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Abstract:

An assumption implied by much of the literature in information systems (IS) research is that people's interpretations of technology influence the way in which technology gets adapted in organizations. Despite this acknowledgment, little insight is provided for how these interpretations can be elicited, and only a few studies suggest methods for doing so. In this article we address this opportunity by advancing cognitive mapping as a well-established method to systematically inquire into people's interpretations of technology. We show how cognitive maps can serve as visual means of representation of these interpretations and discuss how the maps can be used to facilitate individual reflection and collective negotiation of technology adaptation. We illustrate the use of the cognitive mapping method with a case example of the introduction of an electronic patient record (EPR) system in a hospital setting. Based on our findings, we engage in a discussion of the value of cognitive mapping as a facilitating technique of individual reflection, as well as collective negotiation and construction in relation to technology adaptation. This implies a discussion of the epistemological, theoretical, and practical implications of its use.

Keywords: cognitive mapping, user interpretations, technology adaptation, qualitative research, qualitative methods, healthcare

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I. INTRODUCTION

In recent years, the phenomenon of technology adaptation has continued to grow in importance as a topic of academic interest. A number of studies in Information Systems (IS) research emphasizes users' early interpretations as a way to investigate how well technology gets adapted to work procedures and becomes part of work routines [Vaast and Walsham, 2005; Vlaar, Fenema, and Tiwari, 2008]. Technology adaptation connotes how organizations and technology adapt to each other in a reciprocal way during implementation and use [Henfridsson, 1999]. This implies a combined technical and organizational change process in order to reach a stage where the technology is more or less taken for granted and embedded in the organization's social practices [Silva and Backhouse, 2003]. Technologies in these studies are seen as emerging artifacts that are shaped by users' "early assumptions, expectations, and knowledge of the technology" [Orlikowski and Gash, 1994, p. 182]. Consequently, technologies become deeply entangled and embedded in organizational practice over time, while at the same time being influenced by organizational use [Orlikowski, 2010; Wagner, Newell, and Piccoli, 2010].

Prior research has addressed users' reactions to new technologies, suggesting that the operating efficiency of the technologies is heavily dependent not only on users' modifications of the technology itself but also on interactions among diverse institutional contexts, stakeholders, and technology during implementation [Jones and Karsten, 2008; Boonstra and van Offenbeek, 2010]. The physical and organizational context in which the technology becomes embedded also has been emphasized [Orlikowski and Gash, 1994; Tyre and Orlikowski, 1994]. On the cognitive level, focus has been on how users' meaning constructions [Azad and Faraj, 2011], sensemaking structures [Weick, 1995; Henfridsson, 1999; Bansler and Havn, 2006], technological frames [Orlikowski and Gash, 1994; Lin and Silva, 2005; Davidson, 2006], and social representations [Jasperson, Carter, and Zmud, 2005; Vaast and Walsham, 2005] influence the adaptation of technology. These studies share the understanding that organizational members' interpretations of technology are of great importance regarding how, and how well, the technology becomes integrated into the organization.

In this article we argue that more systematic methods for eliciting interpretations, and making them available for reflection and discussion, are needed in order to strengthen the existing knowledge on how users' interpretations of technology relative to their work practices influence technology adaptation [Orlikowski and Gash, 1994]. As noted by Griffith [1999], "organizations that are able to determine which features users mentally bring to the social construction process should ultimately be able to improve technology design, implementation, use, and redesign. Without such knowledge, technology implementation (indeed, any organizational change) proceeds on limited information, and organizations, thus, can less proactively manage the implementation process" (p. 473). Although this view is based on a somewhat deterministic assumption about the manageability of technology, it emphasizes the importance of the socio-cognitive aspects of technology, as also emphasized by, for example, Orlikowski [2000] and Davidson [2002].

While there is quite extensive research on technology adaptation, little research has been conducted on how users' interpretations of technology and their implications for work practices can be elicited in order to reflect on problems and opportunities which might influence technology adaptation. A reason for this may be that organizational members' assumptions and interpretations of the technology are difficult to isolate, illustrate, and understand, as they manifest themselves in behaviors, rituals, and values that are not easily explicated [Bartis and Mitev, 2008]. This assumption is supported by Kendall and Kendall [1981], who argue that we need better techniques to "classify, document, and interpret important factors which usually remain at the subconscious level [of organizational members]" (p. 43).

We address this methodological challenge by advancing a well-established technique, that of cognitive mapping, to illustrate how it can be used to represent and share users' interpretations. We argue that cognitive mapping facilitates an inquiry into how organizational members interpret new technology through visual representations. In addition, we highlight the use of cognitive maps as representations to increase users' awareness of not only their own, but also each other's, interpretations of and reactions to technology. Consequently, we illustrate how maps can be used to share users' early interpretations and thereby serve as input for discussions about the adaptation of the technologies in the organizational context. We pursue the following research question: How can cognitive mapping enable inquiry into representation and sharing of users' interpretations of technology?

The contribution of the study is primarily methodological. Based on the case example, we suggest that cognitive mapping is useful as a method of inquiry into users' interpretations of technology as well as a method of representing and sharing these interpretations. In this respect, the method provides important input to the adaptation process by enhancing individual reflection as well as collective discussion and negotiation of the technology. As the focus of our study is on users' early interpretations of technology-in-use, the findings contribute to studies of appropriation and implementation by providing a method for how these interpretations can be made explicit. Our study thereby serves as input to the appropriation process where managerial issues (see, e.g., Rodon, Sese, and Christiaanse, 2011), institutional arrangements (see, e.g., Orlikowski and Barley, 2001; Jones and Karsten, 2008), as well as system interventions [Åkesson, Kautz and Eriksson, 2010], are in focus.

We pursue the research question in three steps: First, we conduct a literature review on the origins and previous uses of the cognitive mapping method to discuss its potential in eliciting users' interpretations of technology. Based on the existing literature, we argue that the use of cognitive mapping can create a "window of opportunity" [Tyre and Orlikowski, 1994] for individual, as well as collective, reflection on technology-in-use. Second, we present a case example of healthcare professionals' adaptation of an electronic patient record (EPR) system to illustrate the use of the method in practice. Third, we discuss the epistemological, theoretical, and practical implications of its use toward framing the contribution of this study.

II. ELICITING USERS' INTERPRETATIONS BY USING COGNITIVE MAPPING

Users' Interpretations of Technology

In the last decade a substantial stream of IS literature has focused on the role of users' interpretations of technology in relation to its implementation and use. For example, we find studies indicating how users are embedded in social networks during implementation of new technology [Sykes, Vankatesh, and Gosain, 2009]; implications of contextual influences on technology adaptation [Davidson and Chiasson, 2005]; reasons for user resistance to information technology implementation [Lapointe and Rivard, 2005; Jian, 2007]; and the effect of management support, training, and technical complexity on successful IS implementation [Sharma and Yetton, 2003, 2007]. Furthermore, research has looked at the impact of emotions [Beaudry and Pinsonneault, 2010], social power [Azad and Faraj, 2011], and intentions and habits [Ortiz de Guinea and Markus, 2009] on information technology implementation and use.

The focus on adaptation can be seen as a response to earlier criticism that much of the IS literature treats technology as separable from the social and organizational contexts in which it is instantiated, appropriated, and enacted. The tendency to focus less on technology development and more on the social context in which technologies are designed and used is also supported by a study of the core research areas of the IS discipline by Sidorova, Evangelopoulos, Valacich, and Ramakrishnan [2008], indicating a decline in the number of articles about more technology-focused issues over a two-decade period from 1985–2006.

Although studies of technology as integrated and inseparable from its social and organizational context provide different explanations of this relationship, they generally support the view that the meaning of the technology does not reside in the artifact itself but in the way it is interpreted by the relevant social groups that are going to use it [Pinch and Bijker, 1984; Barley, 1986; Leonardi, 2009]. If we look at existing studies in the IS research field, we find a considerable number of studies that focus on users' interpretations of technology implementation and use. For example, we see that interpretations are considered social constructions that are formed through individual reflection and group conversations about new technology. It is argued that interpretations of technology are formed during users' initial engagement with the technology and through their conversations about it [Poole and DeSanctis, 1990; Jian, 2007; Leonardi, 2009]. Interpretations are also based on users' experience with previous technologies relative to their expectations to new ones or a mismatch between expectations and experiences, as we see in studies of habits [Jasperson, Carter and Zmud, 2005; Ortiz de Guinea and Markus, 2009] and routines [Edmondson, Bohmer, and Pisano, 2001], as well as in studies of sensemaking and sensegiving in relation to technology [Weick, 1990; Henfridsson, 2000; Bansler and Havn, 2006; Jensen, Kjærgaard, and Svejvig, 2009].

The many studies on the implications of users' interpretations of technology show that interpretations are indeed considered an important influence on technology adaptation; however, the existing literature does not provide much guidance on how researchers and practitioners can address these. As a consequence, we suggest that it is important for technology adaptation that interpretations are made explicit and can be discussed and shared among users as well as among other stakeholders that influence the technology adaptation. For practice, this brings insights to system developers or implementers who can make changes to the technology or create new features. It also provides insights to managers who can try to manage expectations regarding, for example, the effectiveness of the new technology. For research, it is relevant for establishing more systematic methods when theorizing about technology adaptation.

Given the importance of studying users' interpretations of technology, we argue here for the need to advance more systematic and rigorous methods for doing so [Kendall and Kendall, 1981]. As a well-established method within other research fields, cognitive mapping has the potential of providing a tool to make interpretations explicit and thereby facilitate technology adaptation. Consequently, we propose cognitive mapping as a possible approach to represent users' interpretations of technology, thereby enabling reflection and discussion about the technology.

Cognitive Mapping

Cognitive mapping is a qualitative research method that is used to structure, analyze, and represent an individual's [Jenkins, 1998] or a group's [Ackermann and Eden, 2007] accounts of a specific situation or issue [Eden, 2004; Hodgkinson, 2004]. It builds on the recognition that organizational members edit their experience into patterns of personal knowledge, and the map serves as a representation of this knowledge [Weick and Bougon, 2001]. These representations are also known as mental maps, mind maps, cognitive models, or mental models [Walsh, 1995]. Consequently, cognitive mapping can be used to structure, analyze, and make sense of accounts of problems [Ackermann, Eden, and Cropper, 1992, p. 65].

The process of cognitive mapping does not refer to one specific approach; it is a term used to address several ways of mapping cognition [Eden and Spender, 1998; Narayanan, 2005]. Some mapping techniques claim to be largely content and theory free, while others are based on specific social or cognitive theories [Laukkanen, 1998]. Cognitive maps can be drawn on either an individual [Eden, 1988; Eden, 1992; Weick and Quinn, 1999] or on a collective level (e.g., Langfield-Smith, 1992; Sheetz, Tegarden, Kozar and Zigurs, 1994), and they can comprise many types of relationships among concepts such as, for example, proximity, similarity, cause-effect, category, and contingency [Swan, 1997].

More recent use of cognitive mapping is different from the original idea of Tolman [1948] who proposed the creation of cognitive maps as "true" representations of cognition [Eden, 1992; Siau and Tan, 2005]. Where Tolman [1948] focused on the content of the maps, more recent cognitive mapping approaches place emphasis on articulation and focus on the *process* of mapping as opposed to the *content* of cognitive maps (e.g., Swan, 1997). In this sense, cognitive maps are representations rather than "true" imprints of cognition, and their purpose is to "represent subjective data more meaningfully than other models" [Eden, 1992]. This is linked to the epistemological assumptions on which the use of cognitive mapping is based.

Three Epistemological Stances to Cognitive Mapping

Similar to other qualitative research methods such as interviewing, the use of cognitive mapping varies according to the underlying epistemological assumptions that guide it. In a recent article about the method of interviewing for data generation [Schultze and Avital, 2011], three epistemological stances based on Alvesson [2003] are discussed: the neopositivist, the romantic, and the localist. Application of the same distinction to cognitive mapping shows three very different uses of the method of which, at least in practice, we have seen only two, namely, the neo-positivist and the romantic positions.

From a neo-positivist perspective, the process of cognitive mapping aims at creating representations close to the user's understanding of the technology, based on the belief that users have pre-established views that can be mapped. The cognitive mapping process is seen as the instrument to create a "true" map of the user's interpretations, and, therefore, this perspective comes close to that of Tolman [1948] mentioned earlier. Within the IS research field, we find a number of studies that build on the neopositivist perspective, where cognitive mapping has been used primarily for conceptual modeling [Siau and Tan, 2005] and for requirement specification and analysis [Montazemi and Conrath, 1986; Zmud, Anthony, and Stair, 1993]. In a study of software support operations, Nelson, Nadkarni, Narayanan, and Ghods [2000] used cognitive mapping to understand the major constructs of software support expertise and how the constructs interact in the support process. Researcher bias was addressed by Sheetz, Tegarden, Kozar, and Zigurs [1994], who discussed and explored cognitive mapping using a group support system and then compared their results with individually derived maps.

In the romantic perspective, which we would refer to as an interpretive or symbolic interactionist approach [Hatch and Cunliffe, 2006], the mapping process is seen as an occasion for the user to make sense of the technology and express his/her interpretations. Within this perspective, the maps are seen as created in the process, not as previously existing maps that just need to be expressed. Here the interviewer serves as a facilitator for creating the maps in interaction with the users. Within the IS research field, we find studies that build on the romantic perspective by using cognitive mapping to elicit technological frames [Orlikowski and Gash, 1992; McKay and Marshall, 2005] and to offer insights into the socio-technical problems experienced when various stakeholders or groups of stakeholders have to negotiate perceptions of a system or technological innovation [Swan and Newell, 1994]. A study by Kendall and Kendall [1981] argues that cognitive maps are valuable for decision makers in analyzing the internal organizational environment.

Although we have not found studies in the IS research tradition that exclusively apply a localist perspective in the use of cognitive mapping, we think of it as a critical perspective in which maps can be perceived as constructions which are generated in the local context and which cannot be separated from this. In other words, the maps show constructs generated in the specific cognitive mapping process, and they cannot represent interpretations from other situations. In this perspective, the mapping process, rather than the maps themselves, is in focus, and the maps are seen as expressions of local, maybe even political, statements [Alvesson, 2003; Schultze and Avital, 2011].

Use of Cognitive Mapping in This Study

Our use of cognitive mapping in the illustrative case example is predominantly based on interpretive epistemological assumptions. However, in the discussion we will draw from the localist perspective to critically reflect on the use of the method and discuss its value and limitations. We question the fact that a map exists in the mind of the participant prior to the process of mapping. In other words, users' interpretations and use of technology are continually constructed and cannot be captured in one "true" map [Narayanan, 2005]. The set of interpretations that a map represents is neither a precise reflection of what was in the mind of the person prior to construction of the map, nor is it a new static construct. Instead, we see the map as created in the process of articulating meaning, as eloquently expressed by Weick [1995] in the question: "How can I know what I think till I see what I say?" (p. 12).

In this respect, cognitive mapping as a method of inquiry acts as a tool for eliciting statements from the users in order to obtain subjectively meaningful concepts and relations regarding the technology adaptation process and to get a more in-depth understanding of their interpretations of the technology features. This is useful on an individual level, i.e., for each user to explicate and become aware of his or her perceptions and interpretations, but also on a collective level, i.e., where cognitive maps as representations can facilitate the sharing of users' experiences with, and reactions to, technology in adaptation processes. Orlikowski and Gash [1994] conceptualize this as congruence and incongruence, arguing that "… where incongruent technological frames exist, organizations are likely to experience difficulties and conflicts around developing, implementing, and using technologies." Accordingly, we argue that cognitive maps are useful in grasping users' different interpretations of technology and in sharing diverse perspectives in the technology adaptation process.

In the case example below, we illustrate the use of the cognitive mapping approach for exactly these purposes.

III. ELICITING USER INTERPRETATIONS IN ADAPTATION OF ELECTRONIC PATIENT RECORDS—A CASE EXAMPLE

To illustrate the potential of cognitive mapping in representing and sharing users' interpretations of technology, we report from an empirical study of the implementation of an electronic patient record (EPR) system in a hospital setting. In particular, our case example centers on a clinical ward that specializes in foot surgery and in shoulder, knee, arm, wrist, and hip alloplastics. It includes a standard ward, an outpatient clinic, a sports clinic, and a clerk's office. At the time of our study, the clinical ward employed ten consultant surgeons (all male), one managing consultant surgeon, and forty nurses, with an average of 3,000 emergency and planned admissions a year.

The EPR implementation was initiated in the ward as a pilot project with the purpose of evaluating the introduction of the EPR system with a special focus on reorganization of work practices, quality enhancement of patient treatment, and financial implications. The use of the EPR system was mandatory, and the system was introduced to provide a shared and interdisciplinary access to patient records, enabling healthcare professionals to access patient data and concurrently enter new data into the system from different sites. The EPR system comprised a wide range of clinical information such as nursing, progress, and physiotherapist notes; diagnoses; medicine schemes; historical data; information on patients' temperature and blood pressure; X-rays; and laboratory data.

We consider the clinical ward an ideal setting to study the use of cognitive mapping, as the healthcare professionals (in this case, doctors) were highly motivated to talk about their views, reactions, and immediate assumptions about the EPR system. In a busy work environment, the doctors had limited time to engage in discussions with peers about their experiences with the EPR system, although they acknowledged that this was important for the successful adaptation of the system. Consequently, we were welcomed by the chief physician to facilitate the process.

Below we illustrate the use of cognitive mapping in three steps: We (1) describe how the mapping technique was used to inquire into the doctors' interpretations of the EPR system, (2) highlight how cognitive maps served as visual means of representation of interpretations, and (3) discuss how the maps were used to facilitate individual reflection, as well as collective negotiation, among the doctors.

1. The Mapping Technique to Inquire into Doctors' Interpretations of the EPR System

Preparation for the Cognitive Mapping Session

We entered the clinical ward four months after the initial implementation of the EPR system. Despite the rather short time frame, the majority of the doctors had already become relatively familiar with the system, as they all used the system on a daily basis.

As an initial activity, we conducted observation studies in order to gain contextual knowledge about the setting. We observed five shifts during which the doctors showed us how they used the EPR system in relation to various work procedures: preparation of ward rounds, medicine prescriptions, accessing and registering patient notes in the system, medicine administration, etc. The observation studies were useful to get an understanding of the healthcare context in general and the specific practices in which the EPR system was embedded. Through the observations we also gained insight into the EPR system and its functionalities and saw how the professionals were interacting with the system. Based on this contextual knowledge, we were ready to initiate the mapping technique through semi-structured interviews with ten doctors.

Before the interview session, we prepared twenty-one inspiration cards as the focal point for creating the cognitive maps. Each inspiration card represented an activity or aspect of the EPR implementation at a more or less abstract level, e.g., "user training," "support," "selection of EPR system," "workflow analysis," "information activities," etc. The cards were prepared on the basis of the observation studies at the ward; an extensive literature study on EPR implementations; and various documents that included the project plan, the requirement specification, the user training session schedule, and information from the hospital website. In addition to initiating the interview, the purpose of the cards was to help doctors tell stories and talk about their reactions related to the EPR system and their daily work practices.

Using the Laddering Technique to Elicit Interpretations

We initiated the individual interview sessions by asking the doctor to prioritize the twenty-one cards according to importance. For every card chosen, a so-called laddering technique [Bourne and Jenkins, 2005] was used to elicit the higher- or lower-level abstractions of the constructs or concepts mentioned by the doctors. The technique was performed by probing, which means to "peel back the layers" of the informant's experience [Woodruff and Gardial, 1996, p. 186]. Specifically, we asked the doctor: "What do you understand by …?" or "What is implied by …?" for each construct he chose. For example, if the doctor considered "EPR user training" to be a central aspect, he was asked, "What is implied by EPR user training?" The answer to this question could relate to "the teacher's competences," "the number of hours provided for training," "the number of participants in the course," etc. For each statement, we then continued by asking, "Why is this [aspect] important to you?" This allowed the doctor to reflect on each aspect and relate it to the work practices, his or her role as professional, perceptions of the system, needs, and priorities, as well as mentioning other issues that came to mind.

To decide when we had reached an appropriate level of abstraction and "peeled back" enough layers, we used the criterion of reaching a point of saturation [Walsham, 1995]. This was achieved when the doctor either repeated himself or when no further information was added to the "what" and "why" questions.

Constructing the Maps

Two interviewers were present during each interview: one interviewer was conducting the interview, asking the "what" and "why" questions, while the other was drawing the map and making sure that the doctor would elaborate on all aspects mentioned throughout the interview session. Both interviewers were thus actively involved in constructing the cognitive maps during the interviews in collaboration with each doctor.

To provide an idea of how the maps were constructed during the interview, we present two short interview passages where two doctors independently talked about "EPR user training":

Interview passage 1:

Interviewer:	What do you understand by "EPR user training"?
Doctor:	That I am taught the most basic functionalities of the system and obtain sufficient knowledge about the system and how it works.
Interviewer:	Why is that important?
Doctor:	It is important to me that I'll be able to use the system correctly in my daily work here on the ward.
Interviewer:	What do you mean by using the system correctly?
Doctor:	It is not unimportant how we use the system. If we do not use it correctly, it may have consequences for the patients. For example, if we log the medicine prescription in the wrong place in the system,

then others will not be able to find the prescription … or we might end up prescribing the medicine twice because we do not know how the system works.

Interviewer: Why is it important that you are able to use the system correctly in your daily work?

Doctor: Because we cannot perform our work without the system. We need to be confident using it. The system is here to stay.

Interview passage 2:

Interviewer: Tell me a bit about the “EPR user training.”

Doctor: It is important that we’re taught how to use the system and especially how to get an overview of the information in the system.

Interviewer: What do you mean by overview?

Doctor: As a doctor, it is vital to have an overview of the patient. For example, if the patient is allergic to certain kinds of medicine, I need to know. It is important that we can find the information we need in the EPR system and get an overview of all the information that is related to this specific patient. Here I am also talking about test results from the different examinations of the patient.

Interviewer: Why is it important for you to have this overview and to be able to find the information about the patient in the EPR system?

Doctor: We need to be efficient. It facilitates my work if I can easily find the information I need, and in this way I don’t have to spend too much time on administrative tasks.

The interview passages show the use of the laddering and probing techniques where the two doctors reflect on “what” they understand by “EPR user training”—i.e., they mention aspects such as “using the system correctly” and “overview of information in the system.” We also see the procedure of using “why” questions to elicit the higher level abstractions of the concepts that the doctors use to organize their thoughts about the system.

For each interview passage, we aggregated the statements into constructs as part of the cognitive map. Figure 1 shows how the concepts that relate to the “EPR user training” interview passage above form so-called ladders.

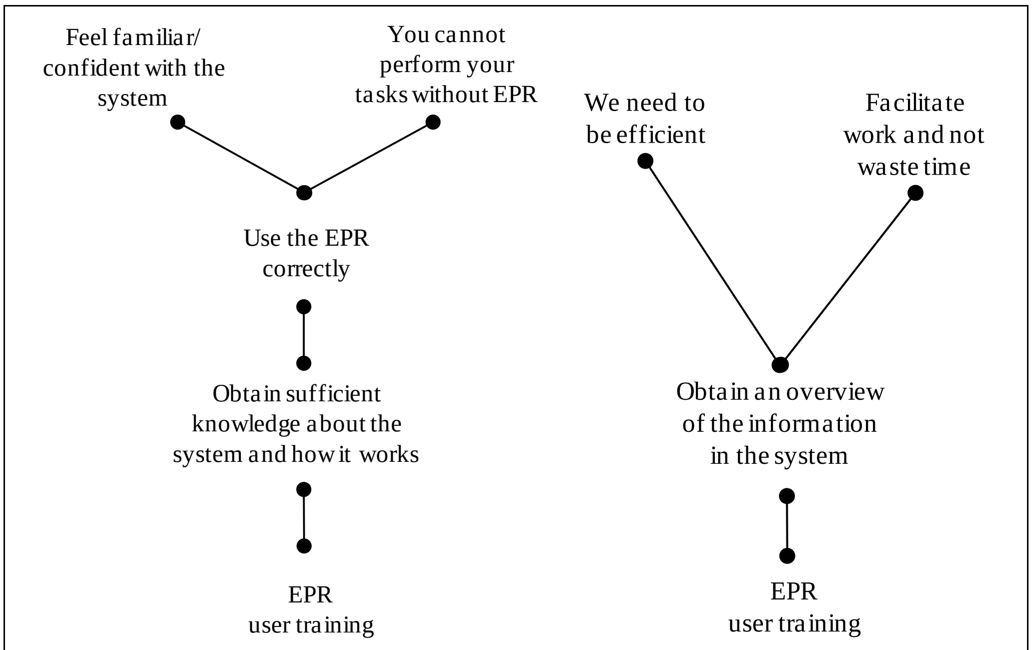

Figure 1. Creation of Ladders from Interview Transcripts

In the two ladders we see that “EPR user training” is perceived to be an important activity in order to “obtain sufficient knowledge about the system” and to “obtain an overview of the information in the system.” A better overview “facilitates the work,” which means that the doctors can be “more efficient” and “not waste their time.” “Obtaining sufficient knowledge about the system” means that the doctors can “use the system correctly,” thus enabling them to perform their clinical tasks as they “cannot perform them without the system.” Moreover, they “feel familiar/confident with the system.” The lines in Figure 1 represent bidirectional relations where the “what” questions indicate a movement downward and the “why” questions a movement upward.

Each map was continuously extended to comprise new statements and new ladders, resulting in an individual map for each doctor, as illustrated in Figure 2:

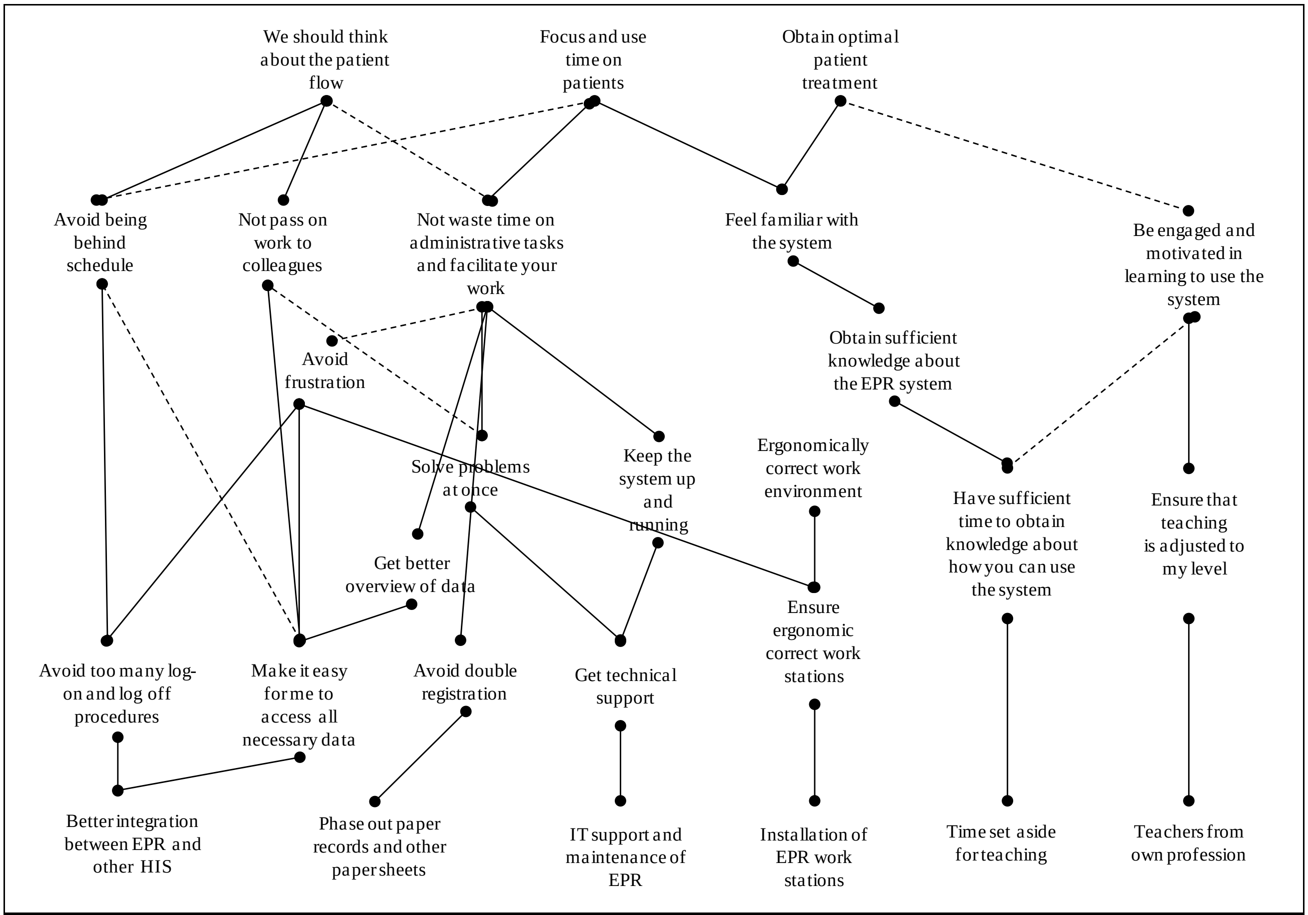

Figure 2. Individual Map for One of the Doctors

We will not describe the content in this individual map but rather highlight the dotted lines to indicate relations that were mentioned by the doctor when he commented on the map after the interview. These relations were then added to the map and used for further aggregation into the group map described next.

2. How Cognitive Maps Served as Visual Means to Represent Doctors' Interpretations

Initial Coding of Data and Building of Aggregated Maps

Although we drew a first version of the map during the interview session, we coded the interview transcripts more carefully after each interview. Inspired by grounded theory techniques [Strauss and Corbin, 1998], we categorized the different statements and observations into concepts, looking for relations between them. It was important that the categories were close to the expressions used by the doctors for them to recognize their own statements in the ensuing process. We compared the data with the emerging categories in a cyclical process inspired by Miles and Huberman [1994]. In order to ease the construction of the maps, we entered the categories and relations into a software program called MECAnalyst to automatically construct the maps. The individual map that was sketched by one of the interviewers during the interviews subsequently was compared to the constructed map from the interview transcripts.

As a next step, aggregated maps were constructed across individual statements for different topics, such as, for example, "user training," "support," and "integration between systems." One of these maps on "Support" is illustrated in Figure 3:

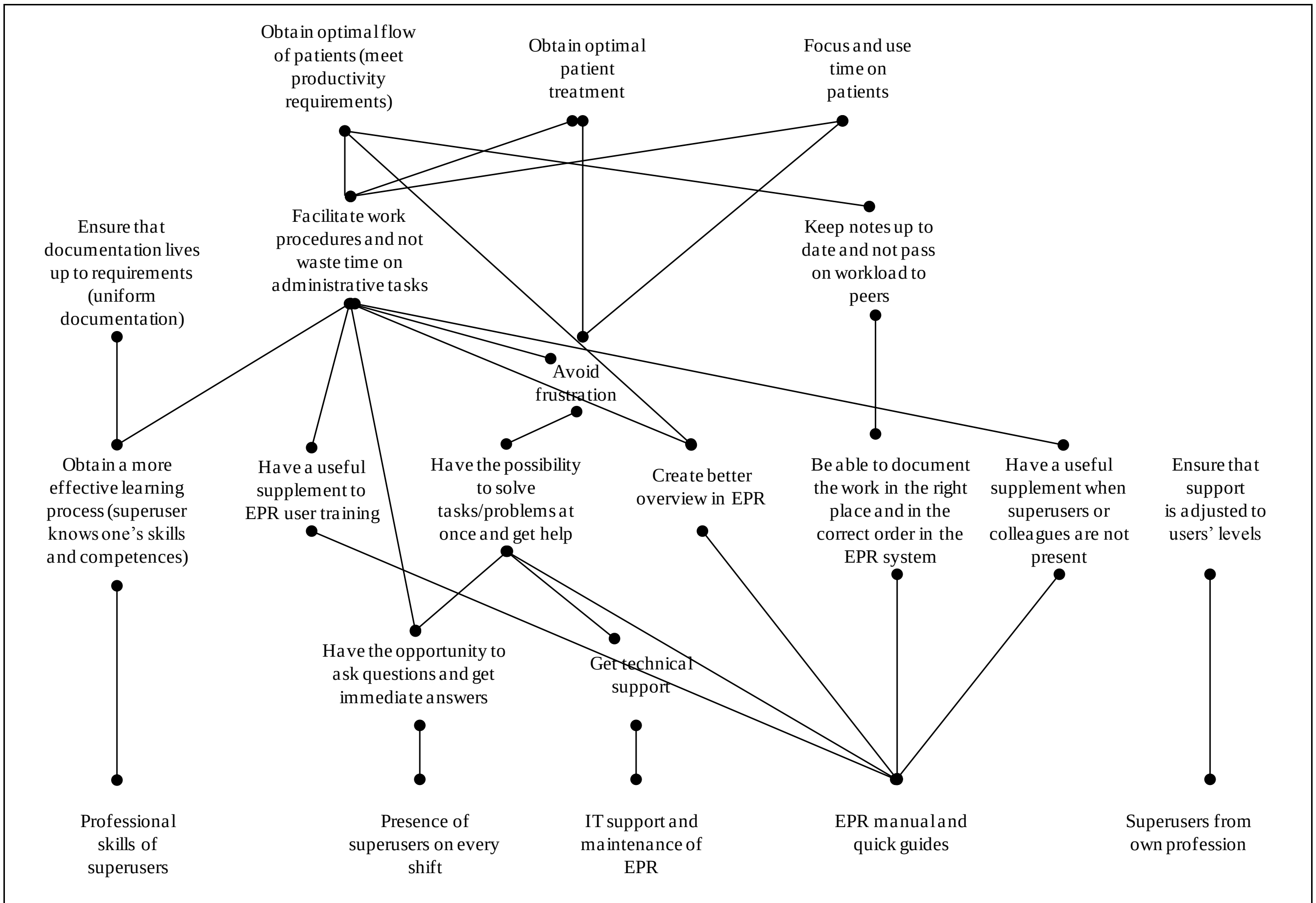

Figure 3. Aggregated Map on "Support"

All the doctors (except one) talked about "support" as an important aspect in the EPR implementation as a way to become familiar and confident with the system. At the bottom of Figure 3, we see how "support" is understood as comprising "professional skills of super users," "presence of super users on every shift," "IT support and maintenance of the EPR system," "the existence of EPR manuals and quick guides," and having "super users from own profession."

The topic maps were constructed in order to view the data from different angles and to ensure that all the elements mentioned by the doctors that related to each topic were included in the maps. The topic maps were intermediary steps in the analysis process and were not used actively in the further construction process. Rather, we merged all the concepts from the individual maps into one single group map that included the entire pool of statements, as is described next.

Constructing the Group Map

As illustrated in Figure 4, the group map is very rich in concepts and relations. The purpose here is not to present and discuss it in detail; instead, in order to show how the map can be analyzed, we have highlighted (with circles) some of the concepts that the doctors mentioned as being important. For example, the doctors believed that the "selection of the EPR system" was an important activity in the implementation process. They believed that "having professionals participating in the selection and development processes" and "having the possibility to improve/upgrade the EPR system continuously" were key aspects because they "wanted to ensure that the EPR system was adjusted to and supported their clinical practices." Furthermore, it was important for the doctors to feel "involved in the decision making," and they argued that if "the EPR was adjusted to and supported their clinical work practices," they would "avoid frustration" and be "able to focus and spend time on patients."

We have added number codes to the constructs that are shown on the higher levels in the map, e.g., "focus and use time on patients," "obtain optimal flow of patients," "obtain optimal patient treatment," and "ensure that practice lives up to high quality and security standards." The codes indicate how many doctors actually mentioned these constructs as being important for their professional identity and norms. This information was used for further discussion in the focus group interview.

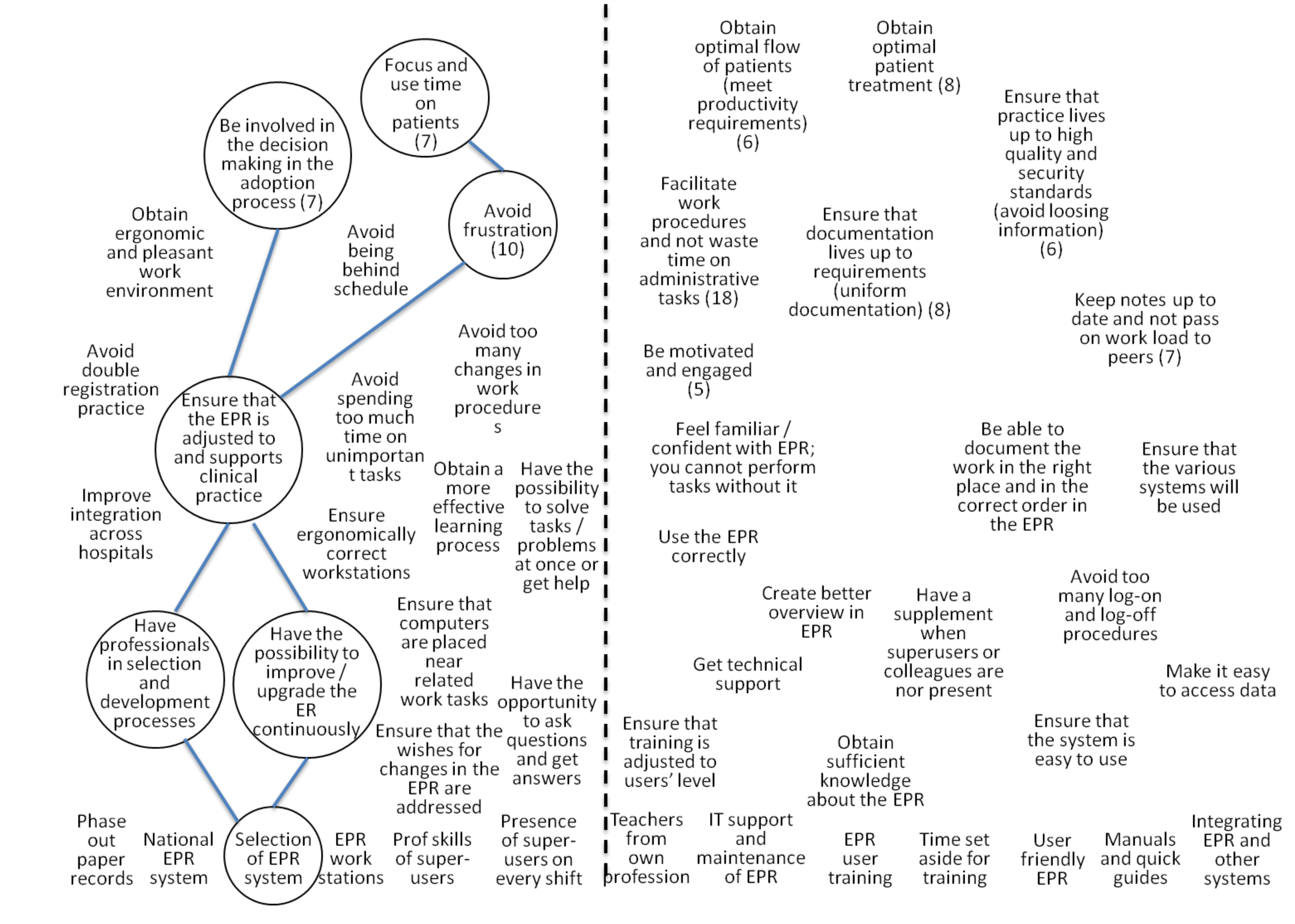

Figure 4. Group Map of the Doctors' Interpretations relative to the EPR Implementation

3. Cognitive Maps to Facilitate Individual Reflection and Collective Negotiation

As a concluding activity of the mapping procedure, we organized a focus group session with four doctors to discuss the group map and its concepts in an open dialogue. We chose four doctors who were available for a two-hour meeting and who had expressed diverse meanings during the individual interviews. The group session, which took place in one of the meeting rooms at the ward, served three overall purposes. First, it was an important step in asking the doctors to verify the group maps created by the researcher on the basis of the individual interviews. Second, the session was an occasion to ask the doctors to elaborate on certain aspects in the map that were not self-explanatory and self-evident. Third, the group session was used to observe the nature and extent of congruence and incongruence among the doctors, thereby observing the negotiation process. The focus group was facilitated by the interviewers, and the doctors participated eagerly in the group discussion and contributed with both positive and negative statements regarding the use of the EPR system.

In this way, the focus group session indicates the usefulness of the map in establishing a dialogue and creating a common understanding of the constructs in the map as part of an analytical process. For example, an explanation of the aspect "avoid frustration" was obtained by asking questions such as "What do you mean by frustration?", "How is frustration reflected in practice?", "Why is it important to avoid frustration?", and "What consequences does this frustration entail?"

This led to a constructive discussion among the participating doctors, as they were now able to talk about this aspect and give different examples of what frustration actually meant for their initial work experience with the EPR system. One doctor mentioned how the system at times seemed to hinder, delay, and complicate work, while another doctor argued that it was important for future adopters of the system to be aware that introducing a new technology could be confusing and time consuming. Based on the map, it was possible for the doctors to address the topic of "frustration" and give voice to an aspect that was otherwise not openly discussed. In this way, the map served as a representation to facilitate reflections of what "frustration" meant for the individual doctor, while at the same time engaging the doctors in a collective negotiation of this particular issue.

Furthermore, we asked the doctors what they meant by "creating a better overview in the EPR," and what would facilitate or inhibit this overview. One doctor mentioned that a better overview would mean better patient treatment, as it would provide a more comprehensive picture of the course of treatment. Another doctor mentioned that, if the EPR system were designed in a user-friendly manner, it would ease work procedures and lead to better patient treatment. Again this question, based on the constructs in the map, led to a fruitful discussion of individual and collective opinions and experiences.

Some of the aspects in the map were quite isolated, and the doctors were asked to elaborate on these matters. For example, the statement "be able to document the work in the right place and in the correct order in the EPR system" was not related to any other aspects at a higher level in the map. Therefore, we asked the doctors about the implications of this statement, and they elaborated that they were able to ensure that "the documentation would live up to the requirements" (unified documentation). They also mentioned that "being able to document the work in the right place in the system" meant that they were able to "keep their notes up to date and not pass on their workload to peers" (another aspect added to the map). We also asked the doctors whether important information was not included in the map or whether they disagreed with some of the constructs. A few of the participants had something to add to the map, but none of the constructs were removed.

The group discussion of the maps was an occasion for the doctors to collectively negotiate the meaning and usefulness of the EPR system and also to reflect on the perceptions of others. One doctor stated, "I recognize many of my statements in the map, and I also recognize what some of my colleagues might have said. We do seem to agree on many of these things." Often the doctors used "we" instead of "I" when they commented on the aspects in the map and in the discussions of the content of the map, reflecting a high degree of agreement. As researchers, we experienced much agreement, as the doctors had similar expectations concerning the role of the EPR system in the clinical ward, and their statements supported each other.

In this way, the cognitive maps worked as artifacts to increase the doctors' awareness of each other's interpretations and reactions to the EPR system, which facilitated a collective negotiation of the system's meaning. The maps also gave the chief physician an impression of the participants' perceptions, which enabled him to address some of the issues from a managerial point of view during the meeting, as well as to present some of the issues to top management. For example, issues on the need for more user training and hands-on support in the clinical ward were relatively easy to implement but required resource allocation from top management. The maps also helped to put a discussion of how to improve integration between the EPR system and other systems in the hospital on the managerial agenda, and the chief physician argued that a similar process could also be useful as a learning process for vendors and other stakeholders. This is discussed in further detail in the upcoming section.

IV. DISCUSSION

The case example illustrates how cognitive mapping can be used to facilitate an inquiry into users' interpretations of technology. At the same time, the case demonstrates how the resulting maps serve as representations to share the interpretations among users, thereby enabling individual reflection and collective discussion about the technology.

To synthesize the experience gained from using the cognitive mapping method, we next discuss the epistemological and methodological issues emerging during the use of cognitive mapping that we believe are important to consider when engaging in cognitive mapping activities, specifically, the nature of cognitive maps and the choice of mapping technique.

Cognitive Maps as Subjective Representations

An important point for discussion relates to considerations about the construction of the maps, which took place in the interaction between the interviewing researcher and the participants. In the case example, the maps represent a socially constructed view of how the doctors experienced the EPR system, showing concepts and relations that were subjectively meaningful for the participants. The participants created a representation of their subjective beliefs, explained to the interviewing researcher, while triggered and framed by the questions posed by the researcher. The resulting maps were bound by the method used for data collection, as also suggested by Goldberg [1994]. The mapping process, thus, is a subjective representation of the meaning creation process taking place in the interaction between the participants and the researcher.

However, one may ask whether the maps can actually be trusted to capture the issues that are salient to the participants. In other words, can we be sure that (more) important issues are not left out [Jenkins, 1998]? The short answer to this is that we cannot capture a complete and true representation of the participants' beliefs; rather, we claim credibility of the use of cognitive mapping [Lincoln and Guba, 1985] based on the process of systematically pursuing issues suggested by the participants in order for them to exhaust the topic—which is done by using the laddering technique and through collective discussions in groups.

The role of the researcher and other participants who took part in the process—or in other ways influenced the mapping process or the maps themselves—is also relevant to address here. We have already mentioned that questions posed by the interviewer—however open they are—will create a frame for the mapping process and the resulting maps. This is a common topic for discussion in qualitative research (see, e.g., Schultze and Avital, 2011), and we argue that trustworthiness can be achieved in cognitive mapping by being as open as possible about what methods have been used and how they were applied in order to make the study as transparent as possible.

In the case example, we drew predominantly from an interpretive epistemological stance, i.e., what Alvesson terms the romantic perspective [2003], by aiming at providing transparency of how the cognitive maps were created and analyzed. However, we also pursued a localist or constructivist perspective by emphasizing that meaning is constructed in a very local and situated context, and that the maps, therefore, are embedded and cannot be separated from the local practice.

From this epistemological point of view, we suggest that learning from cognitive mapping can be achieved by focusing on the process of constructing the maps and by observing the reactions of people to the contents of the maps. If we accept that the maps represent the subjective beliefs of the participants and are created in the interaction between the researcher and the participants, we place emphasis on the process of articulating the participants' beliefs, i.e., on the mapping process. As mentioned by Swan [1997], the process of eliciting the map may alter its composition because the interaction between the researcher and the participants involves articulation which can change the cognitions of the researcher as well as those of the participants. In the case example, meaning construction took place in the interaction between the doctors and the researchers and among doctors; i.e., the concepts and the relations between concepts in the map were created in interaction between the participants in the local setting. We next discuss different techniques for constructing the maps.

The Value of Different Mapping Techniques

In the course of using cognitive mapping, we became aware of the difference between using an aggregated, as opposed to a collective, technique for constructing group maps. One way of creating group maps is to use one-to-one interviews and subsequently aggregating the results into a group map [Eden and Ackermann, 1998], as was the case in this study. Another way is to create the map directly during a group discussion meeting where participants work toward a common understanding, using a group decision support system, resulting in a shared cognitive map [Ackermann and Eden, 2007]. Although the results of both methods are group maps, the maps will be quite different. Whereas the aggregated map has a large degree of researcher influence as the researcher puts together the individual statements into one map, the collective method is less influenced by the researcher. In addition, the reciprocal influence of the participants will be more pronounced when using the collective model, compared to the aggregated model where participants are interviewed individually.

In the case example, the aggregated approach based on individual interviews with doctors was used in order to show a variety of meanings and to compare and contrast these. This would not have been possible if the collective method had been applied. Although our approach of first constructing ladders and then combining them into one map does not result in findings about the construction of maps in collaboration, as other researchers have reported [Sheetz, Tegarden, Kozar and Zigurs, 1994; Ackermann and Eden, 2007], it proved to be valuable for enabling the doctors to discuss the categories and concepts put forward by their peers in order to negotiate the meaning of the EPR system.

The choice of mapping technique is closely related to the intended use of cognitive mapping. Whereas an aggregated approach provides a more comprehensive representation of each individual's meaning constructions and will serve the purpose of giving an overview of diversity in meanings, the collective approach provides a negotiated understanding among the participants which can be useful as part of a process with the goal of reaching a shared understanding.

V. CONTRIBUTION

The main contribution of our study is methodological, as it advances the use of cognitive mapping to make users' interpretations of technology explicit, thereby enabling reflection on the technology and its use. Whereas earlier research has pointed to the importance of understanding how users' assumptions and expectations influence the perceptions and use of technology, it is less clear how this can be done. We suggest that cognitive mapping, as a well-established method, is a helpful tool for inquiring into users' interpretations of technology as well as for representing and sharing these interpretations. Moreover, it supports the emphasis of earlier research on the importance of the socio-cognitive aspects of technology, as emphasized by, for example, Orlikowski [2000] and Davidson [2006]. Following the method provides the basis for enhancing individual reflection as well as collective discussion and negotiation of the technology, which is important as a precursor for planning interventions to ensure appropriation [Rodon, Sese and Christiaanse, 2011].

As a well-established method of inquiry, cognitive mapping has the potential of engaging users in making their interpretations of the technology explicit. The mapping technique provides a "window of opportunity" for the user to articulate his or her perceptions and experiences with the technology [Tyre and Orlikowski, 1994], which are often implicit and part of what is taken for granted in everyday life. In this way, our study supports the existing stream of research that emphasizes the importance of users' interpretations of technology, individual reflection, and group conversations on the adaptation of technology to work practices. Our study extends the current knowledge base by providing a very detailed example of how cognitive mapping systematically can highlight users' interpretations of technology and thereby serve as a discussion and negotiation tool for management and employees about the continuous use of the technology in question.

As a tool for representing interpretations, cognitive mapping provides the maps as artifacts that can be used to present problems or inconsistencies in users' expectations and experiences of technology and to document reactions to or perceptions of technology. Cognitive maps as artifacts enable processes of reflection and articulation that allow people to accomplish their work and negotiate their daily activities [Maitlis, 2005]. This is important in the sense that users' interpretations of technology are critical if we want to understand their interactions with technology, as is pointed out by, e.g., Orlikowski and Gash [1994].

The process of inquiring into and also of representing users' interpretations helps create a dialogue among users and managers about congruent and incongruent interpretations that may have an impact on technology acceptance and use in practice. These interpretations may change over time, which has been supported by a number of more recent studies (see, e.g., Davidson, 2006; Agarwal, Angst, DesRoches, and Fischer, 2010); accordingly, we suggest using cognitive mapping as a technique to capture these changes.

The cognitive map can serve as a representation of individual reflection, thus providing each user with a view of his or her interpretations. In this way, the map helps each user to highlight his or her perceptions of the technology. The value of expressing interpretations of technology is apparent in studies of post-adoption processes where changes to systems need to be implemented in order to make a better fit between the technology and the work processes in which it is used and where people struggle to create meaning as, for example, in the case of how sales agents make sense of a new intranet system [Vaast and Walsham, 2005]. As has been illustrated in the case study, a map also can be used to share interpretations among a group of users or among various groups, as, for example, different specialist groups, which is the case in studies of EPR systems [Ellingsen and Monteiro, 2003; Oborn, Barrett, and Davidson, forthcoming]; among developers, vendors, and users [Gal, Lyytinen, and Yoo, 2008; Levina and Vaast, 2008; Svejvig and Jensen, 2010]; or management and users [Lin and Silva, 2005; Davis and Hufnagel, 2007]. As input for discussion, maps can form a valuable contribution for groups of users to get inspiration from one other and to address resistance to using the technology in a particular practice [Lapointe and Rivard, 2005; Jian, 2007]. The maps as artifacts also can be used to explain different interpretations of a new technology in order to negotiate further development or changes and to discuss relationships among people, technologies, and practices, thereby enabling people to act [Jensen, Kjærgaard and Svejvig, 2009].

In the case example, the doctors used the group map to reflect on and negotiate statements from others and to give new meaning to the use of the EPR system in their everyday work. Although we encountered only minor disagreement between doctors, the method could also be used to show conflicting interpretations which might not be easily resolved in the process itself but would need to be discussed further and could lead to technological or strategic changes. It is important for us to stress that the value of the cognitive mapping process is not necessarily to solve disagreement, although we acknowledge that it has the potential to do so in some instances. Rather, we point to the potential of cognitive maps to elicit differences that might not be solvable in the particular forum where they are elicited but might involve other stakeholders, new technological features, or more profound structural changes. In this way, the discussion and reflection among participants during the cognitive mapping process also may prove useful for management, as discussed next.

VI. IMPLICATIONS FOR PRACTICE

The findings from our study have implications for managers engaged in processes of technology implementation. Cognitive mapping can be used by managers to assist user groups in eliciting their interpretations in a collective process of constructing meaning and making interpretations explicit. In this process, the maps help elicit feedback from others and create common ground for discussion of the technology and its use in practice [Carlile, 2004]. The maps are strong tools for making differences explicit in various professional groups' perceptions of IS, which may help facilitate discussion among the groups involved. The cognitive maps may help the different professional groups develop joint understandings, as the maps enable them to focus their attention and provoke reflection [Vlaar, Fenema and Tiwari, 2008, p. 247].

Cognitive maps provide the possibility of representing users' thoughts, ideas, and critical comments about a technology and other related aspects. By engaging in the cognitive mapping process and by studying the maps, managers can make more sophisticated decisions on organizational adaptations and changes. They can use the maps to discuss future opportunities of technology or investigate how it can support work practices. Our study supports the insight of Weick and Bougon [2001] that cognitive maps can make an equivocal situation around technology implementation more sensible. In this sense, a cognitive map "… contains the structure, the process, and the raw materials from which agreements and conflicts are built when people coordinate action" [Weick and Bougon, 2001, p. 328].

Although the use of cognitive mapping can be perceived to be rather time-consuming and demanding, our experience was that practice was needed to learn to construct the maps, but that this time was well invested. The mapping technique proved to provide much more detail in a more systematic process compared to other prevailing qualitative methods, such as observations and interviews that are also time-consuming and do not always lead to results as effectively as cognitive mapping did, in our experience.

VII. CONCLUSION AND FUTURE RESEARCH

We have illustrated how advancing the use of cognitive mapping as a method for systematically making users' interpretations of technology explicit can become a useful method in technology adaptation processes. Moreover, we have discussed the method's capacity for providing the basis for individual reflection, as well as collective negotiation of technology. While we argue that cognitive mapping is a valuable method for making users' interpretations of technology explicit, we also stress that continuous refinement and fine-tuning of the use of the approach is necessary to explore its most relevant use in future research, as well as in practice.

Our study was limited by our use of cognitive mapping to study users' interpretations of technology at a specific point in time. Realizing that technology is not a stable, but a dynamic construct that continuously changes with use, we suggest that future research based on cognitive mapping should be conducted as process studies. As our case example illustrates, the map as the immediate result of the cognitive mapping process was a static snapshot representing the participants' meaning constructions at a given point in time. A snapshot at a single and fixed time point may allow analysis of a topic matter in detail; however, as users' interpretations of technology may change over time, the method could be used at various points in time to study these changes.

Future research might investigate more systematically whether the use of cognitive mapping may be even stronger when used to study changes between two static maps. It would be relevant to explore if the mapping technique can be used to emphasize changes in meaning constructions over time where new processes of negotiations regarding the technology may appear. To investigate this, we suggest that researchers pursue the use of cognitive mapping in longitudinal studies where the process of mapping is repeated at regular intervals in order to study dynamic change.

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