

Aspects of Awareness in Constructing a Common Information space

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Abstract

In health care there is an ongoing process of structural change that put increasing demands on the organisations to find new ways for co-operative work. This means that complex and heterogeneous networks with requirements for co-operation must search for possibilities to combine differences and common needs. This paper focuses on this condition through the study of issues in forming a common information space in a complex hospital environment. The purpose of this paper is to analyse awareness in forming a technological CIS (common information space) for computer supported communication and co-operation between various hospitals in a region. The study was conducted from an ethnographical point of view, where the empirical data was collected via observations and semi-structured interviews. The aim was to receive significant knowledge of present forms of co-operation and important information about ongoing change processes within the hospital region, for the development of new means for co-operative work. The results have shown that the awareness in the hospital region must be developed on various levels through an active collaboration process in order to support the construction of the regional IT supported CIS.

Keywords: Common Information Space, Awareness, Health Care sector, ethnography

BRT Keywords: BA03, DD02

Introduction

In the field of CSCW (Computer Supported Co-operative Work) only a limited amount of case studies have been conducted concerning relations between larger co-operative fields (Schneider & Wagner, 1993). This implies needs for studying inter organisational co-operative work and the relations to design of IT support for distributed collaboration. In this article this is highlighted through analysing the development of IT supported co-operative work in a hospital region.

Co-operating across organisational boundaries involve finding ways to make complex organisations with common needs work together. The necessity to analyse how heterogeneity and the need to co-operate can be combined has been put forward of e.g. Leigh Star & Griesmer (1989) and Hanseth et al (1994). This article focuses on this condition through the use of the term *awareness* and *common information space (CIS)*

from the field of CSCW. Through the use of these terms central issues in the process of information sharing across organisational boundaries in a complex hospital environment can be revealed.

The term *awareness* is often referred as a critical factor in the design of IT support for co-operative work (Gutwin & Greenberg, 1997). Several studies have been conducted discussing how IT can support the development of awareness (Gutwin et al, 1996; Mark et al, 1997; Palfreyman & Rodden, 1996). In this study the use of awareness gives an opportunity to highlight and discuss central issues in the construction of a CIS on a practical level. The term regional awareness gives the possibility to get a more comprehensive view of the issues discussed. Combining awareness and CIS provide the possibility to express the process of constructing a CIS and make visible the interaction between these terms. In conclusion this use of the terms gives important information and knowledge of the problems existing in a complex hospital environment developing new ways for co-operative work. The main question in this article is: *How can awareness be developed to support the forming of IT supported CIS in a hospital region?* Further, the focus of awareness and the construction of IT supported CIS also brings additional knowledge and information of e.g. organisational change processes.

Background

There are several studies analysing different kinds of co-operative processes in health care. With the purpose to distinguish relevant design implications Symon et al (cited in Lundberg, 1997) examine and discuss the relation between formal procedures and informal practices. Others e.g. Schneider & Wagner (1993) have analysed the complexity of co-operative work in hospitals presenting several design proposals for hospital information systems. Further, Lundberg (1997) have presented an analysis of social networks in a traditional not digitalized radiology department. This study reveals a complex picture of the daily co-operative work practice at a radiology department. In another study by Lundberg & Tellioglu (1999) the authors study complex processes of co-ordination work at several radiology departments. An additional study of co-operative processes in health care has been performed by Hanseth et al (1994). Their study concerns the politics of network technology in health care and discusses the dilemma of needing both centralisation and standardisation and at the same time more locally developed organisations. In order to deal with these issues Hanseth et al propose a strategy of participatory standardisation process.

The study presented in this article aim at analysing awareness in the co-operative process constructing a technological CIS in a hospital region. The point of departure is the ongoing change process in health care organisation in the hospital region of western Sweden. The major changes has involved e.g. unification of hospitals and the forming of the county of western Götaland comprising Skaraborg's, Älvsborg's and Bohus' county and the local administration of Göteborg. These change processes has generated needs and requirements for new ways of co-operative work in the hospital region. Here the use of information technology serves a major role and in the region there are ongoing discussions of how information technology can support the communication and sharing of information. One of the most technically advanced departments at hospitals is the radiology department. Here the introduction of IT has changed radiology work e.g. through the development of digitalized x-ray images (Lundberg, 1996). At the radiology departments in the hospital region of western Sweden there is an ongoing process of finding new ways for co-operative work. This involves the use of information technology

in order to simplify and develop information sharing across organisational boundaries. Today these departments co-operate through communicating radiology information using e.g. conventional mail or taxi. Hence, the focus of this article is to analyse the process of developing IT supported sharing of radiology information in the hospital region.

Health care co-operative work can be discussed at many different levels. This study is concerned only with the communications and collaborations at a regional level i.e. between different hospital in the region. This means that the study is not dealing with the different forms of local collaboration in and between departments at the hospitals.

The article is structured as follows. Section 2 and 3 gives the theoretical framework for analysis and description of the issues identified. In section 4 a detailed description of the research site is presented. The ethnographical approach and methods is outlined in section 5. In section 6 the results of the study are analysed using the theoretical framework.

Common Information Space – CIS

The concept of Common Information Space (CIS) as described by Schmidt & Bannon (1992) and Bannon & Bødker (1997) is a space of shared information e.g. a database, where common information in a co-operating area can be perceived, accessed and manipulated. Further this means that a shared interpretation of the information is necessary.

Kuutti & Karasti (1995) argue that the research of the field have assumed that the shared interpretation of the information is something that just happens by it self, without explanation or negotiation. Kuutti and Karasti means that in real work practise there are moments when a common interpretation must be generated and created actively.

CIS have a dialectical nature (Bannon & Bødker, 1997) where one side emphasise openness while the other stresses the need for closure. In health care there is e.g. a need to communicate information concerning the diagnosis and treatment of patients but there are also needs to maintain a high level of information security with regards to patients integrity.

CIS are constituted differently depending on the organisational context (Bannon & Bødker, 1997). In a work situation where people are gathered in both time and space, the individuals co-operate in both receiving and creating the information.

"...in the case of a physically shared workspace, due to the common work setting and exposure to the same work environment, actors are able to co-operate with each other, both in the production and reception of utterances and information, without having to resort to extended descriptions or elaborated codes, due to their understanding of the shared context within which they work." (Bannon & Bødker, 1997)

In distributed work settings the actors have different problems and decisions to handle. When the persons involved are distributed in time and space it becomes important for the creator of the information to consider that those receiving the information, perhaps years later will be able to understand context and circumstances.

"...in distributed work settings, there is a much greater need for refining and "packaging" information into a meaningful context, in order to maximise the likelihood that the intent of the message is received appropriately, and the recipient is also required to expend some effort in order to "unpack" this information, and hopefully be able to re-create the context of its transmission." (Bannon & Bødker, 1997)

This study focuses on issues in developing IT supported common information space in a hospital region involving several hospitals. Therefore CIS will be discussed from the point of view of a distributed work setting and focusing co-operative work across organisational boundaries.

Awareness

In a distributed work setting it is difficult to have knowledge and understanding of work situations and conditions in various parts of the organisations. A term in the field of CSCW that discusses this at different levels is awareness. Gutwin & Greenberg (1997) have contributed with this description of awareness.

"First, awareness is knowledge about a dynamic environment and must be maintained as the environment changes over time. Second, awareness is maintained through perceptual information gathered from the environment. Third, awareness is generally secondary to some other goal; that is, it is generally *for* something else."(Gutwin & Greenberg, 1997)

In the CSCW literature there exist several kinds of awareness. Greenberg et al (1996) and Gutwin (1996) points at five categories of awareness that will be used here.

- Organisational awareness – knowledge of how the group activity fits in with the larger purpose of an organisation.
- Situation awareness – understanding of the state of a dynamic system.
- Social awareness – the information that a person maintains about others in a social or conversational context.
- Structural awareness – knowledge about such things as people's roles and responsibilities, their positions on an issue, their status, and the state of various group processes.
- Informal awareness – general knowledge of who is around in the work community

In the analyse of this study these categories are used to discussed central issues in the process of constructing a technological common information space in a hospital region. The focus concerns co-operative work across organisational boundaries why the use of awareness will reflect this perspective.

Regional awareness

When analysing awareness in the practical context it is important to classify and describe the identified problems in a way that make a more comprehensive analyse of awareness in the hospital region possible. Since the issues identified are related they are discussed from the basis of one or more types of awareness. This reflects the reality in which the problems exist. There everything is connected and no problems can be looked at separately without being influenced by each other or by other occurrences. When further analysing and discussing the problems identified it is important to create a comprehensive view of awareness. Hence the categories of awareness are brought together and named *regional awareness* that deals with the hospital's understanding and knowledge of the changing parts in the region as well as the dynamic region as a whole. The regional awareness is about having a clear understanding of the purpose and objective of the regional co-operative work and about having comprehension of the roles of the actors in

the co-operation. It is also a part of the regional awareness to have understanding and knowledge of the other actor's work conditions, both practically and technically.

The development of an IT supported co-operative work in the hospital region means forming a mutual space for information sharing. The hospitals involved has of course been sharing information all along but since IT supported information exchange will reshape the handling of information it must be described as a new common information space.

Awareness and the construction of CIS

Both terms can be described as dynamic i.e. they change in the variable environment where they exist. Between awareness and CIS there is an important interaction, which means that awareness, through the knowledge of a dynamic environment, support the forming of a CIS. When the CIS has been established, it will support the continuing development of awareness through its potentials of maintaining the knowledge of the environment.

Research site

This section begins with a report of the studied hospital region. In order to give a clear view of the co-operative context where the study was conducted this is followed by a description of the existing forms of radiology co-operative work. A brief description of the different technical profiles in the hospital region concludes the section.

The hospital region

The study was conducted at radiology departments at hospitals in the county of western Götaland in Sweden. This region includes 17 hospitals in four hospital areas: NÄL/Uddevalla hospital, Skaraborg hospital, Southern Älvsborg hospital and Sahlgrenska University hospital. Also the county of northern Halland was included in the study since the hospitals there geographically and practically are strongly connected to the hospital organisation of western Götaland. In the continuing these two areas (western Götaland and northern Halland) are referred to as "the region". The study was conducted at radiology departments at three hospitals in the county of western Götaland (Borås, Skövde and SU Sahlgrenska university hospital in Göteborg) and at one hospital in the county of northern Halland (Varberg).

Radiology co-operative work

For various reasons radiology information e.g. x-ray images and examination reports, are communicated between the hospitals in the region. As for the smaller hospitals in the region the need for consulting specialists at the university hospital is the most common reason to send radiology information. Sometimes it is cases of emergency where the question is whether or not the patient is treatable at the larger hospital and if they can take over the responsibility for the patient and offer specialist care. Today the procedure involves telephone calls between the hospitals and then the radiology information is sent by taxi. When the examination and consultation is completed the decision is made whether or not to take over the patient. But there are situations when the patient's

condition does not allow this time consuming procedure. Sometimes the emergency of the situation makes it necessary to send the patient to the university hospital without a completed consultation and without knowing whether or not there is any treatment for the patient. Occasionally the patient must return to the smaller hospital without having received any medical care. Naturally this is a very difficult and stressful situation for the patient and their relatives.

The physicians interviewed agreed that it is in these situations of emergency with great demand for fast decisions that IT supported procedures would be of greatest help. It is very valuable time being consumed sending the information by taxi in order to receive an adequate consultation.

There are also other less emergent situations when the smaller hospitals need to consult the specialists at the university hospitals. Sometimes there are very complicated cases where the specialist of the area needs to be consulted in order to make a completely correct diagnosis. The required radiology information is then sent by mail to the university hospital and the report of the consultation is then received a few days later.

Other reasons for communication of radiology information are when a patient is treated for e.g. a cancer at the larger hospital and the control examinations after is made at the smaller hospital. In order to determine whether or not there are any changes of the cancer radiology information must be sent to the smaller hospital. The opposite situation also exist which means that when a patient is staying at the university hospital for e.g. radiotherapy the smaller hospital must send their images that serves as a basis for the radiation treatment.

Even if the communication generally concerns some kind of specialist consultation it can not be viewed as a strict one way communication between the smaller hospitals in the region and the university hospital. As one of the radiologists described it:

"The information exchange between the hospitals is not one-way. It's not only the smaller clinics that want to send to the larger clinic. It's also the large clinic that wants to know what's been done out there."

When the radiology information is physically sent this way between the hospitals the risk of misplacement increases. This creates problems and several of the radiologists interviewed talked about great efforts in trying to locate e.g. missing x-ray images. The reasons to search for dislocated information are many. Sometimes x-ray images do not return when being sent to another hospital or sometimes the images have been sent to the wrong place at the receiving hospital. There are indeed cases when the images have been lost during the ambulance transport to a hospital. Another source of misplacement is the archiving routines. All images are handled manually and sometimes images are lost because of the human element. An image placed wrong in the archive is almost impossible to find.

Technical profile

To handle the information and activities surrounding radiology work at hospitals different kinds of computer systems are used. These systems are described by Lundberg & Tellioglu (1999):

"PACS supports the electronic storage, retrieval, distribution, communication, display, and processing of image data. In combination with HIS (hospital information system) and RIS (radiology information system) it allows the management of work associated with radiological examinations in a networked hospital. RIS, which is mainly used for

administrative purposes, includes functions for communicating and managing patient data and examination requests sent from HIS, managing patient registration, scheduling radiological examinations, creating reports used for accounting, and producing radiological reports."(Lundberg & Tellioglu, 1999)

The technical profile at the hospitals in the region is presented in figure 1. Here the description focuses PACS (Picture Archiving and Communication Systems) and RIS (Radiology Information System) systems. The figure does not give the complete picture of the technology profile in the hospital region. It rather serves to illustrate the problem of the many systems being used and the issue of finding technical solutions for the IT supported co-operative work in the region.

The development of an IT supported regional co-operative work is complicated by the fact that there are several different PACS and RIS systems being used at the hospitals. This problem is further complicated by the demands and needs for integration of the each hospital's own PACS and RIS systems. The problem of different technical profiles in the hospital region is therefore an issue of several dimensions.

	PACS	RIS
Sahlgrenska University Hospital	<ul style="list-style-type: none"> • Xray Manger/Bdapt • Sienet 	<ul style="list-style-type: none"> • Adapt • Medos
Skövde Hospital	<ul style="list-style-type: none"> • Sienet 	<ul style="list-style-type: none"> • Rados/RadNet
Borås Hospital	Are testing and evaluating different systems	<ul style="list-style-type: none"> • Adapt
Varberg Hospital	<ul style="list-style-type: none"> • Agfa PACS • Sienet 	<ul style="list-style-type: none"> • Rados

Figure 1: Some of the different PACS- and RIS-systems used in the hospital region.

The ethnographical approach

The main advantage of ethnography is its ability to make visible the social life in real work situations (Hughes et al 1994). It attempts to give detailed descriptions of the actor's activities in their specific context. The material being collected is directly from the field worker in real work situations of every day life. The purpose of ethnography is to recognise activities as social actions in a socially organised field performed by its members. This gives a possibility to see the everyday way that the members understand and carry out their work. According to Blomberg et al (1993) the ethnographical approach

"...provides a unique perspective to bring bear on understanding users' work activities."

For designers ethnography is an alternative methodology to use that gives access to people's daily activities and work practice. The attempt of ethnography is to interpret and understand these activities (Blomberg et al, 1993). As a method for systems design ethnography is still new and somewhat untested and there are some difficulties. One of the problems concerns the dilemma with expressing the results of the ethnography interpretable for designers. Ethnography is often considered unsystematic and unstructured when it comes to form requirements for design (Hughes et al 1994). Blomberg et al (1993) also means that one of the main issues are to find a way to express ethnographical results where ethnography and systems design can communicate in acceptable manner.

To describe the ethnographical approach in this study the classification (Figure 2) of ethnography made by Hughes et al (1994) will be used. This classification is based on the author's studies and their experiences.

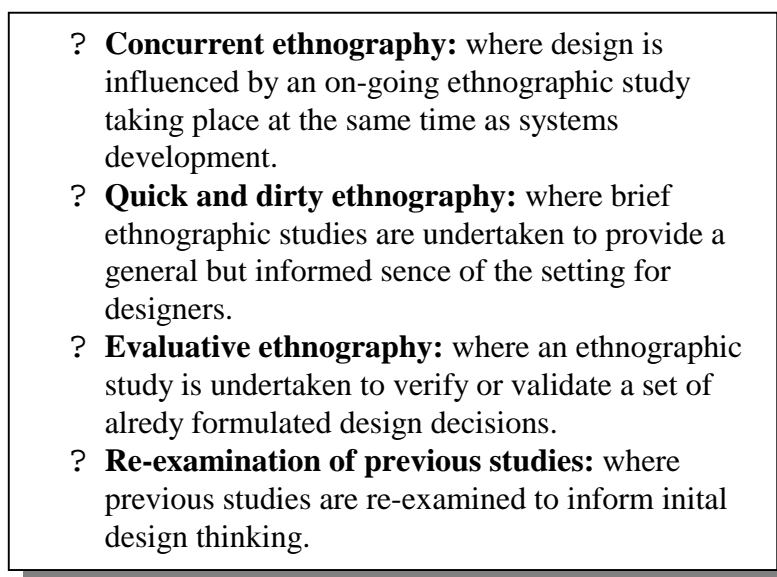
- 
- ? **Concurrent ethnography:** where design is influenced by an on-going ethnographic study taking place at the same time as systems development.
 - ? **Quick and dirty ethnography:** where brief ethnographic studies are undertaken to provide a general but informed sense of the setting for designers.
 - ? **Evaluative ethnography:** where an ethnographic study is undertaken to verify or validate a set of already formulated design decisions.
 - ? **Re-examination of previous studies:** where previous studies are re-examined to inform initial design thinking.

Figure 2; Classification of ethnography

The study reported in this article is described best as "quick and dirty ethnography". It's been conducted during a relatively short period of time (3 weeks) with the purpose of gaining knowledge and understanding of the co-operative work and the communication of radiology information in the hospital region. The purpose also was to get knowledge of some critical issues in developing an IT supported common information space. The use of "quick and dirty ethnography" is also distinguished by trying to give designers an awareness of what work, activities and conditions look like to be used in e.g. the initial steps of design (Hughes et al, 1994). This has also been the attempt of this study.

The fieldwork

The empirical data was collected via observations and interviews with radiologists at the radiology departments. The interviewed are chief physicians at their radiology departments. Three of them also work as managers of the clinics. The

interviews were conducted at the radiology department at the hospitals in Borås, Skövde, Varberg and at SU Sahlgrenska University hospital in Göteborg. All together five interviews were conducted lasting for about one hour. The interviews were semi-structured and each interview began with a general discussion regarding how communication and co-operative work is conducted today. The interview then moved on to a discussion concerning the expectations of a computer-supported system for regional communication of radiology information. This was followed by questions concerning the difficulties of sharing common information across organisational boundaries.

As a complement to the interviews the every day activities of radiologists at radiology departments were studied during observations. These observations were conducted at radiology departments at the hospitals in Borås and at SU Sahlgrenska University hospital in Göteborg. The observations were made at three different occasions (one at SU Sahlgrenska and two at the hospital in Borås) where various activities of diagnostic practice were observed. The aim was to receive significant knowledge of present forms for co-operative work and important information about ongoing change processes within the hospital region, for the development of new means for co-operative work. In addition, another purpose was to gain knowledge of the hospital's proposals for how to, technically and practically, deal with the need for technology supported co-operative work.

The transcribed interviews and the field notes from the observations composing the empirical data was then put together and analysed.

Aspects of awareness in constructing a CIS

In this section the identified problems and issues in constructing the IT supported CIS in the hospital region will be presented using the theoretical framework. Since each issue can be discussed from different perspectives some of the identified problems will be analysed using several of the awareness categories. Finally the discussion is brought together under the term of regional awareness.

Organisational awareness

One central factor in constructing a CIS for a distributed work setting deals with what information is to be made available (Bannon & Bødker, 1997, Schmidt & Bannon, 1992). The study reveals different ideas of what information the radiology departments should exchange. During both interviews and observations radiologists pointed at x-ray images and examination reports as being the most obvious and essential information to share in the hospital region. These ideas were characterised by transforming the routines and procedures of today into a computer supported system. However, some of the radiologists expressed a wider view of radiology information sharing including e.g. scheduling radiological examinations, examination requests, patient records and also use the system for videoconferences and education. These radiologists emphasised investments in a system for future information sharing at once. One of them expressed it this way:

"To develop this kind of technology for radiology consultation – if that's the only thing to do, to replace a few taxis a week, then it is quite expensive. I believe one should change the whole approach to information handling..."

From the perspective of organisational awareness these different views illustrates

uncertainty of the purpose and objective of the IT supported CIS in the hospital region.

Also the strategies for choice of technical equipment at the different hospitals signifies uncertainty of the overall purpose with the IT supported collaboration. As described earlier the hospitals in the region have varying technical profiles (Figure 1). The choice of technical equipment is made usually through testing evaluating and selecting products that the hospitals believe will fit the organisation and earn its purposes on greatest manner. The technical choices was mostly discussed during the interviews and only a few times it was mentioned how the choice of technical equipment could fit in a regional IT supported co-operative work. The most usual comment was:

"It *must* be possible to connect all the systems. To believe that everyone would buy the same system is impossible..."

An aggravating circumstance is that the hospitals in the region are in different phases regarding the adoption to digitalized radiology work. Some radiology departments in the region are in an active phase of implementation where the choice of systems and equipment is already decided while in another departments there is an ongoing analysis and evaluation of different systems.

The work of developing IT supported regional communication of radiology information occur parallel with big changes of radiology work at the different hospitals. The expectations of the technological potentials for the near work area became apparent during the interviews. Answers to questions of how a future regional system would be developed was often related to how the own hospital in the future would be a networking hospital and how the work could be simplified and more effective. The internal development of a networking hospital was viewed as a separate issue not combined with the regional efforts of creating IT supported common information space. One radiologist described the regional CIS just like:

"...An external connection where we can send what we need to send..."

To discuss the possibilities of regional IT supported co-operative work from a local rather than regional perspective of course restrains the process of construction the regional CIS. This lack of a clear regional perspective also reveals uncertainty as for the larger purposes of the regional co-operative work.

Situation awareness

The issue of local and regional viewpoint can also be discussed from the perspective of situation awareness. Since the Sahlgrenska University hospital is the larger hospital in the region much of the communication of radiology information will be gathered here. During interviews and observation it became evident that the radiologists at Sahlgrenska fear that in order to manage information from different hospitals they would have to use several different systems. The following remark points at this:

"For us here at the university hospital we want the information to be presented in a homogeneous way (...) I'm not supposed to act in 10 different ways because the patients come from 10 different hospitals."

The discussions of forming the IT supported regional co-operative work demands that the hospitals all have knowledge and understanding of their different work conditions and dynamic systems. Practically, the hospitals in the region have various work conditions related to small-scale and large-scale health care work respectively, which means that they have very different needs when it comes to regional co-operative work. The way to

discuss the regional co-operative work form a local perspective have created doubts concerning the understanding of each others specific conditions.

In the region another central issue concerns how to access the common information. The study shows that some hospitals want the information to be accessible through some sort of active procedure. This means that the hospital wanting some information have to put in a request for that information and the hospital having the information will make it accessible for the receiver.

"There must be an active request from them and then we can send the images..."

This would not mean full access to a central archive but rather a computerised form of the existing procedure with request and distribution of information. On the contrary there is the idea that all the radiology archives together would form one big central archive that would be accessible regardless which hospital in the region wants the information.

"It would be desirable if we had these open systems where we could look into each others archives and get images (...) They should be able to get images here from us so that we wouldn't have to do all this sending which take almost all the time for some off the personnel."

There are different opinions also concerning access to the information being shared. They who want a more open system emphasise a system with personal log-ins and randomly made controls. Those advocating a system of requests and distribution of information means that the access to that information should be handled in a similar way. This means that the person who wants information also is the one having access to the distributed information. In order to prevent unauthorised access the control system would involve e.g. passwords, codes and randomly made controls.

The suggestion of a more open system is based in a work situation of large-scale and a more intensive use of the information in the regional CIS. This means that the information must be accessible as simple and easy as possible. At Sahlgrenska University hospital the large-scale work situation, the specialist service and the specific conditions when taking over patients in emergency situations demand for access procedures suitable for these specific work conditions. A difficult and complex way to access the information in the region CIS could obstruct the physicians to work effective and practical e.g. in emergency situations.

The opposite suggestion takes its point of departure in a work situation with only a limited use of the regional CIS. For many of the hospitals the regional CIS primarily mean an easier access to the specialists at the university hospitals when asking for consultations specifically in emergency situations. Several of the interviewed radiologists mean that there will not be so much information to put in common.

"Perhaps it's about 10 patients a day that you are interested in. Perhaps then you shouldn't make it too easy to have access to everything."

Social awareness

Another aspect of the issues of accessing shared information deals with work integrity and independence. The different suggestions of how to make the information accessible involve one idea of an open system and another idea of a more closed system with various regulations. The last suggestion gives expression to a need to claim once independence in the region and a way to maintain work integrity.

"It sounds very nice (ironic; authors remark) that they would have access to the entire Western Götaland archives....but I don't think so...it wouldn't feel good if they would have that (...) what would happen to my images then?"

The understanding of new forms of IT supported co-operative work is very much connected to the actor's knowledge and information of IT use. The interviews revealed varying interests and knowledge of the use of information technology. Some of the radiologists could see great potentials with the use of new technology. If there only was enough money and perhaps a greater interest more commonly in health care imagination would be the only restraint. These radiologists discussed different technical solutions in a very concrete manner and they were also aware of costs as well as pros and cons. Others showed a more cautious and thoughtful but yet positive attitude towards the use of IT. They discussed standards and technical platforms more widely and often mentioned the importance of "not to get stuck with one particularly system supplier".

In the work of constructing a regional IT supported CIS these differences in knowledge and interests in IT use also means that possible solutions and suggestions for system design is discussed from various perspectives and different basis of knowledge.

At the observations the different attitudes towards the technology and the use of IT also became apparent. For example it appears like the handling of a computer system, as part of more traditional medical equipment is easier to adopt to than a conventional computer with monitor, keyboard and mouse.

Here two scenes from the observation will illustrate this (the names are fictitious):

Scene 1:

We sit down at the monitors in the CT room. Maria says she doesn't know the system very well. She seems very unfamiliar with the computer and she apologises this. Johnny comes into the room. He and Maria discuss some choices to be made in the system. They have to search a lot but finally they get it right. Maria then carries out the CT examination rather slow.

Scene 2:

Maria is making an ultrasonic examination of the blood vessel in the legs of an older patient. My instant reflection is that this machine looks very complicated. It is quite big and has several displays and control panels. Maria handles the machine very confident and skilful. She makes adjustments and press buttons and makes adjustments again. How come a computer system is more difficult than all this – also being a computer system???

Structural awareness

Structural awareness e.g. deals with knowledge about such things as others positions on an issue and the state of various group processes. Several of the problems in constructing the regional CIS identified in the hospital region can be viewed from this perspective. One example of this is the dilemma of how the hospital region can solve the technical forming of the CIS. The fact that the hospitals in the region developed and still are developing different technical profiles without enough considerations of the consequences for a future regional IT supported co-operative work have been discussed earlier from the perspective of organisational awareness. However, the problem not only indicates insufficiency of the overall purpose and objective of the regional co-operative work but also means lack of knowledge concerning different opinions and the state of

various group processes in the region. In the region there are some knowledge of what systems are being used in different parts of the region but it seems like there have been almost no sharing of knowledge and experiences concerning choices of technical equipment. Here the lack of structural awareness obstructs the development of the CIS in the hospital region.

Informal awareness

The most common reason why the smaller hospitals in the region need to contact the university hospital concerns the consultation of specialists. Sometimes there are particularly difficult diagnose situations and a specialist must be consulted. The radiology information is sent by mail to the university hospital and the answer is then sent back a few days later often by mail. All of the interviewed radiologists expressed that the knowledge of people often determines which specialist is contacted for the consultation.

"Since I was there and learned (to perform a special kind of examination: authors remark) I know them, so it works very well! (...) It is good and they know me too (...) I have met them on courses so they are not totally unknown to me. (...) Even if you don't know them in person you still know who they are."

From earlier employment and through education the physicians have gained personal contacts that they use in their work. However, there are occasions of emergency when the situation does not allow the physicians to use this knowledge of people and informal awareness. One of the interviewed radiologists explained these situations like this:

"This thing with knowledge of people – it's mostly when there are these non-emergency specialist consultations but when something urgent happens - then you just talk to the doctor on duty."

Regional awareness

Several of the problems in the process of developing an IT supported regional CIS can be brought together and analysed at a more comprehensive level. According to the study many of the issues are related to the fact that the hospital region have no clear definition of the purpose and objective of the IT supported co-operative work. Questions of what information should be shared and how this information will be accessed and what technical base to use is not answered in the regional development process. Some wants to computerise the routines being performed today while other have the opinion of using the information technology to develop the hospital co-operative work and to reshape the handling of the radiology information in the region.

The study also reveals insufficient knowledge of the roles each hospital play in the region. The Sahlgrenska University hospital is looked upon as the centre of the region e.g. when it comes to capability to providing specialist care and treatment. However, in the rest of the hospital region there are different opinions of the role played by the university hospital. Most of the interviewed mean that the ability to provide specialist care is the most important while other also mean that as the centre of the hospital region the university hospital also should lead the others e.g. in the choice of technical equipment.

Several of the practical suggestions of how the regional CIS should be formed shows that the hospitals do not have enough knowledge and understanding of each others

different work situations. Large-scale and small-scale health care work have different requirements of how IT supported co-operative work should be formed. The suggestions take their point of departure in local health care work not so much considering the effects of regional co-operative work.

Discussion

"That's the problem with this regional discussion – we have to agree on some sort of policy of how this is to be done and what technology we shall use."

According to Greenberg et al (1996) awareness helps people to co-ordinate their activities and to find the necessary conditions for co-operative work. In a similar way regional awareness can help the studied hospital region to co-ordinate their work and to find new ways to co-operate in a technology supported CIS. The results of the study make visible various kinds of problems in forming a technology supported co-operative work. Problems that indicate inadequate regional awareness, that means difficulties in bridging the heterogeneity of these hospital networks. The hospitals showed: 1) insufficient knowledge of the purpose and objective for the co-operative work among the hospitals. This became obvious through the fact that the hospitals had quite different ideas of exactly what information should be communicated and how the access to the information should be formed. 2) Lack of information about the different roles that each hospital play and what this means in the process of developing a system for technology supported co-operative work. It is, for example, not clear if any hospital should have a front or leading position in the forming of the CIS. 3) Need for developing their knowledge about each other's different and specific work conditions. Many of the suggestions of how to solve the problems regarding the hospitals co-operative work, was made rather from a local than a regional perspective. Practically, the hospitals in the region have various work conditions related to small-scale and large-scale health care work respectively, which means that they have very different needs when it comes to regional co-operative work. Technically, the hospitals have very different basis e.g. in the use of RIS and PACS systems. This means difficulties in integrating the systems in a technology supported co-operative work. An additional complication is the fact that the hospitals are in different phases regarding the adoption to digitalized radiology work. This means that in one part of the hospital region there is an ongoing active phase of implementation. Here the choice of computer system and technical equipment is already decided. Yet in other parts of the hospital region there is a continuing process of testing and evaluation of different systems in order to purchase. Further, other parts of the hospital region are somewhere in between these two extremes, with totally digitalized radiology work only in certain parts of the department.

The central issue in the process of constructing a regional IT supported CIS is the insufficient definition of a clear purpose and objective of the regional co-operative work. This must serve as the basis of further discussions in the construction process. It must be clear what the hospital region really want with the co-operative work form and for what purpose. Without a clear definition of the purpose and objective the hospital region risks continuing discussions from totally separate angles and perspectives.

The consequence of the study is that the region through an active collaboration process must develop its regional awareness at various levels. Increased awareness of e.g. purpose, objective, roles and important knowledge of the different actors supports the

construction of the regional CIS. It is also important to create necessary conditions for the interaction existing between awareness and CIS. This means that the reached level of awareness will support the maintenance of the common information space and since both terms are dynamic and changes over time this interaction will be an ongoing process. In order to reach this continuous interaction the collaborative process must begin with strengthen the regional awareness.

This active collaborative process should begin at a higher level of management in the organisations where the overall purposes and objectives for the regional IT supported co-operative work are defined. This is followed by the involvement of other occupational groups in the health care organisations of the region. A close and near co-operative work in this process will create necessary conditions for improved information of each other's knowledge and interests e.g. in the fields of information technology. The collaborative process will also contribute to an increased knowledge of people.

The continuing development of the regional CIS involves making the definition of the purpose and objective of the co-operative work distinct and clear. It also involves determining strategies for the continuing development of the IT supported regional CIS. The discussions of how the regional co-operative work will be shaped also must give an answer to what information will be included in the regional CIS and how the access to the information will be formed.

The collaborative process will also serve as a mean when developing the knowledge of the hospital's role in the region. This means that a part of the work must be concentrated to make clear how the different hospitals should be related to each other and what their different roles means in the hospital co-operative work.

The establishment of the regional perspective of the development of the IT supported regional CIS is another central issue to the collaborative process. The fact that the hospitals are discussing regional co-operative work from a local perspective is a great difficulty. It is necessary that the actors have the same regional perspective in order to make the continuous development of the common information space successful.

The construction of the regional IT supported CIS also have a political aspect basically because of the tension between the hospitals need to co-operate and at the same time keep their independence. The introduction of IT support in this context can generate several question of e.g. increased control of work and changes in the structure of competencies at the departments. It's important to the collaborative process to discuss and analyse these questions and make clear the attitude in the region concerning these issues.

To get a clear picture of the total technical profile of the region it is necessary to make a complete investigation of what technical equipment and computer systems are being used today. This investigation will serve, as the basis for developing alternative suggestions of how information technology can support the co-operative objectives constituted in the region.

The collaborative process in the region should be characterised by a broad participation of actors in the co-operative area of the hospital region. The actors should work closely and intensively in projects concerning the issues and questions of how the regional IT supported CIS can be constructed. Another form of participatory process is also discussed by Hanseth et al (1994). In their discussion of standardisation processes the authors mean that in a similar way as users participate in systems development they should participate in forming the socio-technical network in which they will work.

A process of this kind is primarily about making it possible for network that represent different opinions and views to reach increased knowledge and understanding

of each other with the purpose of finding new forms for co-operative work. Even if the hospitals in the study have a lot in common they all have their very specific conditions and perspectives which means that the co-operative work in the region is depending on how these heterogeneous networks can develop their regional awareness.

The main contribution of the study is that it highlights the complexity of inter organisational collaboration and makes clear that technical solutions of co-operative work can not be discussed apart from the social and organisational issues. The article also contributes to an increased knowledge and understanding of organisational change processes. It also points at issues of great importance in health care sector today. But the study and the results presented in this article may be criticised for not providing a very thorough analysis of the problems identified. To be able to make a deeper and more complete examination an extended investigation is necessary. Additional interviews and observations at more hospitals in the region including not only radiologists but also representatives from other professions would be essential.

The study was conducted in an organisational environment characterised by heterogeneous networks with high level of independence and no clear superior authority. Other areas of the public sector (e.g. city administrations) represent the same organisational structure and are facing similar demands and needs of integration and co-operation. Here the results of the study can be important and useful when developing IT support for inter organisational collaboration. A comparative study with organisations representing other contexts than health care sector would contribute to further deepen the analysis of the issues addressed.

An additional interesting future work would be to more thoroughly analyse the political aspects identified in the study. In order to combine heterogeneous networks and common needs a core issue is to learn more about the political dimension of co-operative work. We need to extend our knowledge of how this question could be considered when developing IT support for co-operative work across organisational boundaries.

Conclusion

This paper has highlighted central issues in the process of forming a new way for co-operative work in a hospital region. The hospitals have shown insufficient regional awareness, which obstruct the forming of the CIS. Here it is argued, as a proposal, that the hospital region, through an active collaboration process, can combine complex and heterogeneous organisations with common needs for co-operative work. This process will serve as means for improving the regional awareness in a way that make it possible to support the forming of the IT supported regional common information space and start the important interaction between awareness and CIS.

References

- Bannon, L., Bødker, S. (1997). Constructing Common Information Spaces. I Hughes et al (eds.), *Proceedings of the Fifth European Conference on Computer Supported Co-operative Work*, 81-96. Holland.
- Blomberg, J., Giacomi, J., Mosher, A., Swenton-Wall, P. (1993). *Ethnographic Field Methods and Their Relation to Design in Participatory Design: Principles and Practices*. I D. Schuler and N Namioka, (eds.) 123-155, Erlbaum, Hillsdale, N.J.

- Greenberg, S., Gutwin, C., Cockburn, A. (1996). Using Distortion-Oriented Display to Support Workspace Awareness. , I A. Sasse, R.J. Cunningham, and R. Winder (eds.). People and Computers XI, Proceedings of the HCI'96, 299-314. London.
<http://www.cpsc.ucalgary.ca/projects/grouplab/papers/980423>.
- Gutwin, C. (1996). Workspace Awareness Research
<http://www.cpsc.ucalgary.ca/projects/grouplab/people/carl/research/awareness.html> 980415.
- Gutwin, C., Greenberg, S. (1997). Workspace Awareness. Position paper for the ACM CHI '97 Workshop on Awareness in Collaborative Systems, edited by Susan E. McDaniel and Tom Brinck, Atlanta, Georgia, March 22-27.
<http://www.cpsc.ucalgary.ca/projects/grouplab/papers/97StudyingAwareness.CHIWorkshop/gutwin.html> 980420.
- Gutwin, C, Roseman M and Greenberg S (1996). A Usability Study of Awareness Widgets in a Shared Workspace Groupware System. Computer Supported Co-operative Work '96, 258-267, Cambridge MA, USA.
- Hanseth, O., Thoresen K., Winner, L. (1994). The Politics of Networking Technology in Health Care. Computer Supported Co-operative Work. Special Issue on Networking. Nos. 1-2 Vol.2, 109-130. Kluwer Academic Publishers.
- Hughes, J., King, V., Rodden, T., Andersen, H. (1994). Moving Out from the Control Room: Ethnography in System Design. Computer Supported Co-operative Work '94, 429-439, Chapel Hill, NC, USA.
- Kuutti, K., Karasti, H. (1995). Supporting Shared Interpretation of a Space of Representations: A Case of Radiological Conferences. Proceedings of the First International Conference on Cognitive Technology, City University, HongKong. <http://kcox.cityu.edu.hk/ct1995/kutti.htm> 980412.
- Lundberg, N. (1996), How Network Technology Changes the Work Process at a Radiology Department, Proceedings of the 19th IRIS, 175-195.
- Lundberg, N. (1997). Intermediaries in a Social Network. Proceedings of the 20th IRIS, 149-171.
- Lundberg, N., Tellioglu, H. (1999). Understanding Complex Co-ordination Processes in Health Care. Accepted for Scandinavian Journal of Information Systems.
- Mark G, Fuchs L and Sohlenkamp M (1997). Supporting Groupware Conventions through Contextual Awareness. I Hughes et al (eds.), Proceedings of the Fifth European Conference on Computer Supported Co-operative Work, 253-268. Holland.
- Palfreyman K & Rodden T (1996). A Protocol for User Awareness on the World Wide Web. Computer Supported Co-operative Work '96, 130-139, Cambridge MA, USA.
- Schmidt, K., Bannon, L. (1992). Taking CSCW Seriously: Supporting articulation work. Computer Supported Co-operative Work, vol. 1, nos. 1-2, 7-40.
- Schneider, K., Wagner, I. (1993). Constructing the 'Dossier Representatif'. Computer-Based Information-Sharing in French Hospitals. Computer Supported Co-operative Work (CSCW) 1, 229-253.
- Star, S. L., Griesemer, J. R. (1989). Institutional ecology, 'translations', and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social studies of science, 19:387-420.