural–historical psychology, this transition period is called the zone of proximal development (Vygotsky, 1978, p. 86) and is identified as a critical element in securing a positive UX while acquiring knowledge or a practiced skill.

The third stage focused on the period of consolidation of use-practice, the period during which actions were operationalized. The literature review indicated that 3 months are required for an unskilled action to become familiar and to be acquired as a new skill (Venkatesh, Morris, Davis, & David, 2003). Unskilled action requires conscious thought to complete and reproduce whereas the skilled action does not require conscious thought (Nardi, 1996a; Preece, Rogers, & Sharp, 2007). The third stage, therefore, was to evaluate the UX at this point in time and to confirm or refute 3 months as the period of time required for the operationalization of actions.

Businesses inherently need operational cycles based on the week, the month, and the year. Long-term evaluation, the fourth stage, is undertaken after the participants are exposed to the full annual cycle of business activities. From a methodological perspective, this ensures that the final UX assessment is based on the same use exposure as the benchmark. The long-term evaluation of the system upgrade in this study was used also to determine if the 3-month appraisal is an accurate assessment of the re-established norms and that those norms withstood the rigors of a year's use experience.

The financial management system (FMS) presented in this case study was a mandatory-use application implemented in the late 1990s. Consequently, it had the dated look and feel of an early- to mid-1990s application. Hearsay noted the system as one the users loved to hate. The new implementation was Web-based with a modern and more familiar look and feel, which meant the user interactions with the application would be completely new after the upgrade. A précis incorporating an interpretation of the results is presented in this subsection.

The Survey Numerical Index

Considering the global indicator of the SAI over the four stages of the study, the ANOVA $F(3, 137) = 0.1224$, $p = 0.9467$ did not identify a statistical difference between the stages of the study. Table 4 provides indication of the minor variations in the SAI global indices. The response dispersion was less for Stages 1 and 4 than for Stages 2 and 3, which is indicative of a greater consensus among the participants after periods of extended use. I had anticipated a significant movement of the indicator, commensurate with changes in the user perspective. However, because of the limited increase in the dispersion of the user responses for the intermediate stages, the index, as an indicator, was considered unsatisfactory. An investigation into this unsatisfactory outcome has not been initiated at this time. However, observable variation in the graphed responses could be used as an indication of changes in the user perception.

An Interpretation of the Technology Acceptance Model

Stage 1: Establishing the Baseline

Figure 3 provides the TAM evaluation of the FMS for all four stages. A user evaluation of 2.0 is considered the response norm; an assessment of 1.5 or lower warrants further investigation; and an assessment greater than 2.5 is highly commended. The interpretation of the benchmarking data is that the original system was perceived to be useful with the necessary functionality to support

Table 4. SAI Global Evaluation for Case Study.

SAI Indicator	Mean	Standard Deviation	Study Stage	Test Date	Tally
Stage 1	50.03	11.19	Benchmark	September 2006	33
Stage 2	49.32	13.06	Transition	January 2007	31
Stage 3	49.26	13.35	Consolidation	May 2007	47
Stage 4	50.87	11.59	Long-term use	January 2008	30

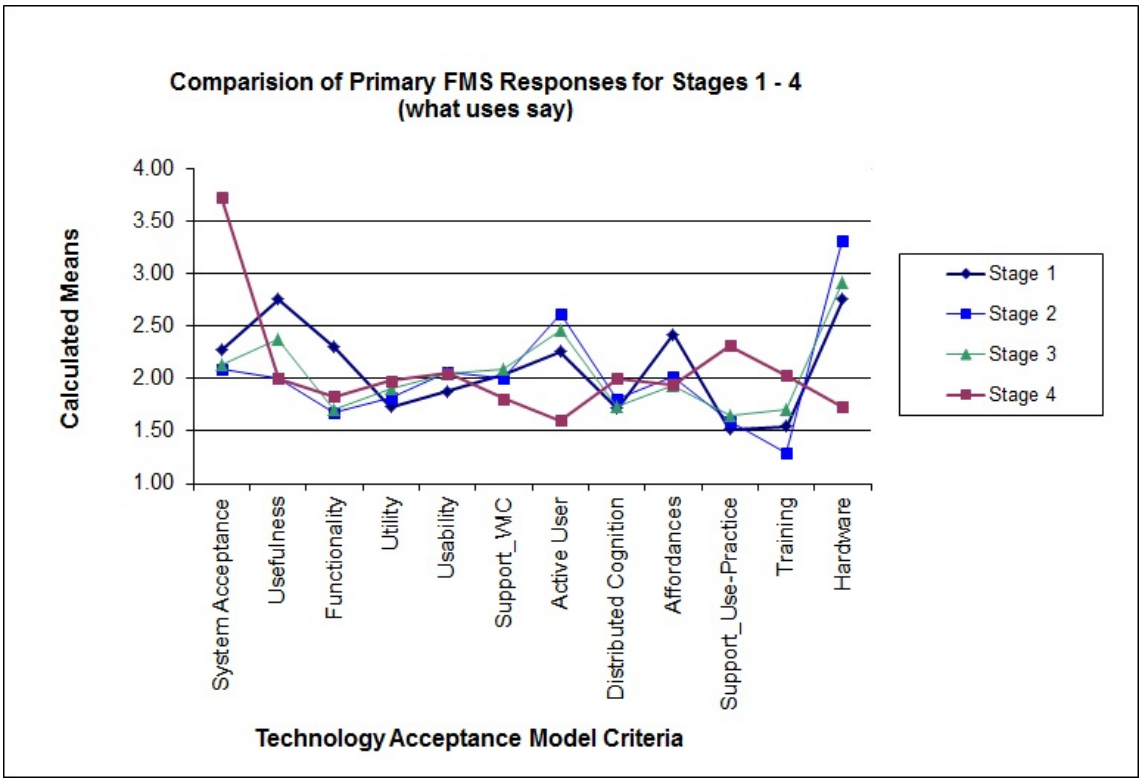

Figure 3. The case study TAM traces for Stages 1 to 4.

the users in their work. The focus groups confirmed that the system as such was accepted by the users. It was not as efficient as the users would have liked, and the issues around utility were investigated in the upgrade review. The utility issues were related to inefficiencies in the interaction design of the business processes and reported in detail in the case study. However, the users reported that they were comfortable with the usability and the integration of the FMS into their work responsibilities.

The assessment of the use perceptions of the active users indicated that the survey participants considered themselves proactively engaged in their self-directed learning to use the FMS. Similarly the focus groups confirmed that affordance-related responses were interpreted as being indicative of the user familiarity with the screen artifacts and layout and how to use those artifacts. However, the low user evaluations regarding the upgrade's use-practice support and training caused concern. The focus groups directed the investigation toward the support of use-practice, which revealed that very few users of the financial system had an accounting or financial background.

From the perspective of the theoretical rationale for the project, the workers were not members of the specific community of practice in which they were employed. They lacked the background in financial knowledge, experience, and skills directly applicable to this system's use. Training also had been poorly perceived. The focus groups reported that the users did not believe that there was a centralized or faculty-sponsored training strategy. They taught themselves by trial and error, an activity that helped to explain the high response to the active user criteria. Finally, the focus groups provided supporting feedback that the users were positively disposed towards the hardware because the application ran well on their machines and over the network.

Stage 2: Transition to the Upgraded System

The focus group discussions related to Stage 2 brought out a number of negative assessments on the upgraded system and the change management associated with the upgrade process itself. From the users' perspectives, the upgrade was not supported by a comprehensive training program. The training provided involved a seminar presentation to introduce the users to the Web interface and the new functionality. The users were not provided with hands-on training or even a step-by-step guide for the work processes affected by the upgrade. The financial reports provision, already an issue identified prior to the upgrade, was not adequate and, consequently, the upgrade did not meet the business requirement to monitor and control budgets. These deficiencies were reflected in the usability engineering criteria of the SAI.

Referring again to the survey results in Figure 3, this user perception of the loss of previously available functionality was interpreted as the reason for the users' poor evaluation of usefulness and functionality during the transition period. Unfamiliarity with the software, exacerbated by the absence of comprehensive training, was discussed extensively within the focus groups. The decrease in the users' evaluation of affordances and training was interpreted as a response to this user perception. In contrast, the survey participants estimated that their active user investigative interaction increased with the new software. Again the focus groups provided the basis for the interpretation presented to the stakeholders regarding training: the inadequate formal training and the proactive self-learning. The users' assessments of the remaining criteria remained at their benchmark levels, thus maintaining the status quo.

Stage 3: Consolidating Use Experience

After 3 months of use, the survey participants' assessments of the usability engineering criteria remained unchanged from the Stage 2 levels, except for Usefulness, which was assessed higher. The explanation for this increase, supported by the focus groups' comments, was the use familiarity gained as the users' learned about the available functionality and developed work-arounds. The focus groups also discussed how staff in their work areas independently sought to initiate some formal training that would help them learn more about the available functionality and how to use it. This discussion supported a trend that had been noted in the TAM graph of the SAI data: Support_Use-Practice was consistently given a low evaluation. This criterion assesses the survey participants' immersion in a work practice, in this case, the users' knowledge of accounting and finance.

The focus groups confirmed that very few of the FMS users had a background in accounting or finance. As a result of these data interpreted within the activity theory precepts of induction into a community of practice, a research project intervention was recommended at Stage 3. It was proposed to the system users' management committee that staff from the finance department mentor the FMS users who did not have a financial background. The objective was to train them exclusively in the use of the FMS for their particular work requirements, based on the scientific management approach (Taylor, 1911), which recognizes the benefit of expert tuition in moving people through Vygotsky's (1978) zone of proximal development. This recommendation was accepted and implemented.

Stage 4: Long-term Use

The notable features of the Stage 4 trace in Figure 3 are twofold: the users' apparent positive response toward System Acceptance, Support of Use-Practice, and Training, and the decline in the Active User. During the extended period for system evaluation involved in Stage 4, the Functionality, Utility, and Usability of the system were not enhanced. While the system did not change between Stage 3 and Stage 4, the use of it did improve, as a result of the contextually focused training implemented at the end of Stage 3.

The rise in the survey participants' positive perceptions of training was confirmed by the focus groups, an indication that the training program provided the background knowledge and the use-practice necessary to complete the allocated work. Specifically, the focus groups confirmed that the improved response to the criterion Support_Use-Practice resulted from the training: the knowledge delivered to better understand the use-practice from a financial perspective. This assessment was supported by the fall in the Active User measure, indicating that the training regime was successful and the users were no longer individually proactive in trying to learn how to use the system.

Functionality was not as well perceived as the other usability engineering criteria. This had been confirmed by the members of the focus groups, who also substantiated the premise that work-arounds were established for the missing or inadequate functionality. Usefulness was not as well perceived at the end of Stage 4 as it was for the benchmark or for Stage 3. Comments made by the focus groups indicate that this perception was due to the pragmatic perspective acquired by the users as a result of their use-focused training and subsequent use of the system during Stage 4.

At the end of Stage 4, the survey participants' positively appraised the criterion System Acceptance. The improved user perspective of this high level usability engineering concept was attributed to the improved knowledge and expertise that the contextually-situated training provided and the frequently stated opinion that the upgraded system was preferred to the system it replaced, thus an implied sense of ownership.

The survey participants' assessments of the criterion Support_WIC was relatively stable for all four stages. There was a slight drop in Stage 4 that could be attributed to the mentoring and undertaking the ancillary work of documenting the work processes and training. The users' assessments of Active User fell with the use-practice-focused training. Criteria that indicate the intuitiveness of the system design—Distributed Cognition and Affordances, which help to make a system easy to learn and use—varied over the period of the investigation. Distributed Cognition, the familiarity with the context of the screen artifacts, rose marginally in Stage 4 with the training. Affordances, the presentation of artifact use options, remained below the Stage 1 assessment but at the normal expectation level.

This situation can be explained. The screens of the upgraded FMS presented familiar artifacts in familiar locations, but it was left to the users to establish a sequence of the screens, menus, and menu items that resulted in the required work output. In effect, they needed to produce the interaction design for each process from the myriad of options presented by the menus on the various screens available. Continued use established the process but, without careful attention to detail, errors would occur and the wrong menu or menu item would be selected. This was because a number of familiar screen artifacts looked

similar but would produce different results from that required for an individual process, hence the lower assessment of Affordances.

An Interpretation of the SAI Results

Figure 4 is the SAI graph for the study of the FMS. This graph was used to discuss the survey results with the system users' management committee. Obviously, the assessment is similar to that of the TAM. To recap, initially the survey participants perceived training poorly and the focus groups confirmed this. In response to this situation, the system users' management committee initiated a mentored training program following Stage 3 to improve the training content and delivery. By the end of Stage 4, the poor perception of training was no longer apparent in the response traces.

After the mentoring, the survey participants perceived the system to be easy use and marginally easier to learn, an expected outcome in response to the more familiar Web-based look and feel and the improved training. The move to a Web look and feel changed the layout of the screens to ones that the users encountered more frequently in their day-to-day interactions with other software in the office and at home. The training introduced the users to financial terminology and practice that they could use to better interpret the meaning of the words in the menus. Together these changes made the learning and use of the FMS more intuitive because the users did not have to learn terminology and practices as they attempted to learn how to use the system. They were able to recognize and use the screen artifacts rather than engage in investigative learning to identify the use and purpose of the screen artifacts.

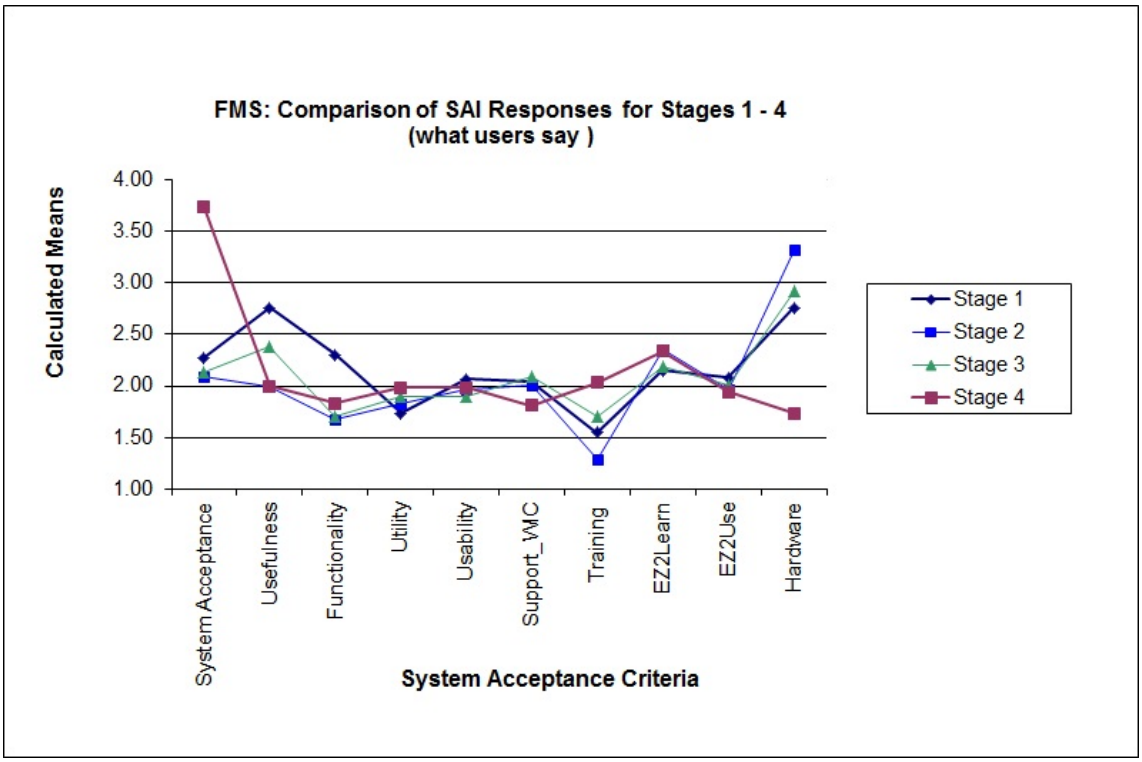

Figure 4. Case Study SAI Traces for Stages 1 to 4.

The issue of concern that arose with the long-term evaluation, however, was the drop in the assessment of the hardware. This criterion, reported through use issues, related to the time required for system network responses and the delays in operational processes. User feedback at the end of the consolidation period indicated that the users were concerned with systemic delays inherent in the Internet implementation. These delays involved queuing for server CPU processing time, queuing due to the maximum limit on concurrent users, and heavy network traffic.

Use Case Conclusions and Summary

The FMS was a mandatory-use system employed within the workplace for a decade prior to the commencement of this study. As such, I hypothesized that some statistical difference would be apparent in the data between the benchmark and the users' transition to the upgraded version. This proved not to be the case. The SAI global evaluation of user assessment remained relatively stable at the established benchmark. However, the theorized rise and fall sequence of user acceptance during the upgrade was observed: The predicted movement of the waveform around the usability engineering criteria, in particular Usefulness and Functionality, was apparent. For the upgrade to successfully leverage existing user practice (i.e., intuitive use), I hypothesized a little movement of the traces around the use-community criteria, and some movement was observed. The users' assessments of training and background knowledge (Support_Use-Practice) were higher after the mentor-based training, underscoring the need for context-specific training. The assessment of the Hardware declined because of the inherent Web technology issues of reduced server and network performances.

The expected fall in usability engineering criteria between Stages 1 and 2 was observed. The largest variation was for the criteria Usefulness and Functionality. The Stage 3 evaluation of Usefulness was higher than for Stage 2. This movement of the reflective assessment criterion Usefulness with confirming feedback from the focus groups was taken to indicate that the survey participants were comfortable with the new system but that new use norms were not established after 3 months use. This assessment was part of the rationale for the intervention.

Usefulness and Functionality were both evaluated lower in Stage 4 than in Stage 1. This result was anticipated because the focus groups were concerned with the limited gap and requirements analyses prior to the commencement of the upgrade project, as well as the number of work-arounds the users implemented. In addition, the user feedback confirmed that the training provided the financial background and use-practice that allowed for a more informed judgment of the overall usefulness and functionality of the system. Based on this assessment, the usefulness of the system within the constraints of the available functionality was improved by training the users in activities specific to their work. The training allowed them to consciously produce output tailored to meet their business process requirements as purposeful actions.

At the emotional level, the use-sensitive training and background knowledge facilitated optimization and confidence, and this was reflected in the high level of system approval at Stage 4. Statements presented at the stakeholders' meetings and comments solicited at the final system assessment by the focus groups supported these interpretations of the participants' responses in the final survey. This agreement was taken as additional endorsement of the validity of the theoretical model in which system acceptance was characterized, but not defined, by usefulness.

The précis of the case study of a system upgrade illustrates how the survey can elicit and monitor the UX across the stages of an upgrade. The UX can be expressed in terms of

immediate use by the usability engineering criteria and the leverage of prior knowledge to make the use intuitive by the use-community criteria. User concerns can be identified at a high conceptual level and investigated in detail to resolve issues. This is the strength of the SAI survey; it is strongly associated with the HCI design concepts that are assessed by the users in their response to the survey questions. The interpretation of the user response, based on previous UX, is intrinsic in the survey analysis methodology.

THE DEVELOPMENT OF THE SURVEY

The previous section was to present the usefulness of a specific type of survey in the context of resolving real-world business related issues. The strength of the SAI is twofold: (a) The criteria were developed from the application of grounded theory analysis (Dick, 2005; Glaser, 1994, 1998) of user-feedback obtained from interviews and surveys, and (b) The theoretical HCI rationale, developed to explain the emergent construct, provides the means to interpret the users' responses in concepts useful for system analysis and design. The following discussion will provide a brief overview of how this was accomplished.

The Survey Development Process

Systems analysts are required to talk to computer users about their computing problems and needs. Initially, it was difficult for me to rationalize and categorize these problems and needs because of the varied descriptions of the issues provided by the users. The process of understanding the users' interpretations of the issues they perceived, as well as categorizing them, led to the realization that a number of problem descriptions reflected the descriptions of issues I had read about in text books and research papers. The users were at times using HCI terminology but with an interpretation of the terms different from that formally used in the field. Consequently, it was necessary to learn to interpret their unique use of HCI concepts and terminology to fully understand the nature of their problems.

Systematic note taking was initiated, followed by a process of coding these notes as references to use again for consistent analysis results. A review of current HCI publications facilitated the coding. These books and papers documented the models, theories, and frameworks for HCI analysis and design. Concepts from a number of HCI paradigms could be applied to specific issues in the users' descriptions of their problems, as well as their requirements for system development. In addition, this review indicated that it might be possible to use the HCI concepts to develop a structured theoretical rationale, using the notes and coding system for analysis to support any recommendations made.

Concepts from a number of paradigms were brought together to form the contextual interpretation base. These concepts included but were not limited to activity theory (Bødker, 1991; Nardi, 1996a; Vygotsky, 1978), situated action (Suchman, 1987), distributed cognition (Hutchins, 1995, 2000), usability engineering (Nielsen, 1993), soft systems modeling (Checkland, 1999; Checkland & Holwell, 1998), cognitive systems engineering/cognitive work analysis (Rasmussen, 1994; Vincente, 1999), scientific management (Taylor, 1911), and the unified theory of acceptance and use of technology (Venkatesh et al., 2003). The 12 emergent

concepts were assembled to characterize the users' descriptions of their computer use experience. These concepts were used as the system acceptance criteria for the SAI.

The development methodology for the SAI followed best practice, as outlined in *Qualitative Data Analysis* (Miles & Huberman, 1994), *Evaluation of Human Work* (Wilson & Corlett, 1995), and the *Handbook for Evaluation of Knowledge-Based Systems* (Adelman & Riedel, 1997). The first stage was to define the objective and set the scope of the survey. The objective was to develop a survey instrument that evaluated the UX using the emergent data categories. In this format, the assessment would determine user satisfaction, as well as identify design and development issues requiring investigation in finer detail. The evaluation format had to be able to present the UX as a series of periodic analyses used to observe the evolution of the system; in other words, provide a numerical universal indicator for the level of user satisfaction and a pictorial presentation of the users' responses to the assessment criteria. This entire process involved five distinct stages.

In the initial stage, consideration was given to the rating method to be used. The Likert summated ratings method—as used by two survey instruments, the System Usability Scale (SUS; Brooke, 1986) and the System Usability Measurement Inventory (SUMI; HFRG, 1993)—was selected as the most appropriate. The reasons supporting this choice are that the Likert scale could be used to yield a single number as a universal indicator and the target audience was already familiar with this method of assessment.

The second stage was to verify and validate the conceptual foundation for the content of the survey that emerged from the data against current practice and research. The theoretical rationale for the grounded theory-determined classifications presented in this article was used as the basis for reverse engineering of SUS and SUMI questionnaires (Lehane, 2012) and the cross-validation by the unified theory of acceptance and use of technology (UTAUT; Venkatesh et al., 2003). During this stage, all of the questions in both surveys and in UTAUT could be classified against the proposed criteria for the SAI. The outcome of the reverse engineering process was early confirmation of the soundness of the emergent theoretical foundation for the SAI.

The third stage was to design the questionnaire content. The wording of the questions was critical to the success of the survey and the project. The questions were developed using simple words and simple sentence construction. The words had to convey a meaning that aligned with the theoretical concepts being assessed and those theoretical concepts had to be understood by the survey participants. The demographic questions of the introductory section were based on the work of Venkatesh et al. (2003) in developing the UTAUT.

The fourth stage was a pilot study using the draft questionnaire. Participants were invited to use the "think aloud" protocol while completing the questionnaire. Integral to their completion of the survey on their use of software were comments on the survey questions themselves and the intended meaning of the words and questions. The rationale for this was to assure that words with the widest shared understanding were used in the composition of the survey. Their comments and questions were considered and, where appropriate, the questionnaire was modified in light of the feedback.

The fifth stage was to implement the SAI in an action research project and assess the cognitive UX in workplace-situated instances of technology introduction. This was the stage during which the data presented in this paper were collected, analyzed, and interpreted. The outcomes of these processes were presented to the two stakeholder groups of the case presented in this article.

Primary and Qualifying Questions

The SAI analysis methodology assigns each question to a primary acceptance criterion and then re-assigns the same question into secondary groupings that qualify the various primary criteria. Thus, the survey responses are presented as two traces. In practice, the primary trace is derived from the high-level reflective assessment of the users' work with the system. By way of example, a primary question might ask: Was the system easy to use? The secondary trace is obtained by combining the response of this primary question with qualifying responses to other primary questions that describe how the user accomplished the task upon which the reflective assessment was made; in other words, how they accomplished what they said they did. If a system is easy to use, then the user should (a) know the actions the screen artifact affordances represent, (b) be in the flow using the system and not comment adversely about limitations or impediments to seamless work processes, and (c) not be confronted with unexpected outcomes from the system. These secondary questions confirm how easy the user actually found the system to use. The grouping of the questions for primary and secondary assessment is shown in Table 5.

To calculate the values plotted in the graphs, each criterion value in the primary trace is the average of the responses to the questions in that grouping (see Table 5, Column 2). The secondary trace is the average of the sum of both the primary and the secondary questions in that grouping, as in Table 5, Column 3. If the descriptive aspects of situated practice (i.e., the secondary questions) as modifiers of the primary question are rated lower, then the evaluation will be lower for the secondary question trace. The up-to-date grouping of questions as primary and secondary is presented in Table 5.

I present here the survey questions, with the rationale of each question as originally drafted. A detailed description of the use case for each question is available in Lehane (2012). A copy of the SAI as a form is available in the Appendix.

Table 5. The Grouping of Questions for Analysis.

Category	Questions, primary grouping	Questions, secondary grouping
Usability Engineering		
System acceptance	1	1,2,3
Usefulness	2	2,3,7
Functionality	3	3,10,11
Utility	4,6,20	4,6,20,10,24,25
Usability	5,24,25	5,24,25,4,6,22
Use-Community Criteria		
Support work-in-context	7,8,10,11	7,8,10,11,1,2,3,12
Active user	13,14	13,14,2,5
Distributed cognition	17,19	17,19,15,16
Affordances	16,18	16,18,15,25
Support use-practice	15,22,23,	15,22,23,5,12,25
Training	12,21	12,21,22,23
Hardware	9	9,20

1. *I would recommend this software to a colleague or friend.* System acceptance, a recommendation for future use by a member of the community of practice, indicates acceptance of the tool into the community by that community member.
2. *Using this software makes me feel bad, i.e., anger, frustration, stress, confusion, headache, or body pains.* System acceptance comes from a positive user experience of the usefulness. If the user feels anger, frustration, rage, tenseness, headaches, or illness, then the user will reject the system. If the user feels satisfaction, confidence, or mental stimulation, these feelings generate a positive user experience and system acceptance. For mandatory-use systems, the user rejection will not impact continued use. However for voluntary-use systems, a sense of ownership is implicit in system acceptance. Rejection of a voluntary-use system leads to discontinued use.
3. *This software does all the things that I need it to do.* Software functionality must mediate all of the activities of the practice, as well as support all of the actions in the activity. The application of the skills, rules, and knowledge paradigm (SRK; Vincete, 1999) apply here in the interface design.
4. *This software takes too many steps to get something done.* Efficiency is measured in the time of and/or the stages in a process (i.e., the number of actions to accomplish an activity). Design should streamline the process to minimize interaction.
5. *I thought this software was easy to learn.* The intent of this question is to verify the basic tenets of ease of learning and use. The assumption here is that elements from distributed cognition (Hutchins, 1995, 2000) and activity theory (Vygotsky, 1978) that make software easy to learn also make it easy to use.
6. *Using this software is slow because I have to make a lot of keystrokes or mouse clicks to do the work.* Efficiency and effectiveness in design-for-use should produce functionality tailored for the use context. The tailoring should produce functionality that is precise and of succinct operation. These two properties should enable actions to be readily operationalized. The artifact affordances needed to undertake the activity should be designed to support the workflow of the actions in the process and support operationalization of actions.
7. *This software makes my job easier.* The workflow of the software should support existing practice, sequence the workflow, clarify and/or affirm terminology, and integrate feed-in/feed-out systems.
8. *This software calls things I am familiar with by a different name.* The terminology used to describe the process and the elements associated with the process are not changed with a change of software, meaning the software does not make changes to existing practices. The use of the noncustomized American enterprise system changed the terminology used in Australian universities: For example, the Australian English term *unit* was replaced with American English term *course* where, previously in the Australian context, *course* was a set of units in a program.
9. *The computer* (i.e., the hardware) *is adequate; it does not need upgrading to run this software.* Adequate hardware is essential for the integration of new software into work processes. A mismatch between the computer specifications and software requirements impacts the operation of the software. The issue may be that the computer's central

processor is too slow, the computer needs more memory or faster peripherals, the network may be too slow, or the screen is the wrong size or resolution.

10. *Using this software, there are too many things to do to get the job done.* Additional work to complete a similar process negatively affects a user's perception of the upgrade: Changes in work practice could involve the user having to manage some form of housekeeping for the software, or an increased complexity due to numerous new stages in the process. Ideally, the process flow and housekeeping would be automated by the software.
11. *Because of this software, the job involves less follow-up work away from the computer.* Ancillary workload involves tasks away from the computer that support or result from use of a software program, such as feed-in/feed-out systems.
12. *The training to use this software was inadequate.* The successful introduction of software requires a suite of complementary activities. These include training in the use of the software, information to the users about the effects on the work of associated activities, and how the software benefits the user now and in the long term. If investments in learning or setting up the system for long-term benefits are needed, these have to be explained and have commensurate adjustments to workloads.
13. *When first introduced to this software, my main aim was to get an output as soon as possible.* This confirming question addresses lower level operational criteria. In the active user production paradox (Carroll & Rosson, 1987), the user is output driven, and once a solution is found, the solution becomes the method. Changing software may require extra work, but how the task is performed within the new software may or may not change. Thus, this question was directed toward determining whether the user is output driven or participates in exploratory behavior.
14. *When first introduced to this software, my main aim was to try as many things as possible.* In the active user assimilation paradox (Carroll & Rosson, 1987), the user tries familiar actions in unfamiliar situations. Therefore, this question is directed toward determining what composes that behavior pattern; the crux is whether or not the user is even interested in exploring other possibilities.
15. *There is always enough information on the screen when it's needed.* A tenet of distributed cognition (Hutchins, 1995, 2000) is that information is distributed between humans and the artifacts within the environment so that the use of the tool is intrinsic within the context of the activity. Distributed cognition implies the presence of the appropriate artifact to facilitate the behavioral task that supports the cognitive task (motive) driving the activity.
16. *Looking at the screen, sometimes I do not know what to do next.* The intent of this question is to consider the metaphor behind the application, that is, the metaphor for any particular screen or screen artifact. Holistically the metaphor should be congruent with the purpose of the activity. The artifacts should provide an individual context for the actions/operations, depending on the user's focus and familiarity. The affordances of the artifact imply what to do and how to do it.
17. *The screen for this software looks like other screens I have used.* The layout of the screen artifacts constituting the functionality of the system, or the composition of

the menus, are not the same on this screen as they are for other screens the user has experienced, or could be expected to come into contact with. The aim here is to check that there is visual consistency in layout, absolute and relative positioning, and the visual representation of artifacts is consistent for artifacts of similar functionality (i.e., consistency in icons or graphics for artifacts that relate to a common function). One of the objectives of design should be the leverage of prior knowledge in use-community praxis.

18. *Sometimes this software does things that I did not expect to happen.* Artifacts relative to the use context should be visible with visible affordances. The operability of the artifact depends on the visibility of the affordances or on the learned behavior of hidden affordances. Consequently, hidden affordances—a property (short form menu) or a method (right-click on mouse-over of artifact)—should be consistent across the occurrences of the artifact in the application and across occurrences in the practice of the use-community. False affordances should be modified or removed to minimize inappropriate expectations.
19. *When I look at the icons and menus, etc. on the screen. I know what to use and how to use it.* The screen artifacts have affordances: One aspect of affordances is the physical representation of the artifact. This physical representation has to incorporate cues to the operation of the artifact as a tool and the possible uses of the artifact as a tool.
20. *It takes too long for me to see things happening on the screen.* The directness and operational transparency of the artifacts relate to the response time of the direct manipulation interface to give feedback to the user.
21. *I found the help in the software to be very useful.* An integrated and contextually related help subsystem of the software is specified in checklists of system functionality.
22. *There is a lot to learn before using this software.* This question addresses the depth to which the user was immersed in the use-community and the amount of prior knowledge that is available for leverage from the user as a member of that community. It does not assess, however, the understanding of the artifacts used to leverage that prior knowledge.
23. *I think I will be able to use this software without asking for help from the experts who know how to use it.* This question is active-user based and directed towards output and training support systems. The user indicates that he/she has the knowledge and experience necessary to use the software. The affordances and metaphors are familiar to the user, who is able to recognize and associate actions with the on-screen display.
24. *This software is difficult to use because I have to work all over the place on different screens.* Functionality should support the activities in the work domain. The question is not about the efficiency of the functionality but rather about utility, the efficiency of using the functionality.
25. *For the things that I use, this software looks and works the same way, every time.* Building user confidence is important. This can be achieved early in the user experience by using meaningful artifacts from the distributed cognition of the use-community. This implies consistency of operational methods for activation of

command sets. The operability of artifacts should be consistent with the metaphor and consistent with the task–action grammar.

CONCLUSIONS

This article presented the SAI survey (Lehane & Huf, 2005, 2006) based on classification criteria that arose from a grounded theory analysis of users' descriptions of their computer use. The central theme for analysis interpretation and issue resolution is community-of-practice-scripted user behavior, based on the tool-associated practice of the use-community. The TAM graph of the SAI system acceptance criteria facilitates the presentation of the elements of scripted behavior (as interpreted by the survey), these being Active User, Distributed Cognition, Affordances and Support_Use-Practice.

In the case study, the SAI analysis identified the upgraded FMS as not being intuitive and proposed a means to resolve the issue. The users were deskilled and had to reskill on the use of the upgraded system, with training focused on background knowledge to make the context of the screen artifacts and their affordances familiar. The experience gained from the training and induction into the finance-community of practice enabled the users to understand what was presented and to navigate confidently the screens and menus. This circumstance illustrated that the difference between being intuitive and not being intuitive was their having to learn to use the system instead of just knowing how to use it by looking at it.

HCI has the design convention of leverage of prior knowledge that I implement as "give the users what they already know" and thus interpret as intuitive design. In the case study, it was necessary to train the users so that they had the knowledge they needed to make sense of the new FMS and use it confidently; the situation for the design convention was reversed. The design incorporated use-knowledge that was unknown and the integration between the users and the technology was to provide the background training assumed by the system designers. Once that experience was formally established, the HCI design convention of leverage of prior knowledge could be seen to be implemented in the new FMS.

The intent of this article is to illustrate the usefulness of the SAI as an analysis practice to elicit user requirements and relate that feedback to system design considerations for intuitive use. The foundation for the link between the users' input and design is the concept of scripted behavior from a community of practice. The theoretical considerations accompanying the development of the survey and the methodology to interpret the users' responses will be presented in Lehane (in press).

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Author's Note

The SAI and an Excel worksheet with notes on use are available for use by those assessing the introduction of technology into the workforce (https://eportfolio.usq.edu.au/view/view.php?t=Zw1TAYBxKMOG5fUPunyi). The only prerequisite for the use of the SAI or the inherent analysis practice is that any published report should acknowledge the source of the measure and practice.

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APPENDIX

This provides a scan of the hardcopy version of the SAI. The same basic layout was used for the online versions. Responsibility, experience, and frequency of use may vary with the survey campaign.

In addition to the closed questions provided here there were four open questions worth considering, because the responses could negate the need for or complement the use of focus groups. These questions were along the lines of

1. For you, what was the best thing about using the software?
2. What annoyed you most about using the software?
3. What would you change?
4. As a user, what is the first thing you would put on the wish list?

System Acceptance Indicator

INSTRUCTIONS This questionnaire should be filled in, in little more than the time it takes to read it. There are no correct answers to the questions. Please place a cross in the box that best indicates how you first feel on reading the question. Give a single response to each question. Please fill in the reference information before responding to the questionnaire.

Reference Information:
Date..... Software .....[Test Identifier.....OfficeUseOnly]

Year of Birth: .....

Gender: female ☐ male ☐

Conditions for use of software: mandatory ☐ voluntary ☐

Responsibility level for software: manager ☐ user ☐

Do you like using the software: no ☐ yes ☐

Experience with software:
less than 1 month ☐ less than 3 months ☐ less than 1 year ☐ more than 1year ☐

Frequency of Use:
several times a week ☐ a month ☐ 3 - 6 months ☐ 6 – 9 months ☐ a year ☐

	Strongly agree		Undecided N/A		Strongly disagree
Q1. I would recommend this software to a colleague or friend.	☐	☐	☐	☐	☐
Q2. Using this software makes me feel bad ie anger, frustration, stress, confusion, headache or body pains	☐	☐	☐	☐	☐
Q3. This software does all the things that I need it to do.	☐	☐	☐	☐	☐
Q4. This software takes too many steps to get something done.	☐	☐	☐	☐	☐
Q5. I thought this software was easy to learn.	☐	☐	☐	☐	☐
Q6. Using this software is slow because I have to make a lot of keystrokes or mouse clicks to do the work.	☐	☐	☐	☐	☐
7. This software makes my job easier.	☐	☐	☐	☐	☐
Q8. This software calls things I am familiar with by a different name.	☐	☐	☐	☐	☐
Q9. The computer is adequate, it does not need upgrading to run this software.	☐	☐	☐	☐	☐

	Strongly agree		Undecided N/A		Strongly disagree
Q10 Using this software, there are too many things to do to get the job done.					
Q11. Because of this software, the job involves less follow-up work away from the computer.					
Q12. The training to use this software was inadequate.					
Q13. When first introduced to this software, my main aim was to get an output as soon as possible.					
Q14. When first introduced to this software, my main aim was to try as many things as possible.					
Q15. There is always enough information on the screen when it's needed.					
Q16. Looking at the screen, sometimes I do not know what to do next.					
Q17. The screen for this software looks like other screens I have used.					
Q18. Sometimes this software does things that I did not expect to happen.					
Q19. When I look at the icons and menus etc on the screen I know what to use and how to use it.					
Q20. It takes too long for me to see things happening on the screen.					
Q21. I found the help in the software to be very useful.					
Q22. There is a lot to learn before using this software.					
Q23. I think I will be able to use this software without asking for help from the experts who know how to use it.					
Q24. This software is difficult to use because I have to work all over the place on different screens.					
Q25. For the things that I use, this software looks and works the same way, every time.					

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