

“The Clinical Eye”



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### ***Address***

EFI, Box 6501, SE-113 83 Stockholm, Sweden • Website: [www.hhs.se/efi/](http://www.hhs.se/efi/)  
Telephone: +46(0)8-736 90 00 • Fax: +46(0)8-31 62 70 • E-mail [efi@hhs.se](mailto:efi@hhs.se)

# “The Clinical Eye”

Constructing and Computerizing  
an Anesthesia Patient Record

Carina Beckerman



STOCKHOLM SCHOOL  
OF ECONOMICS  
HANDELSHÖGSKOLAN I STOCKHOLM

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# Preface

This report is a result of a research project carried out at the Department for Management and Organization at the Economic Research Institute at the Stockholm School of Economics.

This volume is submitted as a doctor's thesis at the Stockholm School of Economics. As usual at the Economic Research institute, the author has been entirely free to conduct and present her research in her own ways as an expression of her own ideas.

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Stockholm in May 2006

Filip Wijkström  
Director of the Economic  
Research Institute  
at the Stockholm School of Economics

Sven-Erik Sjöstrand  
Professor  
Head of the Department of  
Management and Organization



# Acknowledgements

Writing a thesis influences and changes your life immensely. It is like a skiing race, a mental Vasalopp. It craves energy. It is also lonely. When I look back it seems that I have spent years alone in a room reading and writing. During these years I have often asked myself: What is a thesis? And what is a good thesis? Nobody wants to or can really answer these questions. One professor in Uppsala once said: "I cannot say what a thesis is but I know when I see one". So what a thesis is seems to be a well-kept secret. I think that a thesis is like a good wine that matures slowly. The longer it takes the better the results get.

I have been socialized into the academic world, which is special. It is more international but also more segregated than other sectors in society. It is filled with interesting seminars, conferences and workshops. Writing a thesis creates an opportunity for delving into a topic and focusing on a particular question. For someone like me who likes to read and write it is a life of luxury. But it is also a life filled with rituals and tribal wars. Learning the craft of academic writing has sometimes felt like being in a prison. Over the years I have seen many colleagues give up and leave. During this process I have been guided by Charles Pierce (1859-1952) who considered knowledge to be "a never-ending quest motivated by doubt", a quotation that speaks to me because doubt is an element of my personality. I have also been guided by Augustine's words that "patience is the companion of wisdom", which underscores the value of patience both to academics in general and to myself personally.

I want to thank all the people within health care that I have met and interviewed during these years and who have so generously given me their time. I hope they get something useful out of the following pages. I also want to thank professor Sven-Erik Sjöstrand, professor Mats Brommels, docent Birgitta Södergren and professor Jan Löwstedt för useful discussions of and comments on my work. Thank you Sven-Erik for letting me develop my own ideas about this project! Thank you Birgitta for being not only critical but also supportive!

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Stockholm School of Economics

May, 2006

Carina Beckerman

# A map of the thesis

This section is a map over what the reader might find on the following pages. The purpose is to make it easier to get a view over and grasp what this thesis is about. I have had no ambition to experiment with design or form when making the research process visible in text. Instead my intention has been to present the results in a document with conventional looks. To fulfill the research purpose and answer the research questions the rest of this thesis therefore looks like this:

In **chapter one** I report that the overall purpose in this thesis is to investigate what happens when somebody or something interferes into the activities of a knowledge worker in a specific organizational setting. Then the theoretical purpose has been to develop concepts and relations between concepts about how a knowledge worker might influence and be influenced by knowledge management activities. The empirical purpose has been to describe how a key document is socially constructed to be what it becomes and implications of this for a knowledge worker in a specific organizational setting. The following research questions have been specified: 1. How is the content of a patient record constructed? 2. Why is it constructed as it is? 3. What are the implications of constructing and computerizing a patient record for the professional involved? With the word constructing I mean socially constructing and designing a patient record. Then this chapter informs about and conceptualizes the knowledge society, knowledge and knowledge management. I continue to describe the importance of documents and information in health care and the patient record as a very important artifact. The first chapter finishes by describing the empirical setting that I have chosen to conduct this research project in, the anesthesia and intensive care unit of a hospital, and the importance of and earlier research about the anesthesia patient record.

In **chapter two** I outline a theoretical framework that I have used. It integrates ideas from knowledge management with concepts from Giddens structuration theory, and theories about sensemaking, schema use and representations. A professional makes sense of the world, uses representations and mental schemas when exercising his or her knowledge. He or she exercises knowledge in a structured way in a structured organizational setting. If some-

thing, a work process or a tool, is transformed he or she also has to transform the mental schemes and representations he or she uses. Then I divide the practice of knowledge management into six dimensions. I write about how technology can be defined and point out the difference between an information management system and a knowledge management system. In several sections I describe in detail some of the basic ideas in Giddens structuration theory and what concepts I will use when analyzing the data obtained during the research process. I conclude this chapter with a section that integrates structuration theory with ideas about knowledge management.

In **chapter three** I give an account of how I have worked when trying to fulfill the purpose in this study and answer the research questions that I pose. My view of the world is that of a social constructionist. I also write that the overall perspective guiding this research is that we belong to several thinking collectives (“denk-kollektiv”) each characterized by a special thought style (Fleck, 1934/1997) and that parts of our world are socially constructed. (Mead, 1934, Blumer, 1969/1998, Schutz, 1953/1962, Berger and Luckmann, 1966/1991, Sjöstrand, 1997) Like Searle (1995) I believe that there are things that exist only because we believe them to exist but there is also a reality that is totally independent of us. For example the patient record is something you can touch, it “exists”, but the idea and the specialist domain behind it is socially constructed. Then I describe how the research process took place. Three different parts of a transformational process at four different hospitals is explored in this thesis. The first one consists of socially constructing and designing a new patient record on paper, the second with computerizing it and the third and last part of the process informs about implications of implementing a computerized document. Data has been gathered with interviews and observation. Then they have been analysed with constitutive and functional analysis and interpreted within the theoretical framework I describe in chapter two. I conclude this chapter with a few remarks about quality in interpretative studies.

In **chapter four** the aim is to give a picture of anesthesia as a specialist domain and detail the care and documenting process. First I describe anesthesia and then how the anesthesia and intensive care clinic is organized, into pre-operative, operative and postoperative care. I report about what takes place at the anesthesia reception desk and in the OR, operation room. I describe the anesthesia patient record as an artifact and why it is being computerized. I point out some important characteristics of anesthesia employees such as that they call themselves emergency people. In this chapter the clinical eye also emerges as a concept that characterizes the cognitive style of an anesthesiologist. I conclude that it is an important concept when trying to understand how an anesthesiologist exercises his or her knowledge. The clinical eye is one of the theoretical contributions in this thesis and I discuss and write more about it in chapter five, six and seven.

The purpose in **chapter five** is to present and analyze how a patient record on paper is constructed and implications of this for the employees concerned. It describes the project at Karolinska hospital in Sweden, the goals for it and its project history. The changes that can be found in the paper document are set forth and analyzed using the theoretical framework in chapter two. The purpose is to answer the research questions presented in chapter one.

A patient record can be viewed as a structuring technology. In this study I have seen how its transformation transforms and structures certain important elements of the practice of performing anesthesia, such as evaluating the patient, dilution of medication, administering anesthesia and documenting. I notice a narrative trend in the new document. In addition to this, including pictures is a way of supplying more information but in a way that saves energy. I find that already when constructing a patient record on paper it is possible to enforce a strategy that includes both coordination and enhancement. I conclude this chapter by writing that many of the thoughts that develop about what is possible to improve in a patient record on paper can be taken further in a computerized patient record.

In **chapter six** I picture how to computerize and implement a patient record and implications of this for the employees concerned. I describe what anesthesia information management is and how a complete anesthesia information management system might look. I conclude this chapter writing that there are many problems that have to be solved when computerizing a patient record on paper. The first one is how to transform and design what takes place in the anesthesia and intensive care unit in such a way that it can be presented in the software used in a computer. I also argue that a computerized patient record not only influences the different mental schemas mentioned in the preceding chapter it also influences how the anesthetist and the anesthesia nurse move around in the operation room. How to log on and sign information are problems that have to be solved in a computerized patient record. In a computerized patient record it is also possible to include services such as an automatic alarm that is not possible in a patient record on paper. I point out that what the employees at the anesthesia and intensive care unit get out of a computerized patient record depends on what strategy they have behind transforming it. I argue that one question for the project group to decide on is how much coordination and how much enhancement that should be focused on when transforming the patient record into a computerized knowledge management system. I point out that a knowledge management system can expand the idea behind what a patient record is.

In **chapter seven** I interpret and discuss the findings I have made, using the theoretical framework outlined in chapter two. I develop concepts and a theoretical position based in empirical evidence. I write that I find knowledge management to be a multidimensional activity. Codifying knowledge also implies building knowledge. During the research process I have conceptualized

the clinical eye as a cognitive style for an anesthetist and the patient record as a knowledge management system. I discuss the importance of identifying the cognitive style for constructing and designing the document. I introduce the concept knowledge structuring and the concept knowledge domination and discuss how they are interrelated. I relate concepts to each other and integrate them in a theoretical frame. The last section of this chapter reports on the theoretical position that I have developed during this research process.

**Chapter eight** includes an overview of this thesis and a few concluding remarks. I present the empirical contributions, the theoretical contributions and several implications for practitioners of constructing and computerizing a patient record. I conclude this chapter with a few directions for and thoughts about future research.

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# Chapter One

## Points of departure

In modern society there is an urge to manage many complex phenomena such as creativity and knowledge. This has resulted in the practice of managing knowledge, a confusing construction but a profitable one for consultants, researchers and many others. This practice gives rise to two central questions: how to do this and what happens when somebody or something, either from outside or inside of an organizational setting, interferes in the activities of a professional man or woman. When exercising his or her knowledge a professional uses among other things documents. Documenting what one does is part of being professional. And to computerize a key document is part of being modern, of reducing risk and trying to control the outcome of future events, or “colonizing the future” as Giddens (1991) has expressed it. I therefore concern myself with the implications of computerizing a key document for a professional in a specific organizational setting.

The idea behind the practice of managing knowledge is based on us supposedly having left “the information society” and now living in “the knowledge society” (Lane, 1966, Bell, 1974, Böhme, Stehr, 1986, Drucker, 1993, Castells, 1996, OECD, 1996). OECD has used the expression “knowledge-based economies” instead of “the knowledge society” and characterized them as “those that are directly based on the production, distribution and use of knowledge and information”. This thesis takes its point of departure in the knowledge society. One important difference between “the information society” and “the knowledge society” is that the first is characterized by low-cost information and the general use of information and communication technology while the key factor in the second is mainly investments in people utilizing new information and communication technology.

In the next section I outline how the concept the knowledge society has been used earlier. I also argue that a knowledge economy’s growth into a knowledge society depends on the emergence of knowledge-intensive activities and communities. I touch on the question of whether it is possible to manage knowledge at all and point out that codification and innovation are core activities in this society. Finally I make a few general remarks about how

the knowledge society includes some people and excludes others and why this is so.

## 1.1 In the Knowledge Society

The concept “the knowledge society” was used for the first time by the American researcher Robert Lane in an article published in *The American Sociological Review*.

“As a first approximation to a definition, the knowledgeable society is one in which, more than in other societies, its members: a) inquire into the basis of their beliefs about man, nature and society, b) are guided (perhaps unconsciously) by objective standards of veridical truth, and, at upper levels of education, follow scientific rules of evidence and inference in inquiry, c) devote considerable resources to this inquiry and thus have a large store of knowledge, d) collect, organize and interpret their knowledge in a constant effort to extract meaning from it for the purposes at hand, e) employ this knowledge to illuminate (and perhaps modify) their values and goals as well as to advance them. Just as the “democratic” society has a foundation in governmental and interpersonal relations, and the “affluent society” a foundation in economics, so the knowledgeable society has its roots in epistemology and the logic of inquiry” (Lane, 1966).

The knowledge society has also been particularized as the “post-industrial society”, by the researcher Daniel Bell. In this society there has been a change from a goodsproducing to a serviceeconomy. The professional and the technical class play a dominating role and theoretical knowledge is central as a source of innovation and policy formulation in the society. The future orientation of society includes the control of technology and technological assessment. And decision-making is influenced by the creation of a new “intellectual technology” (Bell, 1974).

According to Bell the importance of the post-industrial society is that it strengthens the role of science and cognitive values as a basic institutional necessity of the society. It makes decisions more technical and brings the scientist or economist more directly into the political process. It deepens existing tendencies towards the bureaucratization of intellectual work and creates a set of strains for the traditional definitions of intellectual pursuits and values. It creates and extends a technical intelligentsia and raise at the same time crucial questions about the relationship between the technical and the literary intellectual.

Bell concludes that the post-industrial society is a knowledge society:

“The post-industrial society, it is clear, is a knowledge society in a double sense: first, the sources of innovation are increasingly derivative from re-

search and development (and more directly, there is a new relation between science and technology because of the centrality of theoretical knowledge); second, the weight of the society/measured by a larger proportion of Gross National Product and a larger share of employment/is increasingly in the knowledge field" (Bell, 1974).

In this society new information and communication technologies provide a distinct technological base that changes the conditions for the production, distribution and use of knowledge. These new technologies enable access to communication networks and make interaction and the exploration and analysis of the contents of gigantic databases possible. They emerged in the 1950s and took off with the introduction of the Internet during the 1990s. They can transmit written texts, pictures and music and have generated activities like e-learning, e-commerce and e-government. Now people can buy books and airline tickets, submit tax returns and even vote on the Internet.

I think that some of the many interesting characteristics of this society are: a) the accelerating speed at which knowledge is created, accumulated and depreciated, b) the growth of knowledge-intensive activities, c) the growth of knowledge-intensive communities, d) the increasing dependence on innovation, and finally e) the transformation of some groups of professionals into knowledge workers and the questioning of these groups in an unprecedented way that they never used to be (Scarbrough, 1999, David and Foray, 2002).

### 1.1.1 Knowledge-intensive activities and knowledge-intensive communities

A knowledge economy's growth into a knowledge society depends on the emergence of knowledge-intensive activities and communities. In this thesis I conceptualize knowledge-intensive activities as activities that require a lot of scientifically based professional knowledge of both the providers and the clients/customers. This way of viewing knowledge-intensive work shows that a service like house-cleaning is not at all knowledge-intensive since it requires very little knowledge based on scientific grounds on the part of both the provider and the client/customer. R&D services require in general a lot of knowledge both of the provider and the client and belong to the most knowledge-intensive activities that exist, while medical services that requires a lot of knowledge of the provider but very little of the client/patient can be found somewhere in the middle.

Knowledge based activities emerge when people, supported by information and communication technologies, interact to co-produce new knowledge. This involves three main elements: a significant number of a communities members combine to co-produce new knowledge, the community creates a "public" space for exchanging and circulating the knowledge and new infor-

mation and communication technologies are intensively used to codify and transmit the new knowledge.

Knowledge-intensive communities can be characterized by strong knowledge production and reproduction capabilities, a public or semi-public space for learning and exchange and the intensive use of information technologies (David and Foray, 2002). A learning space is any forum where professional experts, ordinary users of information and uninitiated students are brought together by their shared interest in a given subject.

As an example medical doctors illustrate a key characteristic of the knowledge society, a higher frequency of information transactions between equals and colleagues that is a key characteristic of the knowledge society. Many doctors document their new clinical knowledge and make it available to others through easily accessible electronic databases. Then other practitioners can draw on or add to that pool of information, enhancing the advance of what is called evidence-based medicine.

### 1.1.2 Codification and innovation are core activities in the Knowledge Society

The ability to invent and innovate are core activities and a survival mechanism in the knowledge society. The ability to innovate often emerges from the interplay between codified knowledge and learning processes in knowledge intensive communities. Codification serves to further memorization, communication and learning. It forms a basis for the creation of new knowledge and new ideas that then can be embodied in products, processes, organizations and people. One of the important activities in the knowledge society is therefore to codify knowledge. The goal is to articulate and clarify the knowledge of a professional man or women so that it can be expressed in a particular language and recorded on a particular medium.

### 1.1.3 The Knowledge Society includes some and excludes others

The knowledge society is a society in which its inhabitants exercise their knowledge and express themselves with the help of new information- and communication technology. It is a society that seeps through some layers of the everyday world surrounding us, but not all. The people that participate in this society, contribute to it and benefit from it, are well-educated professionals such as producers of IT, technicians and consultants. It costs to participate in the knowledge society in the form of investments in education and equipment but it also costs to not participate.

A paradox in the knowledge society is the accelerating attention to systematic investigation, despite the irregularity and ad hoc-processes that is often connected to the production of "great" ideas. Science is in focus and the goal

seems to be to define and categorize, manage, control and rule. Computer-terms like "up-grade" have become keywords. People do not only upgrade the software on their computer. They are also supposed to upgrade their education, themselves and maybe many other aspects of their life like their home or even their partner. Another often used word is "interface". Creation of new products and ideas appear at places that are interfaces between different specialist domains at the same time as people become increasingly specialized.

To me the knowledge society is a place that includes some people and excludes others. In this society some people want to gain access to the tacit knowledge of others, codify and make it explicit but at the same time tacit knowledge is not always allowed to develop because of stress and lack of time. Moreover when someone takes the knowledge of people away and makes it explicit the individual loses status. Some people become alienated and exchangeable.

In the next few pages I will detail different ways to categorize knowledge and how I have decided to view knowledge in this study. I will also write a few words about how the concept professional knowledge is constructed.

## 1.2 Knowledge: localized and embedded in practice

Knowledge used to be personal, a private good and contributing to an individual's status in society. In the knowledge society the aim is to make knowledge a public good, applied to doing and productive (Drucker, 1993). Knowledge is conceptualized as an economic resource that creates values in both society and organization.

### 1.2.1 Different ways to categorize knowledge

In the literature about knowledge one can find concepts such as personal knowledge and organizational knowledge. Personal knowledge can be defined as "the individual capability to draw distinctions within a domain of action based on an appreciation of context or theory" (Tsoukas and Vladimirou, 2001). The concept organizational knowledge can be pictured as "the capability members of an organization have developed to draw distinctions in the process of carrying out their work, in particular concrete contexts, by enacting sets of generalizations, whose application depends on historically evolved collective understandings" (Tsoukas and Vladimirou, 2001).

Professional knowledge or intellectual capital, is another often used concept that I will write more about in the section that follows. Then there is explicit knowledge and something called tacit knowledge (Polanyi, 1966). Explicit knowledge is knowledge that is easy to transmit or disseminate

throughout an organization, such as rules, specifications and mathematical formulas. Tacit knowledge is normally constructed as a kind of knowledge that people possess but are unable to articulate, it is a form of subjective know-how that allows people to act. It is in general achieved by doing and transferred through a master-apprentice-system.

Tacit knowledge can be thought of as having two dimensions, one technical and one cognitive. The technical dimension is know-how represented in “the master craftsman” who “develops a wealth of expertise” at his fingertips, after years of experience. But he is often unable to articulate the scientific or technical principles behind what he knows (Nonaka and Takeuchi, 1995). The cognitive dimension of tacit knowledge consists of schemata, mental models and perceptions (Fiske and Taylor, 1991).

Blackler (1995) provides another way to categorize knowledge when he suggests that organizations depend on at least five different types of knowledge:

- Embrained knowledge: depends on conceptual skills and cognitive abilities
- Embodied knowledge: action-oriented and rooted in specific physical context
- Encultured knowledge: the process for achieving shared understanding
- Embedded knowledge: resides in systematic routines
- Encoded knowledge: information conveyed by signs and symbols

A third way to categorize organizational knowledge is provided by Choo when he proposes that organizations depend on background knowledge, rule-based knowledge and cultural knowledge. Background knowledge is knowledge that is part of the organizational culture and communicated through stories, metaphors, analogies, visions and mission statements. It supplies the world-view by which people in an organization understand and make sense of events, actions, objects, utterances or situations (Choo, 1995). In an organization background knowledge generates rule-based knowledge that guides action by answering three questions: What kind of situation is this? What kind of person am I or What kind of organization is this? What does a person such as I, or an organization such as this, do in a situation such as this? Cultural knowledge is a filter that helps people in an organization to place a value on certain kinds of knowledge and while also keeping out knowledge that is deemed unimportant by the dominant group in a culture or organization. Choo (1998, p. 112) describes cultural knowledge as knowledge that: “Includes the assumptions and beliefs that are used to describe and explain reality, as well as the conventions and expectations that are used to assign value and significance to new information. These shared beliefs, norms and values form the framework in which organizational members construct reality, rec-

ognize the saliency of new information and evaluate alternative interpretations and actions".

### 1.2.2 Professional knowledge

This thesis deals with what has also been called professional knowledge. A professional uses both explicit and tacit knowledge which are not only complementary, but in many ways also interdependent. Tacit knowledge or professional skill as a practice is normally not something professionals "think" about. They are too busy employing their skills to "think" about them. One can say that those skilled routines become "second nature" to the professional or the knowledge worker. In this thesis I focus on the mental schemas that a professional develops when he or she exercises his or her knowledge. The professional often operates with an intuitive feel for how to accomplish his or her work or through accumulated experience (Davenport, Jarvenpaa, Beers, 1996). Therefore sufficiently altered routines, like implementing an information system, might introduce insecurity into the practices of a knowledge worker.

Professional knowledge has been equated with the concept of intellectual capital, something that resides in people in terms of skills, expertise and experience. Intellectual capital is constructed as a combination of human capital and structural capital. Human capital is defined as the combined knowledge, skill, innovativeness, and ability of the company's individual employees to meet the task at hand. It also includes the company's values, culture and philosophy. Anything that people know, think, innovate or invent in an organization is human capital. This kind of capital cannot be owned by the company.

Human capital grows in two ways: 1) when the organization uses more of what people know, and 2) when more people know more that is useful to the organization.

Structural capital is what allows human capital to be packaged and used again. It is the hardware, software, databases, organizational structure, patents, trademarks and everything else of organizational capability that supports the productivity of the employees. Structural capital also includes customer capital, that is the relationships developed with key customers. Structural capital can be owned and traded (Edvinson and Malone, 1997).

### 1.2.3 How I view knowledge

In this thesis I view knowledge as an ongoing social process of construction and collective action in organizations and a cognitive capability that empowers its possessors with the capacity for physical or intellectual action. "Knowledge is the individual capability to draw distinctions within a domain of action based on an appreciation of context or theory" (Tsoukas and Vladimirou, 2001). When a person exercises his or her knowledge certain mental schemas

and representations are enacted and used. Knowledge can also be described as information effective in action, focused on results that are both inside and outside the person, in society and economy, or in the advancement of knowledge itself. I want to emphasize that the opinion that knowledge is embedded in practice means that it cannot be separated from an individual's engagement in exercising his or her practice.

A theme in the next section is how professionals have been transformed into what is often called knowledge workers and the implications of this for the people concerned.

### 1.3 Professionals are transformed into knowledge workers

Carr-Saunders and Wilson (1933) have described professionals as a phenomena which once arose to meet specific needs in society: a priest saves a soul, a lawyer his client and a medical doctor hopefully cures the patient.

According to Larson (1979) professionalism consists of a cognitive, a normative and an organizational component. The cognitive part includes specialist knowledge and long training, the normative part ethical standards and a commitment to provide a service for the public good. A professional is normally also regulated by an organizational body with disciplinary powers that support these cognitive and normative elements. In addition to this, professionals and what they do are characterized by autonomy in relation to the surrounding world, a distinct occupational culture and client-orientation (Alvesson, 1993).

Initially professionals included only physicians, lawyers and priests but today this class also includes technicians, scientists and different types of managers. Many new occupations like management consultants, information technology analysts, software designers, project engineers and computer technologists have also emerged in response to demands of many different companies and organizations.

In the knowledge society people often turn to experts, like many of the above mentioned occupational groups, for efficient problem-solving and provision of customized services. The demand for expertise and expert knowledge is continuously increasing and social change is in general related to scientific knowledge. Science and technology also tend to be central to many of the new sectors that have contributed to the growth of the economy over the past few decades; these include pharmaceuticals, scientific instrumentation, aeronautics and information and communication technologies (David and Foray, 2002).

At the same time as new information systems have expanded the distribution of specialist knowledge, they have also made it more transparent. Professional and semi-professional groups have increasingly becoming exposed to market

forces and control by management hierarchies. The influences of professional institutions also have been weakened by deregulation and globalization, and by IT systems that "threaten professional autonomy with surveillance and remote control" (Scarbrough, 1999).

Giddens (1991) writes that expert knowledge in pre-modern cultures tended to depend on procedures and symbolic forms that resist explicit codification, or when such knowledge was codified, it remained unavailable to lay individuals because literacy was a monopoly of the few. But the knowledge incorporated in modern forms of expertise is in principle available to everyone, provided they have the time, energy and intellectual capacity to acquire it.

So, in the knowledge society many professionals have been transformed into knowledge workers, and some of the mystique surrounding what they do has disappeared. Knowledge workers also apply high levels of abstract and specialized knowledge to the interpretation of information and the production of services or goods, and their knowledge base is exclusive, non-substitutable and global.

Compared to traditional professionals knowledge workers often seem to be less concerned with formal occupational and organizational credentialism, today. Instead they make use of the exclusive nature of their knowledge to create market niches for themselves. Pay also seems to matter more to knowledge workers than to professionals since it carries both economic and symbolic meanings (May, Korczynski and Frenkel, 2002).

Another, and as I think important difference today is that customers have become more knowledgeable and critical and demand more customized services and products.

The next section seeks to recount how I view the concept knowledge management in this thesis.

## 1.4 The concept of knowledge management

Efforts at trying to manage knowledge in organizations have generated theories and ideas about a practice called "knowledge management". People who participate in this discourse, such as researchers, consultants, human resource managers and suppliers of new information technology, investigate and discuss whether it is possible to manage knowledge, how to do so and the outcome of such efforts.

The development of the concept "knowledge management" is based on a view of knowledge as an economic resource in the knowledge society (Swan, Scarbrough, 2001). If knowledge is a critical resource and a source of competitive advantage it must be managed more efficiently.

Knowledge management has grown out of earlier research about information management and organizational learning. Information management can be described as the management of information resources, the information of management tools and technologies, or the management of informa-

tion policies and standards (Choo, 1998, p. 260). Organizational learning focused on people and human resource management while knowledge management is supposed to be something more. It is supposed to improve “factors that lead to superior performance: organizational creativity, operational effectiveness, and quality of products and services” (Wiig, 1993).

Knowledge management had replaced organizational learning as a perspective used in scientific papers around 1997 (Scarbrough, Swan, 2001). At the same time information systems, which were originally concerned with the processing of data and information, were beginning to be applied to support knowledge activities in organizations.

I look at knowledge management as “the dynamic process of turning an unreflective practice into a reflective one by elucidating the rules guiding the practice, by helping to give a particular shape to collective understandings and by facilitating the emergence of heuristic knowledge” (Tsoukas and Vladimirou, 2001).

Since the basis for most knowledge management activities is the idea of taking advantage of new information technology that perspective is taken for granted in this study. In addition a social and cognitive perspective could be useful when studying knowledge management projects. This is because I view information technology as socially constructed in interactions between people, between people and physical materia, and between people and the institutions governing their every day working life. “Technology like science, involves process as well as product. In short both scientific facts and technological artifacts are to be understood as social constructs” (Woolgar, 1987). The implication of this is that different actors engage in different strategies in an organizational setting to shape a technology according to their own plan. To understand why a technology looks as it does, one has to study what this process looks like, what happened and why.

It is also necessary to emphasize micro-processes such as cognitive processes, concept formation and thinking (Lane, 1966). The cognitive perspective taken on knowledge management is based on a realization that human beings can concentrate on and attend to a limited number of activities since humans have cognitive limits. One way to reduce the effects of this limitation is to eliminate distractions and make some activities automatic. I believe that adding, taking away or redesigning work tasks are important activities when trying to manage how knowledge is exercised in everyday work-life.

## 1.5 Is it possible to manage knowledge?

The editors of *Journal of Management Studies*, which devoted a special issue to knowledge management in November 2001, writes that “the question in the greater part of the knowledge management literature is not so much whether knowledge, and knowledge work, can or should be managed, but how?” and then they quote Fuller (2002) “if knowledge is the problem then manage-

ment is the answer". A question that is rarely asked is whether it is possible to manage knowledge at all.

Alvesson and Kärreman (2001), probably inspired by Schein (1992) who wrote about the contradiction between the two words information and management, point to the contradiction between the words knowledge and management. If knowledge is what they define it to be, "an ambiguous phenomena, intrinsically related to meaning, understanding and process", then it is not possible to manage. Others also think that the value of knowledge management is limited since it implies control of processes that may be uncontrollable or stifled by heavy-handed direction (von Krogh, et al, 2000). Södergren and Söderholm (2001) found that management and knowledge-intensive workers frequently use different languages. At the very least management has to realize that there are both individual and organizational barriers to managing knowledge. Typical obstacles are "knowledge as power" and few rewards for sharing knowledge. Sometimes individuals feel threatened and do not want to share their experiences and knowledge. Sometimes individuals do not want to contribute insight and knowledge if they feel that they don't get anything back. Trust is therefore considered an important element when trying to communicate and share knowledge within organizations. Organizations also need a language, organizational stories, procedures and paradigms that allow creation and transfer of knowledge to take place (von Krogh, et al 2000).

### 1.5.1 Goals and strategies for knowledge management

One can look at knowledge management as a way to improve management of the intellectual assets of an organization (Edvinson and Malone, 1997). One can also look at knowledge management as the art of creating value from an organizations intangible assets (Sveiby, 1999). I have already written that I view knowledge management as "the dynamic process of turning an unreflective practice into a reflective one by elucidating the rules guiding the activities of the practice, by helping to give a particular shape to collective understandings and by facilitating the emergence of heuristic knowledge" (Tsoukas and Vladimirou, 2001). I also view knowledge management as an effort to improve the ways a knowledge worker exercises his or her knowledge so that more value is created in both society and organizations.

Other ways to approach the practice of managing knowledge is: Knowledge management as extended library (information exchange), KM as community (sharing of ideas), KM as normative control (prescribed interpretations) and KM as enacted blueprints (templates for action). These are four distinctive orientations arranged along the dimensions of the medium of interaction and the mode of managerial intervention.

- 1) The first one involves extensive use of databases, advanced search systems and sophisticated communication systems. Here KM is basically

a process run by a central agency responsible for the compiling, synthesizing and integrating idiosyncratic work and project experiences. Motives may be quicker or better work and support for those that need the information.

- 2) Knowledge management as community is often grounded in an interest in the existence of tacit knowledge. Then management is a matter of coping with diversity and encouraging knowledge sharing through influencing the workplace climate.
- 3) Knowledge management as normative control can be viewed as an attempt by management to exercise normative control through efforts to build and maintain a feeling of a distinct corporate identity with which employees can identify, and the downplaying of differentiation markers such as sub-organizational boundaries and status symbols, may support experiences of community across the organization.
- 4) The last type of knowledge management activity tries to engineer environments and control individuals at a level closer to behavior than to values or ideas. Then the aim of knowledge management is to provide templates and guidelines that produce the wanted action (Alvesson and Kärreman, 2001).

One can choose between following objectives for knowledge management:

- 1) One objective with a KM-project can be to create knowledge repositories to store codified knowledge. Then the strategy for managing knowledge focuses on the computer. Knowledge is carefully codified and stored in databases. There it can be accessed and used by anyone in the organization.
- 2) Another objective can be to provide access to tacit knowledge and facilitate its transfer between individuals. As long as tacit knowledge or skills remains the property of individuals the organization is limited in its ability to amplify that knowledge to gain economies of scale or strategic advantage. Knowledge is closely tied to the person who developed it and shared mainly through direct person to person contacts. The chief purpose of computers at such companies is to help people communicate knowledge, not store it.
- 3) A third type of project can focus on establishing a rich and generous environment that encourages creation, transfer and use of knowledge.
- 4) A fourth type of knowledge management project might focus on managing knowledge as an asset. One approach to this way of thinking involves measuring the value of intellectual assets in the organization and including this information in financial statements.

Three key components are to identify, capture and share intellectual assets. The identification of intellectual assets can be done through knowledge audits. The goal is to locate and map knowledge in the organization. What

knowledge is needed? Where does that knowledge reside? What form is it in? To capture intellectual assets is the way in which knowledge is stored or held, in a reusable format, for future use. This is not only technological formats, but includes the narratives and corporate folklore told by members of the organization. To share the intellectual assets is one way in which knowledge is disseminated and leveraged throughout the organization. The combination of ideas and knowledge in the sharing stage can create new knowledge for individuals, groups and the organization. Sharing of knowledge includes organizing, accessing and utilizing knowledge.

- 5) Finally one can also link the management of knowledge with organizational innovation (Brown and Duguid, 1991, Swan et al.,1999 a, Swan and Newell, 2000).

In the next section I will give a summary of some of the perspectives taken when researching knowledge management projects.

### 1.5.2 Perspectives on knowledge management

Knowledge can be managed with an IT, a cognitive or a social perspective or a combination of these depending on what stance the knowledge manager or the researcher takes.

- 1) The IT perspective focuses on the technology in itself, the internet, intranets, databases and how to build and implement them. The exploration of information and communication technology as a means of supporting the management of knowledge is a common research topic (Boland Jr and Tenkasi, 1995, Alavi and Leidner, 1999, Scarbrough et al., 1999, Swan et al.,1999 a). And there is an interest within computing, engineering and industrial communities in developing and using increasingly complex knowledge management systems (Swan et al., 1999 a, Swan et al.,1999 b). This perspective accounts for approximately 70 percent of the themes discussed in KM articles in 1998 while social issues in general were neglected (Scarbrough, Swan, 2001).

In 2 000 the Conference Board in New York published a report called "Beyond Knowledge Management: New Ways to Work and Learn". What the Conference Board advocate with the expression "beyond knowledge management" is a focus on both IT and human resource management that means that both a social and cognitive perspective on knowledge management is needed. This is because as the role of an information system evolves from the processing of data to the support of knowledge-based work there will be a need to integrate the technical system of the firm or the organization not only with the social system, but also with the specific "knowledge system" that characterizes the knowledge worker (Abbott, 1988).

- 2) The social perspective recognizes that the processes and practices of knowledge management are social and political. It has grown out of earlier studies about IT and organizational change based on theories about organizational politics, organizational culture, institutional theory and/or organizational learning. In each, organizational change is seen as a process in which transformative actions must overcome persistent structures and in which information technology can support the forces of either persistence or transformation, or both at the same time. This means that changes in organizations can be met by political opposition, cultural drag, institutional inertia, or organizational remembering but new organizational forms may appear nevertheless (Robey and Boudreau, 1999).

In theories about organizational politics researchers pay attention to opposing interests of those promoting a particular change and those opposing it (Markus, 1983, Zuboff, 1988). An information system can be viewed as part of politics at a work place and looked at as a gift or a punishment. It can be looked at as a tool for power and an attempt to direct or influence the behavior of other people. A few studies, like Davies and Mitchell (1994), have used Foucault's ideas about power and knowledge when researching implications of new information technology. They analyzed how IT was prevented from becoming a significant factor in transforming an organization because of its definition as a knowledge object had shown it to be tied to supporting the status quo.

Within studies dealing with organizational culture the following three perspectives have been dominant: from an integrative perspective culture forms the glue that holds the organization together and helps to define its distinctive features; from a differentiation perspective, the organization is seen as a collection of subcultures. Depending on one's sub-cultural identification technology may acquire different significance and meaning and provoke ambiguity. Finally from a fragmentation perspective ambiguity and contradiction are seen to be the pervasive and inevitable essence of culture.

Both Kling and Iacono (1989) and Kling and Scacchi (1982) focus on the persistence of organizational structures when implementing new information technology, otherwise very few studies about information systems have used institutional theories that tries to explain why organizational structures and values endure even in the face of strong efforts to change them. Kling and Iacono (1989) claim that information systems may take on institutional characteristics themselves and resist change in spite of clear advantages of upgrades and modification.

- 3) The cognitive perspective on knowledge management concerns the cognitive basis and the nature of knowledge worker's expertise and knowledge. It is based on a realization that human beings have a limited ability to take in and use information and act. This originates in earlier studies about IT and organizational change based on theories

about organizational learning and research in cognitive organization theory. For an overview of this research see Björkegren (1989), Löwstedt (1989) and Hellgren & Löwstedt (1997).

Now it is time to touch on the importance of documents for a professional man or woman. Computerizing these documents involves transformations of how a professional, or as I prefer to call them here knowledge workers, exercises his or her knowledge.

## 1.6 Documents, information technology and transformation

It is common in organizations to organize work with and around documents like budgets, reports, journals and memos. They are supposed to ease communication, planning and decision-making. They are used to formulate strategies, manage situations and to check and control. How a document looks is based on certain norms and expectations in a specialist domain, but in general it includes words and/or pictures. When documents are constructed, reconstructed and computerized it involves transformations. These transformations have implications for work activities, people's involvement with others, their identities and roles at work and the information used and knowledge exercised in an organizational setting.

Levinson (1972) suggests that when people examine the usefulness of an organization's acquired knowledge, they should inquire about its accuracy, availability and comprehensiveness.

- Accuracy concerns questions such as the proportion of knowledge that is factual, the proportion of detail that can be trusted, and how much of the information is speculative.
- Questions of availability concern where the information is stored, how it is filed, the ease with which it can be checked out, the people to whom it is accessible, and whether it can be used on repeated occasions.
- And assessment of comprehensiveness is concerned with questions like whether the knowledge is based on thorough or incomplete data, whether the knowledge is annotated, and whether it contains errors and bias (Levinson, 1972, p. 214-15).

So, it definitely matters how knowledge is packaged.

"If knowledge is packaged in the mind of one individual, presumably the organization will unfold in a different manner than if the memory is housed in a committee or a set of committees with different interests. Furthermore the organization's usage of its retained interpretations will

also be affected by whether that memory is placed in files, rule books, or on computers and how much of that information the organization admits to" (Weick, 1969 p. 206).

"In situations where interpretations and explanations are called forth some time after the events, the organizational "memory" (e.g. files, budgets, statistics, etc) and the retrieval system will affect the degree to which different participants can use past events, promises, goals, assumptions, behavior, etc in different ways (March and Olsen 1976, p. 62-63).

This is because computerized information systems are not neutral. In deciding and initiating action, "the organization treads between improvisation and control, and between evolution and design" (Choo, 1998, p. 246). Implementing information systems creates disturbances. They initiate transformations and therefore also feelings for or against their existence. They provide different ways of viewing the world. They reflect norms and values about what can be achieved in for example an organization. And they provide a facility that can be used in the control and co-ordination of both material and human resources. Computerized systems can be associated with the reinforcement of existing social structures but may also be associated with significant social change.

If we want to support a specialist in his or her work, by implementing a computerized patient record, we have to understand how this person applies his or her knowledge, how a practice is performed, including the hidden or tacit aspects of it. Participating in a practice means holding certain values, values that are implicit in the practice. These values might influence the outcome of efforts to manage knowledge. To computerize a key document might for example even reshape the contours of a professional practice. The implementation of some of these abstract systems into day-to-day life, coupled with the dynamic and uncertain nature of knowledge, means that awareness of risk seeps into the actions of almost everyone.

"The concept of risk becomes fundamental to the way both lay actors and technical specialists organize the social world. Under conditions of modernity, the future is continually drawn into the present by means of the reflexive organization of knowledge environments" (Giddens, 1991, p. 3).

To computerize a key document is part of being modern, of reducing risk. Risks concern future happenings as related to present practices. Today a significant part of expert thinking and public discourse is made up of risk profiling analyzing what in the current state of knowledge and in current conditions, is the distribution of risks in a given environment of action. Thinking in terms of risk and risk assessment is a more or less ever present exercise in modern society. Political risk assessment and health risk assessment as two examples of this.

When searching for an area in which documents play an important role as tools in every day working life I found health care to be an interesting one. This is because of the amount of information used in health care and the importance this information has, even when it comes to questions about life or death. The following section informs about the importance of information and knowledge in health care.

## 1.7 Information, knowledge and health care

"Few other institutions have a more vital significance for us all or a more far reaching impact upon our lives than does the hospital. Few other organizations have a clearer meaning for their members and customers, or more crucial functions for the complex social order within which they operate. In our organization-oriented society, the hospital is one of the few organizations of whose purpose we are vividly aware, and with whose functioning we are unambiguously concerned. Like our family, schools and government, the hospital ultimately touches us all, individually and collectively. Our personal physical and mental health, our community wellbeing and our economic resources are all intimately affected by the work of our hospitals. In fact, seldom do we rely more dramatically or more completely on the products, or services, of an organization than we do in the case of the hospital." (The Community General Hospital by Basil S. Georgopoulos and Floyd C. Mann, 1962)

A hospital can be characterized as a place with a surgical unit and beds with patients staying over night. It can also be constructed as a facility that provides a wide range of services related to medical care. A hospital consists of clinics, many of them as big as a medium sized company with 200-400 employees. Henry Mintzberg has included hospitals together with universities in what he calls "the professional bureaucracy". The professional bureaucracy relies for coordination "on the standardization of skills and its associated design parameter, training and indoctrination. It hires duly trained and indoctrinated specialists/professionals for the operating core, and then gives them considerable control over their own work". (Mintzberg, 1979, p. 348) Control over his or her own work means that the professional works relatively independently of colleagues, but closely with the clients he or she serves.

Hospitals are characterized by a dual leadership, the administration and the medical competence, and there is often competition between these two. If the director of a hospital wants to implement a computerized patient journal, the head of a clinic at the same hospital may refuse to do it. Bate (1998) has described how "tribalism" among medical specialists might demoralize and tear apart a whole hospital under weak leadership.

A professional bureaucracy, such as a hospital, is a place where “the technology of the organization/its knowledge base/is sophisticated but its technical system/the set of instruments it uses to apply that knowledge base/is not (Mintzberg, 1979).

The medical experts might use the latest and the best technology when performing their own work but the rest of the tools they use might be old-fashioned and out-dated. A professional man or woman is in general said to be a conservative person promoting stability and resisting change. The British Medical Organization was accused of being against change also hundred years ago (Carr-Saunders and Wilson, 1933). In addition to this, professionals have also been accused of lacking both vision and balance:

“The leading intellects lack balance. They see this set of circumstances, or that set; but not both sets together. Professional men do not grasp the essential features of the social and economic structure and the place of professions in it. And if they interest themselves in matters outside the development of their own technique, they often fail lamentably to display the same standards of exactitude and judgement as they demand with rigor in their immediate spheres” (Carr-Saunders and Wilson, 1933, p. 498).

Medical work is often described as a complex and time-critical activity that takes place in networks. To facilitate communication, cooperation and coordination it is supported by tools or artefacts like clinical guidelines, patient journals and X-ray pictures that are used by a large number of actors for many different purposes (Berg, 1996, Kay and Purves, 1998, Toussaint, 2000, Lundberg, 2000).

Medical networks exist within and between hospitals, within and between clinics, and among hospitals and smaller health care units in society. Medical work is characterized by multiple and intersecting documentation practices that is known to structure the use of time badly. Documenting a patient’s history can be looked at as a “re-localization” process in time and space, which means that data about the patient is documented again and again in primary care, the ER, the ward and so on.

According to Teldok’s report 119 (1998), WHO’s World Health Report (2000), and interviews I did in a pilot study, employees within health care lack a feeling for infrastructure and networks. Resources are often badly used and no routines exist for many important work procedures. Instead a task might be performed differently by different physicians since professionals and knowledge workers are characterized by autonomy. Health care is also characterized by problems in connection with transfer of information within and between different units. A physician is an individualist and prioritises his own performance. He takes less notice of what others do. Merton (1940) has showed that when a task is specialized people tend to become more attentive to their component task and less concerned with the larger assignment of

which it is a part. They become less concerned with how their contribution will fit with the contribution of others.

At the beginning of year 2000 the Institute of Medicine in Washington DC published a report, showing that at least 98 000 people die every year in US because of medical mistakes. Many of these mistakes, such as wrong medication, could be avoided with the help of a computer providing the right information at the right moment. But the cost of building IS-systems is high, and health care has invested a lower proportion of revenue in information technology than any other major industrial sector (California Health Care Foundation, 1999). The health care sector is also always lacking money compared to some other sectors. The costs for implementing computerized information systems demand investments that the health care sector lacks. In health care there is also a fragmented situation when it comes to using computers, platforms and software. Since work procedures are performed differently by different units it is difficult to develop standards, which makes everything much more expensive. Different units that perform the same kind of services use different equipment, differently designed documents and so on. It is supposed to be costs, lack of standards, lack of leadership and issues of secrecy that pose barriers to integrating and taking advantage of medical information in a more efficient way (Teldok, report 119, 1998, California Health Care Foundation, 1999). According to WHO's World Health report (2000) new information technology, used in connection with producing information about patients is mentioned as important for a more efficient health care sector all over the world.

In the pages that follows I will write about patient records, which are the document type that I have decided to focus on in this thesis project, safety and a few words about previous research on patient records.

## 1.8 Patient records

"Whatsoever things I see or hear concerning the life of men, in my attendance on the sick or even apart there from, which ought not be noised abroad, I will keep silence thereon, counting such things to be as sacred secrets."

Oath of Hippocrates, 4<sup>th</sup> Century, B.C.E.

Medical decision-making and all information processing connected to it is considered to be the most important part of the administration in a hospital (Rhenman, 1966). In a number of situations technical artifacts, like patient records, plays the same role as human actors, a sort of glue that keeps a social order in place (Berg, 1996). The interests of the players are inscribed in the tool, it both enables and constrains action. It is the place where the critical data of medical care, the patient history, lab results, x-ray results and so on are

gathered. This is data and information on which a physician bases decisions about care and exercises his or her knowledge. It is information that is guarded by extensive legislation about safety. The words above of Hippocrates continue to guide medical doctors on how to deal with information about their patients.

### 1.8.1 Patient records as professional artifacts

Tools, or artifacts like patient records, are the result of how we work and the organizational setting we work in. Then practical knowledge, like writing a patient record, has to do with rulefollowing, judging and interpretation (Janik, 1996). It is part of certain rituals that create and construct the day of a medical doctor. What is written in a patient record is also characterized by a special thought style, a style that has developed among a medical collective.

Earlier research in Sweden shows that physicians and nurses spend 25-50 percent of their time doing "paper work", most of it related to the patient record. Between 15-20 percent of patient records were not found so that they could be used during a meeting with the patient. And 5 percent of patient records had still not been found, after a month. Some hospitals have had as many as 30 employees just to search for lost patient records (SOU 1991:18). At the same time health care employees document more and more to protect themselves from accusations of malpractice and because of new legislation (Socialstyrelsen, 2000). They want to be able to justify decisions they have taken about care and the care process if questioned.

General practitioners and small health care units have used computerized patient records for a long time without any specific problems while computerized patient records in clinical settings have been harder to find (Berg, 1996). When this study started only 10-15 percent of Swedish hospitals used computerized patient records while the same number in primary care was 85 percent. The situation in Sweden is more or less the same as in other western countries like Holland, the UK and the US. This is because many different specialists work in a hospital. They use different patient records at different clinics. Different specialists use and write patient records differently.

Even within the same clinic there may exist different types of patient records. At one anesthesia and intensive care unit existed nine different types of anesthesia patient records. This is because an anesthetist giving anesthesia to cancer-patients and one giving anesthesia to a heart-patient or a women in labor will work differently. In primary care and small health care units the working procedures are easier. The patient often meets the same doctor. In a hospital a patient might meet several different specialists the same day. To build a standardized patient record for a hospital is therefore more complex compared to for a small health care unit.

In a document from 1965 called "Hospital Rationalization with ADB", Karolinska hospital, there is a discussion similar to today. The goal then was to "build an information system for a hospital". The reason was that "societies

cost for building and managing care resources have, during the last few years become, comprehensive. It has become a big problem for many caregivers to recruit personnel."

Therefore the Swedish government decided in May 1965 to investigate the possibilities of rationalizing activities in health care utilizing ADB. "The coordination of planning of production, patient care, production control and research is becoming increasingly necessary" because it is difficult to plan "a patients way through the hospital". Employees who wrote this document thought that ADB might lower cost and increase efficiency, exactly like today. They also saw the need for "problem-oriented" patient records, just like today.

The project of upgrading and computerizing patient records has been described as a modern "crusade" (Kay & Purves, 1998). People who pursue this crusade want to clean up what they see as the administrative mess of the paper-based record and replace it with a wellorganized computerized one. They want to formalize both the form and expression of the medical record. They are motivated by an opinion that many problems in health care are caused by poor recording and ineffective retrieval of clinical information. Among the problems they want to solve are difficulties which arise from clinicians simply misunderstanding illegible script, to deeper "integrity faults" related to sins of data omission which result in patients and information being in the wrong place at the wrong time. Today patient records on paper can be illegible or unobtainable and aggregating information from them is both labor-intensive and costly. A quality movement that started in US during the 1980's has also put pressure on health care organizations all over the western world to increase efficiency and quality (Press, 1997).

A combination of low equipment prices, standardization, younger generations of clinicians, and the move of physicians into larger health care networks is expected to cause a slow but real diffusion of computerized patient records in the next few years (California Health Care Foundation, 1999). Increasing specialization and the development of process-oriented care also results in participation by many more people in solving the problems of a patient. These people do not always work at the same place but need immediate access to the patient record (SPRI, 1998). Many transformations in health care put the patient in focus. It is a major aim in health care internationally to support patient-focused use of medical data, process-integrated decision support using high quality medical knowledge, and comprehensive use of patient data for clinical research and health reporting. Computerized patient information should and could be a support in daily medical work and make it possible to evaluate medical work quantitatively and qualitatively. More research is therefore needed on the computerized patient record and how to organize medical databases (Haux, R. 2002).

### 1.8.2 Patient records and safety

In most countries extensive legislation ensures that information about patients are not disclosed without the consent of the patient. A patient should be able to trust his or her physician enough to talk freely about whatever is on his or her mind – what is said should not be accessed easily by unauthorized people. Unfortunately this is not always the case when patient records are written on paper. They disappear, are dumped in hospital garbage and sometimes even become the subject for gossip around coffee-tables in some hospital archives.

In spite of this, computers have been seen as a bigger threat to patient privacy than anything else. Safety has also been used as a reason for not computerizing patient information. Problems like personal safety, insurance issues, loss of personal privacy, failure to meet legal obligations and loss of confidence are some of the problems connected with this issue. Horror stories are told, like the one about when hundreds of medical records from patients in Michigan appeared by mistake on the Internet 1998. Several threats like this to the confidentiality of personal health information have been reported recently but the situation is the same if not worse with paper records.

It has been easy to obtain patient records, for example by private detectives and others who telephone a general practice or hospital and pretend to be the secretary of a doctor who needs the record for emergency treatment of the person who is the subject of the investigation. Police sometimes gain access to records this way. In the UK a newspaper gained access to medical patient records by paying a small fee to a commercial agency. Nationwide health networking has also been seen as a threat to confidentiality because patient records will be available to many more people. In Sweden the computerized patient record of at least two well-known politicians were read by unauthorized personnel. But because a computerized patient record was used the hospital could trace who had been reading the record and punish them.

Research in US published by National Institute Of Health shows that 75% of the population are concerned a “great deal” or “fair amount” about medical information being used in the wrong way by health insurance companies. About 85% of Americans believe that protecting the confidentiality of medical patient records is “absolutely essential” or “very important” in health care.

### 1.8.3 Previous research on patient records

Earlier research has shown that the introduction of a computer into the physician-patient relationship reduced time-consuming tasks, such as dictation, captured far more detail than found in previously dictated and handwritten notes and provided immediately available data for quality assurance activities (Essin, et al, 1998). A study of the results from integrating a computerized anesthesia patient record into a hospital information system at LDS Hospital in Salt Lake City showed a reduction in time for charting from 20,4% to 13,4%.

The computerized anesthesia patient record was more legible and complete than the manual journal (Wang, et al, 1995). In a study from 1993 was the proportion of the anesthesists time spent on the documentation for the computer records also decreased from 36,6 to 14,9 % from the manual record (Edsall, et al 1993). More vital sign data points (from 45 to 245,2) and more notes and drug information (from 40 to 61) per case were also recorded. According to these studies an information system might free eyes and hands and create a possibility for improved and more accurate information about the patient. But this research places insufficient emphasis on how a physician exercises his or her knowledge and how structures, values and broader contexts in society influence the outcome of a project like the one studied in this thesis. Now there is a need to establish a "fit" between the needs of clinical work, the health care system and information technologies. Human factors and those linked with the activity of health care professionals have to be studied before any development and installation of a computerized patient records into a specialist domain takes place (Beuscart-Zephir, et al, 2001).

Computerized patient records have been considered as "cognitive artifacts" which shape the way in which health care workers obtain, organize and reason with information but there are few studies conducted with this perspective. Results from one study (Patel, V.L. 2000) indicate that exposure to the computerized patient record was associated with changes in physicians information gathering and reasoning strategies. Differences were found in the content and organization of information, with paper records having a narrative structure, while the computerized patient record were organized into discrete items of information. The differences in organization had an effect on data gathering strategies, where the nature of the doctor-patient dialogue was influenced by the structure of the computerized patient record. The conclusion in the study was that technology has a profound influence in shaping cognitive behavior and the potential effects of cognition on design of technological artifacts needs to be further explored. More research is therefore needed into how patient records are constructed and reconstructed in different medical collectives.

Now after having given an introduction to this thesis the following section detail the research purpose and research questions.

## 1.9 The research purpose and research questions

The overall purpose in this thesis is to investigate what happens when somebody or something from inside or outside a specific organizational setting interferes with the activities of a knowledge worker. This can be divided into one theoretical and one empirical purpose:

The theoretical purpose is to develop concepts and relations between concepts about how a knowledge worker's exercise of knowledge might be influenced by and influence knowledge management activities.

The empirical purpose is to describe how a key document is socially constructed and designed to be what it becomes and the implications of this for a knowledge worker in a specific organizational setting.

From the empirical research purpose are the following questions specified:

1. How is the content of a patient record constructed?
2. Why is it constructed as it is?
3. What are the implications of constructing and computerizing a patient record for the physician and the nurse involved?

I want to repeat that with the word construction I mean socially constructing and designing a patient record. In the next sections I will describe the empirical setting that I have singled out to conduct research in, what anesthesia is, a few words about the anesthesia patient record and earlier research about this patient record.

## 1.10 Empirical setting

When searching for an area in which to conduct an empirical investigation I found health care to be the most interesting one. Moreover in health care many documents are used that contain information that even concern life or death. I decided to focus on implications of computerizing a patient record for how a physician exercises his or her knowledge. This is based on a personal interest for knowledge management as a possible practice and the importance of words and pictures as tools when working in an organizational setting. When deciding on what kind of patient record to focus on I found the anesthesia patient record the last one to be computerized all over the western world. There is also a general sense among people I have met during this research process that it is the most difficult one to computerize.

### 1.10.1 Anesthesia

Anesthesia comes from the greek word *anaesthesia*, (lack of sensation), and is translated as total or partial loss of sensation (*The American Heritage Dictionary*). It can also be translated as general or localized insensibility to pain or other sensation. (*Random House Webster's Dictionary*) An anesthetic, like ether, is a substance that produces anesthesia. The purpose of anesthetics is to make the patient more or less stop breathing during surgery without passing away. Anesthesiology is the science of administering these drugs.

The characteristics of the practice of anesthesia differ from those encountered in many medical fields and the nature of the work of anesthesists has

therefore remained outside the mainstream of research into medical practice (Klemola, Norros, 1997). According to Klemola and Norros there are two orientations in performing anesthesia, one realistic and one objectivistic. The realistic orientation recognizes uncertainty in anesthesia and that the patient is unique. It is characterized by an extensive use of situational information and an aim to construct a cumulative interpretation of a patient's physiological state. The objectivistic orientation treats the patient as a natural object and uncertainty is not recognized. This orientation is characterized as a reactive habit of action that seemed to be based on a preoperative plan and its deterministic implementation.

### 1.10.2 The anesthesia patient record

The early pioneers among anesthesiologists such as John Snow (1813-1858) have kept information about the anesthetics in the form of written records in narrative text (Atkinson 1968 in Hallen 1973). The first known anesthesia patient records from Sweden, which appeared at Serafimer-lasarettet 1758, were of a similar type. Graphic representations of the pulse and blood pressure fluctuations during anesthesia was introduced in the beginning of the 20<sup>th</sup> century by Cushing in USA, and Olivecrona in Sweden among others. Several systems for the acquisition, storage and retrieval of anesthetic data have been created and applied since then. These records usually have consisted of a graphic representation of the anesthetic events to which have been added codes and numbers and a limited amount of rigidly structured text. An anesthesia journal on paper, designed by Torsten Gordh in the 1940's, was used until 1966 at Karolinska. But in 1965 the idea that computer technology might increase the efficiency of retrieval and analysis of anesthetic data was introduced. After a period of trial and error, an automatic data processing system applied to anesthetic records was implemented on the first of July 1967 (Hallen, 1973). That system later failed and people stopped using it.

Today the anesthesia patient record itself consists of three parts: the perioperative record, the anesthesia curve and the anesthesia report. The first is produced during evaluation/risk assessment before an operation and gives advice about what anesthetics to use. The anesthesia curve is produced during an operation and characterized as a technical record that shows what happens during operation. The last one is a review of the course of the anesthesia.

The practical role of computers in critical care environments is generally restricted to the storage and retrieval of data coming from electronic medical devices and hospital information networks. It is believed by people who work with these questions within health care that the benefits of the use of computers will be delivered if they can efficiently relieve the clinical staff of repetitive tasks and support practitioners in decisionmaking in real time. Instead of keeping up endless paperwork, nurses and physicians should be able to focus on patient care.

### 1.10.3 Earlier research about the anesthesia patient record

Earlier research, such as a French study, showed that when 2 422 anesthesia patient records, including 88,732 items, were analyzed, the level of correct information were 72 percent. These results suggest that the quality of the anesthetic patient records could and should be improved (Falcon, et al, 1999). In a Canadian study the overall completeness of charting remained low, 37%, with no relationship based on the anesthesiologists age, level of training or number of years in practice. Charting of data to the anesthesia patient record remained incomplete and inaccurate in all groups independent of the level of training, age and number of years in practice (Devitt, et al 1999).

The advantages of a computerized anesthesia patient record seem to be continuous high quality, more data collection than in the handwritten anesthesia record, and the possibility of implementing an electronic database. According to a study at Duke University Medical Center (Lubarsky, et al, 1997) it is now possible to accurately evaluate anesthetic drug because an anesthesia information management system is now used as a cost containment tool.

I also want to point out that traditional methods of drug administration and record keeping in anesthesia are relatively error prone. A well-functioning system might therefore improve patient safety by facilitating correct drug administration and accurate anesthesia record making (Merry, et al, 2001).

A disadvantage of the computerized anesthesia patient record is that some practice is required to input clinical events such as drug administration. Ergonomic problems also remain to be solved for a wider acceptance of the automated electronic anesthesia patient record in clinical practice (Yamaguchi, et al, 2000).

## 1.11 Limitations

This thesis is not about an IT-project. Instead it is about a structuring project. I view the patient record as a structuring tool. Then I explore how a transformed patient record structures and restructures knowledge in a specific medical setting. But I could just as well have chosen to study how any other tool, activity or work process structure what takes place in this setting. The focus of this study is multi-level. It means that I explore what takes place both outside and inside an anesthetist in the anesthesia and intensive care unit when an anesthesia patient record is transformed and computerized. Above I have mentioned earlier research about the anesthesia patient record that is relevant for this study. Most studies about patient records have an administrative focus and report about implications such as time-savings of computerizing information about the patient. I have found one study that have inspired my research that I also recount above. It is a study that views computerized patient records as cognitive artifacts (Patel, V.L. 2000). Patel concludes that

computerized patient records are "cognitive artifacts" which shape the way in which health care workers obtain, organize and reason with information. According to Patel differences were found in the content and organization of information, with paper records having a narrative structure while the computerized patient record were organized into discrete items of information. Patel also found that the structure of the computerized patient record influenced the doctor-patient dialogue. This thesis takes place within a theoretical framework consisting of knowledge management, structuration theory and cognitive theories about sensemaking, schema use and representations. I will write more about that in the next chapter. I have limited myself to analyzing the results within this framework. It means that I am not interested of other theoretical perspectives one can have on this project. I also limit myself to explore what takes place when an anesthesia patient record is transformed. I am aware of that transformations of other types of patient records might generate other results.

## 1.12 A chapter summary

Before we proceed, I want to repeat that the knowledge society is a place in which we invest in people using new information and communication technology. I view knowledge as an individual capability to draw distinctions within a domain of action based on an appreciation of context. It is also important to realize that knowledge is embedded in practice and cannot be separated from an individual's engagement in exercising his or her practice. Knowledge management is defined as the dynamic process of turning an unreflective practice into a reflective one by elucidating the rules guiding the activities of the practice, by helping to give a particular shape to collective understandings and by facilitating the emergence of heuristic knowledge. I write that knowledge management is supposed to improve factors that lead to superior performance, organizational creativity, operational effectiveness and quality of products and services. Then the overall purpose in this thesis project is to investigate what happens when somebody or something from inside and/or outside a specific organizational setting interferes in the activities of a knowledge worker. The theoretical purpose is to develop concepts and relations between concepts about how the exercise of knowledge of a knowledge worker might be influenced by and influence knowledge management activities. Empirically I want to describe how a key document, such as a patient record, is constructed to be what it becomes and implications of this for a knowledge worker in a specific organizational setting. I focus on knowledge management taking place within health care. I am interested of the implications of socially constructing, designing and computerizing an anesthesia patient record. From my empirical research purpose, I have specified the following research questions: How is the content of a patient record constructed? Why

is it constructed as it is? What are the implications of constructing and computerizing a patient record for the physician and the nurse involved?

In the chapter that follows this I will present the theoretical framework that informs this thesis project.

# Chapter Two

## The practice of managing knowledge in a structured setting

To fulfill the purpose of this thesis and answer the research questions I presented in the preceding chapter, I have used a theoretical framework integrating ideas about knowledge management with certain concepts from structuration theory and cognitive theories about sensemaking, representations and schema use. The pages that follow are divided into three parts: the first one informs readers about the practice of managing knowledge and the second about several concepts from structuration theory that I use. In the third part I integrate structuration theory with ideas about knowledge management. Then I conclude this chapter with a summary of its content. I start the first section by giving an account of theories about sensemaking, representations and schema use. Before I divide knowledge management into six dimensions, that I believe to be important, I recount a definition of technology and the difference between a knowledge management system and an information management system.

### 2.1 The practice of managing knowledge

A knowledge worker interacts with others in an organizational setting when trying to make sense of the world and a problem that demands action. He or she formulates ideas, thoughts and perceptions about the world in his or her head. And different cognitive styles are common for different knowledge workers (Taylor, 1991; Dervin, 1992; Wilson, 1997). A cognitive style is the same as information processing habits that represents how a knowledge worker thinks, remembers, perceives and solves problems. Perception can be described as the process of getting to know an external object by the impression made by it on our senses. For example vision has been described as an intel-

lignant process of construction (Hoffman, 1998). Humans have a tendency to “see” the time and remember with pictures (Schacter, 1996). But at the same time we have to realize that what the observer observes, and how he or she makes sense of the world, depends on earlier experiences, knowledge and expectations.

### 2.1.1 Sensemaking

Human beings use the physical world and others as sources of information to understand and make sense of the world and/or a specific situation. When interpreting the information before taking a decision on how to act, he or she draws on a frame and/or a particular abstract knowledge system that he or she has acquired through studying and working (Abbott, 1988). To make sense of a phenomena means that a human being, such as a physician, can place it in a framework that is known to him or her and construct a meaning out of it. The individual recognizes what is happening because he or she may have seen it before.

“So far I have argued that sensemaking is about such things as placement of items into frameworks, comprehending, redressing surprise, constructing meaning, interacting in pursuit of mutual understanding, and patterning” (Weick, 1995, p. 6).

According to Weick sensemaking is about the ways people generate what they interpret. He has given following seven properties of sensemaking:

1. Grounded in identity construction
2. Retrospective
3. Enactive of sensible environments
4. Social
5. Ongoing
6. Focused on and by extracted cues
7. Driven by plausibility rather than accuracy

The first property means that we construct our identities in interaction with others. At work we might be a human resource manager or a financial analyst but at home we are a mother or father. During other circumstances we are the next-door neighbor or a partner in a tennis-game. To shift among interactions is to shift among definitions of our selves. We have a different identity depending on whom we interact with. And depending on who I am my definition of what is “out there” will also change.

The creation of meaning is also an attentional process, but it is attention to that which has already occurred. It is retrospective. Because the attention is directed backward from a specific point in time whatever is occurring at the moment will influence what is discovered when people glance backward. In other words, because the text to be interpreted has been forgotten and is a

memory anything that affects remembering will affect the sense that is made of those memories.

The third property means that people create their own environments and these constrain their actions. If one believes change is possible he or she might act so that change takes place, but if one does not believe in change, perhaps nothing will be done to change a specific situation. Instead one's actions may subconsciously make change impossible.

The fourth property means that sensemaking is never solitary because what a person does internally is dependent on others. How one makes sense of things happening depends on how others make sense of the same phenomenon. Others, when making sense of the world, influence us but we also influence others.

Fifth, sensemaking never starts at a specific moment since it is going on all the time. Even when we are sleeping it seems that we are trying to make sense of the world around us and find solutions to important problems through dreaming.

The sixth property means that extracted cues are simple, familiar structures that are seeds from which people develop a larger sense of what may be occurring. They function as a point of reference when making sense of something.

According to the last property I need to know enough about what I think to get on with my projects but no more, which means that sufficiency and plausibility have a tendency to take precedence over accuracy. "The sensible need not be sensible, and therein lies the trouble" (Weick, 1995, p. 55).

Weick also writes that words approximate the territory; they never map it perfectly. That is why sensemaking among us human beings never stops (1995, p. 107). The strength of sensemaking as a perspective derives from the fact that it does not rely on accuracy and its model is not object perception. Instead sense-making is about plausibility, pragmatics, coherence, reasonableness, creation, invention and instrumentality (Weick, 1995, p. 57).

The central problem in sensemaking is how to reduce or resolve ambiguity, and how to develop shared meanings so that the organization can act collectively (Choo, 1998, p. 70). As long as a person is making sense of his or her experiences it is possible to move ahead. But from time to time this movement is blocked by the perception of a cognitive gap. This is a situation that the person is unable to make sense of. It causes stress and uncertainty. To close such a gap a person starts searching for information to make new sense of a situation and thereby be able to continue doing what he or she is doing (Dervin, 1992). At the cognitive level, the individual's style and preferences impact on the processing of information. The person selects a source that has a high probability of providing information that will be relevant, usable and helpful. As an example a physician often asks a trusted colleague if the needed information is not available. At the affective level people use information selectively, for example if they want to avoid conflict or embarrassment or support their own decisions. Personal motivation and interest in the problem

also determine the amount of energy that the person invests in information seeking. At the situational level the selection and use of sources is influenced by the amount of time and effort that is required to locate or contact the source and to interact with the source to get the information needed (Taylor, 1991; Dervin, 1992; Wilson, 1997).

### 2.1.2 Representations

In addition to the processes described above, a human being uses sound, gestures or symbols that stand for or refer to objects, things and concepts in his or her working or private life. In other words they use representations. A representational system has two essential ingredients: (1) the represented world: that which is represented; (2) the representing world, a set of symbols, each standing for something in the represented world. When we think we create a symbolic representation of the world that is a picture of the world that is separate from the world itself. Representations are important because they allow human beings to work with events and things absent in space and time, or events and things that never existed such as imaginary objects and concepts. Representations that can be part of a workspace shared with others, require some sort of constructed device to support them: an artifact. For example, a map of Sweden is a social construction but it is also a representation of the concept Sweden. It might be used during a discussion of how to improve the roadsystem or how the population is diffused over the country. The ideal is to develop representations that capture the important, critical features of the represented world while ignoring the irrelevant. It is important that they are appropriate for the task, enhancing the ability to make judgments, and to discover relevant regularities and structures (Norman, 1993, p. 52). Representations that match our perceptual capabilities are simpler and easier to use than those that require reflection. Under a heavy work load, stress, danger and time pressure representations that require reflection are not used as rapidly and efficiently as those that can be used through simple perceptual comparisons.

### 2.1.3 Schema use

To orient him or herself in an informational context a human being also uses mental schemas developed in a specific organizational setting (Giddens, 1984, Fiske and Taylor, 1991). A schema influences the encoding of new information, memory of old information and inferences about missing information (Fiske and Taylor, 1991, p. 117). It is a way of organizing information about the world relevant to a particular task and can be described as a filtering mechanism. A schema is a cognitive structure that represents knowledge about a concept or type of stimulus, including its attributes and the relations among those attributes. It facilitates top-down, conceptually driven, or theory-driven processes, which means processes that are influenced by prior knowl-

edge. A mental schema makes it easier for a person to make sense of a situation and decide how to act.

There are interpretative schemas, person schemas, self-schemas, role schemas and event schemas. Interpretative schemas are influenced by the shared understanding of a group of people about a phenomena. A physician within a certain specialist domain is socialized in how to interpret certain situations and solve certain problems. When doing that he plays the role of a physician. He acts out the role schema of being a doctor. Event schemas describe appropriate sequences of events in well-known situations. One example of this is how a person learns how to get on the bus or to ride the subway. People can also have "place schemas" for particular kinds of locations. One example of this is how a surgeon learns how to move around in a certain way in the operating room of a hospital. Categories and mental schemas allow us some sense of prediction and control, which is essential to our wellbeing. They save energy. And they make us believe that we understand the world. Stable mental schemas lend a sense of order, structure and coherence to social stimuli that otherwise might be to complex and overwhelming to make sense of.

Mental schemas are difficult to change. People ignore exceptions to a schema, they even interpret the exception as proving the schema. Many of the informationprocessing advantages of schemas would be lost if they changed at each encounter with slightly discrepant information. But having an incorrect schema is also costly since it can make people inadequate problem solvers. The wrong schema can lead one to be inaccurate, biasing encoding, memory, and inference. But nevertheless schemas are believed to be cognitively more efficient than understanding each instance afresh (Fiske and Taylor, 1991, p. 176).

To sum up the above: In this thesis I have decided to view a knowledge worker as a person that uses certain mental schemas when he or she makes sense of the world or a problem that demands action. He or she also uses representations when working with events and things absent in space and time. One example of this is that a picture on a paper might represent a patient, a roadsystem or an organization. A picture of a beach with palmtrees might be a representation of the concept vacation, and so on. Now I will continue in the section that follows with dividing the practice of managing knowledge into six different dimensions.

#### 2.1.4 Dimensions of knowledge management

This thesis is based on an interest for knowledge management as a way to create values in organizations and society. The practice of managing knowledge may consist of intra-organizational and/or inter-organizational activities. It means that knowledge management might take place within an organization but also between organizations. Here I sort the practice of managing knowledge into the six following categories: mobilizing knowledge, codifying knowledge, creating knowledge, converting knowledge, building knowledge

and linking knowledge. Some of these are interrelated, and the key component in several is to codify tacit knowledge and make it explicit.

*a) Mobilizing*

When mobilizing internal knowledge, information processes are managed to promote the sharing of information, conversion of tacit knowledge, experimenting and prototyping and the migration of knowledge to other parts of the organization. The transfer of knowledge from an individual to a group level might for example occur through the development of a unique language or code which allow group members to learn who knows what and then coordinate their activities. A person that develops software might find a solution to a problem he is working on. When he communicates this solution to his colleagues he uses a language including certain words and expressions that they all understand. He doesn't have to explain what he means with these words. His colleagues understand anyway. But before it is possible to mobilize knowledge in an organization one has to investigate and make visible what kind of knowledge that exists, and this can be done through knowledge-audits organized by management. There are three critical factors in knowledge integration: shared experiences, shared symbolism captured in metaphors and logos, and shared artifacts. The effectiveness of integration mechanisms depends on, as I have already concluded, the existence of common knowledge, including the existence of a common language and other forms of symbolic communication, the commonality of specialized knowledge, shared meaning and the recognition of individual knowledge domains.

*b) Codification*

Professional and specialist knowledge is a matter of both formal education based on scientific knowledge and skills. (Abbott, 1988, Janik, 1994) A professional has the same education as others in the same field but there are better and worse professionals. The difference lies in their capacity to learn from their experience and to acquire "tacit" knowledge. Tacit knowledge consists, among other things, of search rules, or heuristics, that identify a problem and the elements consisting of the solution (Polanyi, 1966, p. 23-24). The key to innovation in the knowledge society is in unlocking the personal, tacit knowledge of the organization's members. But many cognitive capabilities are not so easy to articulate explicitly or transfer to others.

"What has become decisive for the organization of decisions and the direction of change is the centrality of theoretical knowledge – the primacy of theory over empiricism and the codification of knowledge into abstract systems of symbols that, as in any axiomatic system, can be used to illuminate many different and varied areas of experience" (Bell, 1973, p. 38).

Knowledge reproduction has long depended on the "master-apprentice" system or inter-personal transactions among members of the same profession or community of practice. These means of reproducing knowledge still remain at the heart of many professions, but they can easily fail to operate when social ties or contact is broken between older and younger generations and when professional communities lose their capacity to act in stabilizing, preserving and transmitting knowledge. Then reproduction stops and the knowledge in question is in danger of being lost. Codification that involves the exteriorization of memory might be a solution to this problem. This means that knowledge is detached from the individual, and the memory and communication capacity created is made independent of human beings, at least as long as the medium upon which the knowledge is stored is safeguarded and the language in which it is expressed is remembered.

Codification consists in translating knowledge into symbolic representations so that it can be stored on a particular medium. Choo (1998) writes: "Drawing out tacit knowledge requires taking a mental leap, and often involves the creative use of a metaphor or analogy."

Here advances in information technology-based recording methods are crucial, for they allow representations of knowledge to progress from a "preliterate" stage with gestures and words, to the "literate" with writing and drawing, and then to "post-literate" stages of modeling structured interactions. But what is expressed and recorded is not complete knowledge. It is more of a learning program that helps to stabilize and reproduce knowledge (David and Foray, 2002). In more complex cases the codified knowledge will provide only partial assistance. Knowledge reproduction will then occur through training, practice and simulation techniques, as is the case for pilots and surgeons.

### *c) Knowledge creation*

Knowledge creation is stimulated by a situation that identifies gaps in the existing knowledge of the organization. Such gaps stand in the way of solving a technical or task-related problem, designing a new product or service, or taking advantage of an opportunity. Choo (1998) uses a general metaphor for knowledge creation that is "looking across many levels". It means that new knowledge is created by sharing and shifting knowledge across many organizational levels, including individuals, groups and other organizations. Knowledge creation is also achieved through recognizing the synergistic relationship between tacit and explicit knowledge and through the design of social processes that create new knowledge by converting tacit knowledge into explicit knowledge.

Nonaka and Takeuchi (1995) propose a model in which the knowledge-creation process in an organization develops through the following five phases: sharing tacit knowledge, creating concepts, justifying concepts, building an archetype and cross-leveling knowledge. The knowledge creation takes place

when team-based concepts are combined with existing data and explicit knowledge.

New knowledge is the outcome of the continuous interaction between cultural, tacit and explicit knowledge. Cultural knowledge supplies the assumptions and beliefs with which people explain reality and recognize the importance or value of new knowledge. Tacit informal knowledge often provides the creative impetus that drives the beginning of a new idea or concept, whereas explicit formal knowledge is in a form that can be tested and implemented in models or prototypes. The results of knowledge creation are new innovations or an expansion of the organizations capabilities. It is interesting that von Krogh (2000) argues that care is one of the key enabling conditions for knowledge creation processes. He identified five dimensions of behavior in relationships that emphasized care: mutual trust, active empathy, access to help, lenience in judgment and courage. He believed that low care organizations have difficulty in knowledge integration/creation processes especially with respect to tacit knowledge. In such organizations individuals are likely to try to retain as much knowledge as possible for themselves and the common form of knowledge exchange will be transactional. In high care knowledge creation processes, individuals will share their knowledge, and the common form of knowledge exchange will be indwelling which involves joint commitment. A norm such as "the patient comes first" is one example of a norm or a principle that motivates a medical collective to perform as good as possible and share knowledge among themselves. This norm can be described as a motivating principle that is indwelling.

#### *d) Knowledge conversion*

Knowledge conversion in an organization starts with an individual. The first stage is socialization, which is where tacit knowledge starts its path towards becoming explicit as it is communicated outward. The second stage is externalization, where the tacit knowledge becomes explicit within the organization. A third stage is combination. During combination the explicit knowledge is individually internalized based on the relative context of that person's own knowledge and beliefs. The final stage in knowledge conversion is internalization. This is where the individual creates new tacit knowledge by reassembling explicit knowledge. During knowledge conversion the organization continuously creates new knowledge through conversions between the personal, tacit knowledge of individuals who develop creative insight and the shared, explicit knowledge by which the organization develops new products and innovation. Tacit knowledge is shared and externalized through a dialogue that uses metaphors and analogies. New concepts are created, justified and evaluated according to their fit with organizational intentions. They are tested and elaborated by building archetypes or prototypes. Finally, concepts that have been created, justified, and modeled are moved to other levels of the organization to generate new cycles of knowledge creation.

*e) Knowledge building*

Leonard Barton (1995) suggest the following knowledge building activities: shared problem solving, experimenting and prototyping, implementing and integrating new processes and tools, and importing knowledge from outside. When it comes to the last activity he distinguishes between external knowledge that is technical in nature and knowledge about the market. The key to importing technological knowledge is for the organization to expand its absorptive capacity by scanning broadly and continuously for technical opportunity and by identifying employees who can act as technological gatekeepers. Knowledge about the market might generate new products. This is a challenge when the technological potential outstrips users ability to understand it. During the activity of shared problem solving, employees with different specializations and problem-solving approaches are brought together so that the diversity of their knowledge and background can be channeled toward creative problem solving. Diversity is an important and widely discussed concept. But in real life it often seems difficult to achieve diversity in groups and organizations. As people become highly skilled they develop individual "signature skills", which are formed from their specialization, cognitive style preferences, and preferences for particular tools or methods. Bringing all these people with diverse signature skills together to work on a problem often generates an environment that can be fertile for innovations. When integrating and implementing new methods and tools proprietary knowledge is introduced along with process tools and methods that improve internal operation. To ensure successful implementation, user involvement is essential in these projects since the future users of the tool will have critical information that must be integrated during design. Through the activity of experimenting and prototyping the organization extends its existing capabilities as well as building new capabilities for the future. And "intelligent failures" often provide valuable lessons. Both technical knowledge and knowledge about the market can be imported to enhance the innovate capabilities of the organization.

*f) Knowledge linking*

The strategic knowledge of any organization lies in its long-term, knowledge-generating capabilities, which it has built up over time. These capabilities are the result of the quality of its internal network of people, skills, communications, information resources, cultural norms and the quality of its external network of relationships with customers, suppliers, distributors, information sources, and other associates. These networks are not always easy to build and they are definitely not easy to keep alive. Knowledge-linking (Badaracco, 1991) between organizations is another way to work to acquire new knowledge. Knowledge links are defined by four traits. First the central objectives of knowledge links are learning and creating knowledge. This may be contrasted with product links, where the main goal is to provide access to a new

product or open up to wider distribution of an existing product. Second, knowledge links are more intimate than product links since they require relations between people who have a stake in what happens. Third, knowledge links can be established with a wide range of partners not necessarily within the same industry. Fourth, knowledge links have a greater strategic potential than product links. Knowledge links can extend or enhance an organization's basic capability whereas product links tend to be more tactical allowing the organization to catch up or defend its position. In knowledge linking the organization forms intimate learning alliances with other organizations in order to transfer knowledge that is embedded in the specialized relationships, work cultures and operating styles of the partner organization. The goal is to enhance the knowledge-density of the networks. The creation of knowledge is no longer the activity of an organization working in isolation, but the collaborative result of its members working closely in internal groups and in partnership with other organizations.

Four conditions are often necessary for the exchange and combination of knowledge or intellectual capital. 1) The opportunity to make the exchange and combination must exist. 2) Parties involved in the exchange and combination must expect some value from the exchange. 3) Parties involved in the exchange and combination will be able to appropriate or realize some of the new value created by the engagement. 4) The capability to combine information or experience must exist.

But the migration of knowledge between organizations continues to pose many challenges. Inter-organizational collaborations depend on the alliance or the governance structure of the agreement between the partners. Equity joint ventures will lead to a higher degree of knowledge sharing than contract-based alliances. In a project that both parties have invested money they are probably more likely to share knowledge compared to in a project that is loosely put together and formalized by a few words on a paper. Then the internal capabilities, nature of knowledge, collaborative strategy, bargaining powers, management processes and network structure of the partners influences the outcome of knowledge linking. A significant amount of knowledge is still being transacted in the form of specific pieces of equipment, software, blueprints, documents and the like. Such prefabricated knowledge tends to have short life spans and is often exchanged for operational or tactical reasons.

In chapter one I emphasized the importance of technology in the practice of trying to manage knowledge in organizations and society. I wrote that in the knowledge society we invest in people using new information-and communication technology. We hope that these investments will make it possible for knowledge workers to exercise their knowledge in a more brilliant way that is supposed to create values both in society and organizations. And in several of the above mentioned dimensions of the practice of managing knowledge technology often plays an important part. But the concept technology is often used in a confusing way.

## 2.2 Technology

In this section I will briefly address definitions of a technology, and the difference between an information management system and a knowledge management system.

### 2.2.1 Technology as human artifacts, produced and reproduced through human action

A "technology" can be physical objects or artifacts, activities or processes, what people know or what they do; one example is the "know-how" that goes into operating a device in the operating room (Bijker, Hughes and Pinch, 2001). A technological project is thus never technological first and foremost (Latour, 1996). There is always an idea behind a technology. But there is also often confusion between this idea and situated action. This is because implementing technology directly into a knowledge worker's daily life influences established patterns of action. Tools, like computerized patient records for example, might confuse employees, alter social relations and manipulate cognitive abilities. They might even change the ease of solving a problem (Norman, 1993).

During the last decades information technology has been conceived as an ensemble of artifacts, skills, applications and infrastructure that carry social meanings (Kling and Scacchi, 1982; Kling and Iacono, 1989; Markus and Robey, 1988). The functions of these technical systems are not predetermined but evolve within specific, socio-political contexts. In light of structuration theory (Giddens 1979, 1984) and social constructionism, technologies can be seen as human artifacts, produced and reproduced through human action, which both constrain and enable human action (Orlikowski and Robey 1991, Orlikowski 1992). A computerized patient record is an example of what is called collaborative information technology (Karsten, 2000) or enabling technologies (Applegate, 1994). The technology in itself is not collaborative but it has collaborative work as the purpose for its implementation and use. These kind of technologies have also been discussed as arenas for social experience or as "social technology" (Sproull and Faraj, 1997).

The trick when designing technology is to provide situations that minimize error, that minimize the impact of error, and that maximize the chance of discovering error once committed. With properly designed tools, experts use them subconsciously, automatically. Ideally the tools, the person, and the task seem to meld into a seamless whole (Norman, 1993, p. 34). I have already written that a knowledge worker functions by creating mental models and explanations of the things he or she interacts with, and if the technology does not provide the information required to create a proper model or explanation, he or she may create an improper one. Appropriate tools should therefore be designed by starting with human needs working with those who will

be using the tools to fashion them into the most effective instruments for the task.

A common activity in the practice of managing knowledge is to implement an information management system or a knowledge management system.

### 2.2.2 An information management system vs a knowledge management system

I have viewed an information system as a system that consists of at least one person, who faces a problem within some organizational context, for which he or she needs some information to arrive at a solution, and that information is made available to her through some mode of presentation (Boaden and Lockett, 1991). This mode of presentation is often some sort of information or communication technology.

A knowledge management system goes one step further. It is an information system designed specifically to facilitate codification, collection, integration and dissemination of organizational knowledge (Alavi and Leidner, 1999). A typical knowledge management system involves a database, a cataloguing system, version control, document access control, a user-friendly search and navigation capability, and a possible variety of advanced features such as e-mail notification or commenting.

Because a knowledge management system involves the cataloging of knowledge for later reuse, most knowledge management systems today have been developed to enhance the efficiency of a work process. But to do so technology must be implemented with sensitivity to the nature of this work and its practitioners (Davenport, Jarvenpaa and Beers, 1996). However, there are difficulties inherent in developing and analyzing the need for knowledge management systems because of the complexity of many of the tasks involved in the processes of knowledge creation and use (Sheng et al., 1989/1990), and because knowledge workers often resist the codification of their expertise (Hansen et al., 1994).

Now I have reported on a major part of the theoretical framework that I will use in this thesis. I have written that I have decided to view a knowledge worker as a person that uses mental schemes and representations when making sense of certain situations that craves a decision on how to act. One way to try to manage knowledge is to implement technology into a knowledge workers daily work life. We may try to influence how a knowledge worker exercises his or her knowledge through implementing an information management system or a knowledge management system. This is part of what I name the practice of managing knowledge. In addition to this I also sort the practice of managing knowledge into the following six categories: mobilizing, codifying, creating, converting, building and linking knowledge. But when exercising his or her knowledge a knowledge worker exists in a certain context or organizational setting. This setting is organized or structured in a certain way.

The purpose of the next section is to offer a preliminary exposition of what structuration theory is and Giddens's ideas of how an organizational setting is structured. Structuration theory belongs to social theory. I will report about what position it takes when it comes to relationships such as system – organization – institution, agency – structure and time – space – body. Finally I will enumerate and describe the key concepts in structuration theory that I have included in my theoretical framework. This chapter concludes with a section that integrates ideas about knowledge management with structuration theory.

## 2.3 Giddens's structuration theory

"Sociology for me is not only about the big institutions, such as governments, organizations, business firms or societies as a whole. It is very much about the individual and our individual experiences. We come to understand ourselves much better through grasping the wider social forces that influence our lives." (Anthony Giddens, published at [www.polity.co.uk](http://www.polity.co.uk), a leading social science and humanities publisher.)

This quotation helps identify one reason for integrating ideas about knowledge management with concepts from Anthony Giddens structuration theory in the theoretical framework that I use as an analytical tool in this thesis. Structuration theory concerns itself with the social forces that influence our lives and these forces interest me. In the same article Giddens continues: We live in a world of quite dramatic change. There are three major sets of changes happening in contemporary societies and it is the task of sociology to analyze what they mean for our lives today. First there is globalisation. The second big influence is that of technological change. Information technology is altering many of the ways in which we work and in which we live. The nature of the jobs people do, for example, has been transformed. The third fundamental set of changes is in our everyday lives. Our lives are structured less by the past than by our anticipated future.

When searching for a suitable theoretical framework I also thought that integrating knowledge management with structuration theory fits well with my theoretical purpose, which is to develop concepts and relations between concepts about how a knowledge workers exercise of knowledge might be influenced by and influence knowledge management activities. Giddens does not really discuss knowledge as a resource that structures an organizational setting in his structuration theory. And originally he treated technology only as an allocative resource used to coordinate and control material objects. But combining structuration theory with knowledge management makes it possible to use Giddens meta-theory to analyze and theorize about how knowledge in an organizational setting, such as the anesthesia and intensive care clinic,

structure and is structured and implications of implementing a computerized patient record into this setting. I will elaborate further on this under the heading Integrating structuration theory with knowledge management, which is the fourth section in this chapter.

Structuration theory (Giddens, 1979 and 1984) is one of Giddens's contributions to social theory. The main concern of social theory is to construct and/or rework conceptions of human being and human doing, social reproduction and social transformations. According to Giddens, the best and most interesting ideas in the social sciences (a) participate in fostering the climate of opinion and the social processes which give rise to them, (b) are in greater or lesser degree entwined with theories-in-use which help to constitute those processes and (c) are thus unlikely to be clearly distinct from considered reflection which lay actors may bring to bear in so far as they discursively articulate, or improve upon, theories-in-use (1984, p. xxxiv). Giddens points out that theories and findings in the social sciences are likely to have practical and political consequences regardless of whether or not the sociological observer or policymaker decides that they can be "applied" to a given practical issue (1984, p. xxxv).

The sociologist studies phenomena that are already constituted as meaningful. The condition of getting into this field is getting to know what actors already know, and have to know to "go on" in the daily activities of social life. Then the concepts that sociological observers invent are "second-order" concepts. They presume certain conceptual capabilities on the part of the actors to whose conduct they refer. But it is in the nature of social science that these can become "first-order" concepts by being appropriated within social life itself. It means that theories in the social sciences often are based upon ideas that are already held by the agents to whom they refer.

In his book *The Constitution of Society* Giddens characterizes two major schools of sociological research: those predominantly concerned with *structure* and those predominantly concerned with *agency*. Structuralists and functionalists (Marx, Parsons and Levi Strauss) have largely given explanations of social behavior in terms of structural forces which constrain people to do things in particular ways. Other traditions in sociology (hermeneutics and phenomenology) have concentrated on the human being as the primary actor in, and interpreter of, social life. Giddens deplores and disapproves of the way these researchers focus on either social structure or the individual. Instead he tries to bridge the gap between these two in his structuration theory. Structuration theory is based on the premise that this dualism can be reconceptualized as a duality – "the duality of structure".

Structuration theory is also a constructionist theory. It holds that humans are social constructs and that their institutions of all sorts are constructs upheld by humans acting according to their images of what reality is. Giddens sees structuration as not external to the individual but as interdependent with the individual. One of the many things that Giddens tries to grasp in his theory about structuring, and the one that interests me in connection with this

thesis, is that our life passes in transformation and structure is more of a process than a steady-state phenomena. At the same time, Giddens also emphasizes the routinized character of every day life. He thinks that the enactment of routines minimizes unconscious sources of anxiety in day-to-day social activity. Routinized practices are the prime expression of "the duality of structure". Proceeding from the social sciences, and what I have written above, I conclude that the basic domain of study in structuration theory, is the experience of the individual actor and *social practices*. Social practices are accomplished by knowledgeable human agents with powers to make a difference, according to Giddens. These agents have a capacity for self-reflection in day-to-day interaction, a practical, often 'tacit' consciousness of what they are doing and an ability under certain circumstances to do it.

However, social practices are not random and purely voluntaristic, but ordered and stable across space and time, in short routinized and recursive. In producing social practices, which make up the visible patterns which constitute society, actors draw upon "structural properties" (rules and resources) which are themselves institutionalized features of societies. Structure is therefore activity-dependent. It is both the medium and outcome of a process of "structuration" – the production and reproduction of practices across time and space. This process is what Giddens has called the "double hermeneutic", the double involvement of individuals and institutions. "We create society at the same time as we are created by it" (Giddens, 1984, Sjöstrand, 1985). I repeat that the "double hermeneutic" is Giddens conceptualization of the "mutual interpretive interplay between social science and those whose activities compose its subject matter" (Giddens, 1984 p. xxxii). He wrote that "all social actors, it can properly be said, are social theorists, who alter their theories in the light of experience" (Giddens, 1984 p. 335). And all social theorists are likewise actors.

The sociologist studies phenomena which are already constituted as meaningful. The condition of entry to this field is getting to know what the actors already know about how to "go on" in the daily activities of social life. In the agent's reflexive monitoring of his or her conduct, Giddens favours three levels of consciousness, consisting of discursive consciousness (what the agent can express of his motivation and rationality), practical consciousness (what the agent is aware of without being able to express) and unconscious motives/cognition. Then Giddens formulates a conception of day-to-day living as involving "an ontological security expressing an autonomy of bodily control within predictable routines" (Giddens, 1984 p. 50).

I also want to emphasize that I support the notion that the social scientist is a communicator, introducing frames of meaning associated with certain contexts of social life to those in others. Therefore it is of value to keep in mind that literary style is not irrelevant to the accuracy of social descriptions. In addition to this, it is important to be sensitive to the complex skills which actors have in co-ordinating the contexts of their day-to-day behavior. Social life may often look predictable in its course. But its predictability is in many

of its aspects “made to happen” by social actors. It does not happen in spite of the reasons they have for their conduct. If the study of “unintended consequences and unacknowledged conditions of action” is a major part of social research, it is nonetheless important to stress that such consequences and conditions are always to be interpreted within the flow of intentional conduct.

Finally, a social analyst should also be sensitive to the time-space constitution of social life. Analyzing the time-space coordination of social activities means studying the contextual features of organizational settings through which actors move in their daily life and the regionalization of settings stretching away across time-space. Such analysis is inherent in the explanation of time-space distancing and in the examination of the heterogeneous and complex nature assumed by larger societal totalities and intersocietal systems in general.

I will now single out three relationships in structuration theory that I have found important: system – organization – institution, agency – structure, and finally also time – space – body.

### 2.3.1 System-organization-institution

In general sociology is macro (concerned with societies) or micro (concerned with the social relationships of individuals). Giddens has much to say about both, but little directly to say about organizations or groups of people that normally are the unit of analysis for a researcher of management, organization, institution or information system. When Giddens does mention them he tends to do so in a way that implies that they fall within the scope of his theory without special conditions.

Organizations are collectivities in which the reflexive regulation of the conditions of system reproduction looms large in the continuity of day to day practices. They depend on ‘the collation of information which can be controlled so as to influence the circumstances of social reproduction’ (Giddens, 1984, p. 200).

Instead of using the word organizations Giddens uses the word systems and they are conceptualized as “patterns of relations in groupings of all kinds, from small, intimate groups, to social networks, to large organizations” (1984, p. 131). That is, it is the patterns of enacted conduct, the repeated forms of social action and interaction, or the “enduring cycles of reproduced relations” that form social systems. Systems could be families, communities, or cities, either at the face-to-face level or existing via networks over time and space. The networks associated with print or electronic communication, or occasional person-to-person meetings associated with conventions or conferences, are examples of systems that have become more common today with the development and expansion of communication and transportation.

I think that Giddens systems can be compared to the way Zander and Kogut (1995) conceptualize organizations as social communities which use their relational structure and shared coding schemes to enhance the transfer and

communication of new skills and capabilities. An organization is distinct from a market because coordination, communication, and learning are situated not only physically in locality, but also mentally in an identity (Kogut and Zander, 1996). Kogut and Zander argue that this identity may improve coordination, communication and learning. It is critical in creating a dialogue through which information and solutions are discovered. The capabilities of any organization lie in the organizing principles by which individual and functional expertise is structured, coordinated and communicated.

Organizations can also be described as constructs that constitute arenas for interaction processes (Sjöstrand, 1997). In organizations individuals come together because each want to perform some act and need the other person to do certain things in order to make this performance possible. In an organizational setting people interact with each other and the institutions surrounding them when constructing their every day work life and tools to use. This life possesses a situated structuredness. Situations envelop, enclose and capture their participants and all situations have emergent, unforeseeable properties and dimensions.

In organizations personal knowledge can be transmitted because a set of values are learned, permitting a shared language by which to communicate (Berger and Luckmann, 1966). This language provides a normative sanction of how activities are to be organized or what information to be collected and evaluated. Social integration then refers to face-to-face reciprocities between agents who meet in circumstances of co-presence, and therefore preserves a concern for *praxis in situ*, and system integration refers to reciprocities between absent agents, i.e. agents who are physically and/or temporally situated in different settings, which admits the possibility of inter-situational articulations of systemic patterns (Giddens, 1984).

### 2.3.2 Agency-structure

Agency and structure are concepts that often are widely discussed and intimately related to the debate about subjectivism and objectivism. Sewell (1992) notes that structure is actually one of the most important and most elusive terms in the vocabulary of current social science. In this study, I use Giddens's conceptualization of agency and Sewell's conceptualization of structure. Agency, according to Giddens, refers not to the intentions people have of doing things but to their capability of doing those things in the first place. Agency concerns events of which an individual is the perpetrator, in the sense that the individual could, at any phase in a given sequence of conduct, have acted differently. Therefore the reflexive monitoring of activity is a chronic feature of everyday action and involves the conduct not just of the individual but also of others. This means that actors not only monitor continuously the flow of their activities and expect others to do the same. They also routinely monitor aspects, social and physical, of the contexts in which they move.

Social systems and the structural properties of these social systems are created every day through our thinking and actions. Giddens emphasizes that it is human beings that bring structures to life. Even when we talk we enact a structure. Structures are recognizable because repeated and recurrent. They are seen as a pattern that emerges in human relationships. This pattern shapes what people do. It is inherent in structuration theory that people create the structures that shape them and these emerge and evolve over time. What agents know about what they do, and why they do it, their knowledgeable ability as agents, is largely carried in practical consciousness. Practical consciousness consists of all the things that actors know tacitly about how to “go on” in the contexts of social life without being able to give them direct discursive expression.

Human agency, in Giddens formulation, is the “capacity to make a difference” (Giddens, 1984, p. 14) – (also known as transformative capacity). It is intimately connected with power – in fact this is one of its defining characteristics since the loss of the capacity to make a difference is also powerlessness. In practice, human agents almost always retain some transformational capacity though it be small. I will write more about Giddens view of power in the last section in this chapter.

Giddens defines structure as: rules and resources, recursively implicated in the reproduction of social systems. Structure exists only as virtual memory traces, the organic basis of human knowledgeable ability, and as instantiated in action (1984, p. 377). William Sewell (1992) criticizes Giddens definition of structure and writes that some resources cannot be virtual. Instead Sewall defines structure as schemas with a purely virtual existence supported by resources that are the media and the outcomes of the operation of structure. Giddens uses the concept of structures to get at relations of transformation and mediation that are the “circuit switches” underlying observed conditions of system reproduction. He suggests that an explication of virtual structures requires examining actor’s knowledge (memory traces), their social practices (organized through the recursive mobilization of that knowledge) and the capabilities implicated in the production of their practices.

For Giddens, structure refers to practices that are structured along certain lines. These are:

- Procedural rules – how a practice is performed
- Moral rules – appropriate forms of enactment of social action
- Material resources – means of production, commodities, income, consumer and capital goods
- Resources of authority – how time and space are organized, production and reproduction, social mobility, legitimacy and authority

The value of Giddens’s systems and structures is to provide a means of bridging the structure-agency gap, focusing on systems and structures as patterns

of enacted conduct. At some level we may consider these as existing apart from the individual, but if social action and interaction were to end, it is clear that social structures would no longer exist. What I like about Giddens's structures and systems is that they seem to be dynamic and not closed, so that they can accommodate many different forms of power and social change.

### 2.3.3 Time-space-body

Giddens writes that in moving from the analysis of strategic conduct to a recognition of the duality of structure, we have to begin to "thread outwards" in time and space. That is to say, we have to try to see how the practices followed in a given range of contexts are embedded in wider reaches of time and space. In brief, we have to attempt to discover their relation to institutionalized practices (1984, p. 297-98).

Time, or the constitution of experience in time-space, is an evident feature of human day-to-day life (Giddens, 1984). Time-space is concerned with the constraints that shape the routines of day-to-day life and put an emphasis upon the significance of the practical character of daily activities, in circumstances of co-presence, for the constitution of social conduct. Giddens defines time-space distanciation as the stretching of social systems across time-space on the basis of mechanisms of social and system integration.

Also fundamental to social life is the positioning of the body in social encounters. All social interaction is expressed at some point in and through the contextualities of bodily presence.

The human body imposes limitations upon the capabilities of movement and perceptions of the human agent. The limited capability of human beings to participate in more than one task at once, coupled with the fact that every task has a duration and the fact that movement in space is also a movement in time, influences the outcome of implementing a computerized patient record in a specific organizational setting such as in the operating room. Time-space always has a limited packing capacity. No two human bodies can occupy the same space at the same time. Giddens expresses it so that the body is positioned in the immediate circumstances of co-presence in relation to others. Positioning is to be understood in relation to the seriality of encounters across time-space. It means that every individual is at once positioned in the flow of day-to-day life; in the life-span which is the duration of his or her existence; and in the duration of "institutional time", the "supra-individual" structuration of social institutions. Finally, each person is positioned, in a "multiple" way, within social relations conferred by specific social identities; this is the main sphere of application of the concept of social role. The modalities of co-presence, mediated directly by the sensory properties of the body, are clearly different from social ties and forms of social interaction established with others absent in time or in space (1984 p. xxiv-xxv).

### 2.3.4 The structuring of a setting

The structuring of a specific social setting takes place as actors draw on and make sense of institutional patterns of signification, domination, and legitimation to construct roles and interpret persons, objects, and events in their environment (Giddens, 1984). The diagram below shows how social structure and human interaction are broken down into three dimensions and the recursive character of these dimensions is illustrated by the linking modalities.

Thus, as human actors communicate, they draw on interpretative schemes to help make sense of interactions; at the same time those interactions reproduce and modify those interpretative schemes that are embedded in social structure as meaning or signification. Similarly the facility to allocate resources is enacted in the exercise of power, and it produces and reproduces social structures of domination, and finally moral codes (norms) help determine what can be sanctioned in human interaction, and in doing so these codes iteratively produce structures of legitimation.

The study of day-to-day life is integral to the analysis of the reproduction of institutionalized practices. Day-to-day life is bound up with the repetitive character of reversible time, with paths traced through time-space and associated with the constraining and enabling features of the body. Giddens treats regularized acts as situated practices. Any action that is repeated frequently by a knowledge worker in an organizational setting, like for example administering anesthesia in the operating room, becomes cast into a pattern, which can then be reproduced with an economy of effort. A social order is created.

Structures	Signification ↔	Domination ↔	Legitimation
Modalities	↕ Interpretative schemes	Authoritative and allocative resources	↕ Norms • for use • for explanation
Interaction	↕ Communication ↔	Exercise of power ↔	↕ Sanctions

Figure 2.1 Basic concepts and relationships of structuration theory (From Giddens, 1984)

To create a social order around a way to work is an ongoing human production and a way to save energy. It is a way to establish a structure.

### 2.3.5 Key concepts

I have included the following concepts from structuration theory in the theoretical framework used in this thesis:

#### 1) *Structure*

Giddens defines structure as rules and resources, recursively implicated in the reproduction of social systems. Structure exists only as virtual memory traces, the organic basis of human knowledgeability and as instantiated in action (1984, p. 377). I have already pointed out that William Sewell (1992) criticizes Giddens definition of structure and writes that some resources cannot be virtual. Instead Sewall defines structure as "schemas with a purely virtual existence and resources are media and outcomes of the operation of structure". I use his definition since as an example material resources such as blood cannot be considered virtual since material things by definition exist in space and time. Schemas are defined by Sewell as "generalizable procedures applied in the enactment/reproduction of social life". Structure is dynamic, not static; it is the continually evolving outcome and matrix of a process of social interaction. Even the more or less perfect reproduction of structures is a temporal process that requires resourceful and innovative human conduct. But the same resourceful agency that sustains the reproduction of structures also makes possible their transformation. If resources are effects of schemas, schemas are effects of resources. Schemas not empowered or regenerated by resources would eventually be abandoned and forgotten just as resources without cultural schemas to direct their use would eventually dissipate. Sets of schemas and resources may be said to constitute structures only when they mutually imply and sustain each other over time (Sewell, 1992).

#### 2) *Signification*

Signification has to do with what theory of coding exists. A theory of coding is the product of symbolic orders or modes of discourse. The signification structure is linked to organizational interaction by different kinds of interpretative scheme. These schemas are the cognitive means by which actors makes sense of what others say and do.

#### 3) *Domination*

Domination has to do with what theory of resource authorization, and theory of resource allocation that exists. Economic institution and political institution decide resource allocation and authorization. The domination structure deals with various ways of exercising power using different types of resources.

#### 4) *Legitimation*

Legitimation has to do with what theory of normative regulation exists and what legal institution constitutes the institutional order. The legitimation structure involves the moral constitution of interaction and is mediated through norms and moral codes which sanction particular behaviours.

#### 5) *Interpretative schemes*

By interpretative schemes Giddens mean standardized elements of stocks of knowledge applied by actors in the production of interaction.

#### 6) *Resources*

Resources are of two kinds: authoritative resources, which derive from the co-ordination of the activity of human agents, and allocative resources, which stem from control of material products or of aspects of the material world. Authoritative resources refer to types of transformative capacity generating command over persons and actors. Allocative resources refer to capabilities and to forms of transformative capacity generating command over objects, goods or material phenomena. Resources are the media whereby transformative capacity is employed as power in the routine course of social interaction; but they are at the same time structural elements of social systems as systems reconstituted through their utilization in social interaction.

#### 7) *Transformation*

All social rules (codes and norms) are transformational. To say that mental schemas are transformational is to say that they generate an indefinite range of empirical contents, which have an identity with one another only in respect to their relation to those rules. The notions of transformation and mediation apply not only to the structuring of interaction in real time-space, they are also essentially involved in analyzing structures themselves. When mediation and transformation are taken together they can be said to concern the convertibility of rules and resources (Giddens, 1984, p. 104).

”What is especially useful for the guidance of research is the study of, first, the routinized intersections of practices which are the “*transformation points*” in structural relations and, second, the modes in which institutionalized practices connect social with system integration” (Giddens, 1984).

#### 8) *Routinization*

Routinized practices are the prime expression of the duality of structure. In the enactment of routines people sustain a sense of ontological security. The

routine (whatever is done habitually) is a basic element of day-to-day social activity. The term "day-to-day" encapsulates exactly the routinized character which social life has as it stretches across time-space. The repetitiveness of activities that are undertaken in like manner day after day is the material grounding of what Giddens call the recursive nature of social life. Routinization is vital to the psychological mechanisms whereby a sense of trust or ontological security is sustained in the daily activities of social life.

In the next and final section of this chapter I will explain about why and how I integrate structuration theory with ideas about knowledge management and the implications of this for this thesis. But first I will recount how Giddens conceptualize knowledge.

## 2.4 Integrating structuration theory with ideas about knowledge management

The concept knowledge is defined by Giddens as memory traces of how things are to be done (Giddens, 1979, p. 64). Giddens also points out that knowledge can be understood in terms of both practical and discursive consciousness. Practical consciousness, which is knowledge embodied in what actors "know how to do", and discourse, what actors are able to "talk about" and in what manner or guise they are able to talk about it (Giddens, 1979, p. 73). Giddens thinks that knowledgeable embedded in practical consciousness exhibits an extraordinary complexity. It is a complexity that unfortunately often remains unexplored in orthodox sociological approaches, especially those associated with objectivism. Actors are always knowledgeable about the structural framework within which their conduct is carried on because they draw upon that framework in producing their action at the same time as they reconstitute it through that action (Giddens, 1979, p. 144). The line between discursive and practical consciousness is fluctuating and permeable, both in the experience of the individual agent and as regards comparisons between actors in different contexts of social activity (Giddens, 1984, p. 4).

Then the concept mutual knowledge stands for a non-corrigeable resource that the social analyst depends upon, as the medium of generating "valid" descriptions of social life. Mutual knowledge incorporated in encounters is not directly accessible to the consciousness of actors. Most such knowledge is inherent in the capability to go on within the routines of social life. Giddens writes that to know a form of life is to be able to participate in it.

Earlier structuration theory has not been used very often in connection with theories about knowledge management but to a certain extent in connection with information systems research, in spite of that Giddens originally considered technology only as an allocative resource. In addition to this structuration theory has often been criticized for being only a meta-theory that requires researchers to specify whatever logic that is appropriate to a specific

phenomena or contexts. Giddens response to this critique is that although structuration theory carry no particular methodological implications it sensitizes the researcher to particular sets of concepts (such as the relationship between action and structure) which might otherwise have been ignored. In this thesis I want to sensitize people to the importance and value of knowledge when an organizational setting is organized and structured. Few researchers, except Orlikowski (2002), have combined structuration theory with ideas about knowledge management. But she writes: With the intensification of globalization, acceleration in the rate of change, and expansion in the use of information technology, particular attention is being focused on the opportunities and difficulties associated with sharing knowledge and transferring best practices within and across organizations.

A knowledge worker acts in a certain context. For Giddens context involves the following: (a) the time-space boundaries (usually having symbolic or physical markers) around interaction strips; (b) the co-presence of actors, making possible the visibility of a diversity of facial expressions, bodily gestures, linguistic and other media of communication; (c) awareness and use of these phenomena reflexively to influence or control the flow of interaction. Social identities, and the position-practice relations associated with them, are "markers" in the virtual time-space of structure. They are associated with normative rights, obligations and sanctions that, within specific collectivities, form roles.

According to Giddens actors employ typified schemes in the course of their daily activities to negotiate routinely the situations of social life. Knowledge of procedure or mastery of the techniques of doing social activity is methodological. That is to say such knowledge does not specify all the situations that an actor might meet with. It provides for a generalized capacity to respond to and influence an indeterminate range of social circumstances.

Giddens use the concept rules and say that they can be intensive, tacit, informal and weakly sanctioned. Rules can also be shallow which means discursive, formalized and strongly sanctioned. He thinks that the structuring qualities of rules can be studied in respect of the forming, sustaining, termination and reforming of encounters (Giddens, 1984, p. 22-23).

As I read Giddens these encounters concern meetings between people. But in this thesis I focus on the meeting between new technology and people that exercise knowledge in a specific organizational setting. I'm interested of how a new technology re-structures what takes place in this setting. Both technology and knowledge can be looked at as resources, but knowledge can also partly be said to consist of rules for how to do things. These rules are also related to interpretative schemes that develop for how to perform certain tasks. Since I do not use Giddens definition of structure as rules and resource but Sewell's definition that structure are schemes and resources, I will look at exercising knowledge as exercising certain mental schemes supported by certain resources.

In this thesis I include knowledge in Giddens model as a phenomena that structure and gets structured. I view both technology and knowledge as a source for social structure, and as consisting of sets of schemes supported by certain resources (Sewell, 1992). Knowledge is part of the structure as mental schemes for how to perform a practice. The signification structure in an organizational setting is linked to the interaction that takes place by different kinds of interpretative schemes. This means that an anesthetist applies a certain amount of knowledge and talk about his or her work in a special way and use certain mental schemes when evaluating situations and taking decisions about how to act. The transfer of knowledge from an individual to a group of people often also occur through the development of a unique language or code which allows group members to learn who knows what and coordinate their activities. This language, code, mental schemes, knowledge frames or thought style, influences and is influenced by what takes place in an organizational setting. I have already written that interpretative schemes make people know how to do things, in this case evaluating the patient. It is also easier to integrate knowledge among a group of people using shared metaphors and logos and a common language. As an example tacit knowledge is more easily shared and externalized through a dialogue that uses metaphors and analogies.

So when exercising knowledge, actors mobilize the existing knowledge in a specific setting to improve a work situation. Here mastery can be described as a generalized capacity to influence a range of social circumstances related to a specific worksituation. Experimenting and prototyping might transform the existing mental schemes and build new capabilities. I view this as a sort of learning that takes place in connection to a project such as in this thesis.

Power is considered as one of several primary concepts of social science, all clustered around the relations of action and structure. Giddens writes that power is the means of getting things done and, as such, directly implied in human action. It is a mistake to treat power as inherently creating discord, but there is no doubt that some of the most bitter conflicts in social life are accurately seen as power struggles. Such struggles have to do with efforts to subdivide resources that yield modalities of control in social systems. By "control" Giddens means the capability that some actors, groups or types of actors have of influencing the circumstances of action of others. The domination structure in an organizational setting deals with various ways of exercising power using different types of resources, in this case knowledge. I believe that what and how knowledge gets codified in a setting depends on how the domination structure looks. Authoritative resources refer to a transformative capacity generating command over people. Giddens thinks that resources, such as knowledge, are the media whereby this transformative capacity is employed as power in the routine course of social action. He writes that the routinized intersections of practices are the transformation points in structural relations and the modes in which institutionalized practices connect social with system integration. Giddens emphasizes that routinization is vital to the psychologi-

cal mechanisms whereby trust is sustained in the daily activities of social life. Care or trust is also one of the key enabling conditions for a knowledge creation process (Von Krogh, 2000). In a situation with no care or trust, there will be no creation or transfer of new knowledge.

To sum up one can say that starting from the formulation of the concept of the duality of IT (Orlikowski, 1992), the use of structuration theory has expanded and increased in richness and complexity. Examples of this are studies on radical changes (Orlikowski, 1993), emergent causality (Robey and Sahay, 1996) and analyses of the time-space dimension (Sahay, 1997; Walsham and Sahay, 1999). Jones (1999) identifies four types of use of the structuration theory in information systems-research: attempts to reconstruct the theory to accommodate technology, application of the theory as an analytical tool, use of the theory as a meta-theory and use of concepts from structuration theory to inform information system research. The application of structuration theory has up to now been largely in the theorizing and analyzing modes; the theory itself (the double hermeneutic) implies that this will feed back into practice. Some researchers have argued that information systems research on structuration should only include a focus on human action; the logic is that we only have to study structuring moves and not technology itself since technology has no independent meaning or force outside of its use (Jones, 1999). However, most technologists find the disregard of technology as artifact, even in the study of structuration, to be too limiting. Instead, technology is seen as one source of social structures (i.e., sets of rules and resources), which are embedded in technology by designers during development and then dynamically changed as users interact with technology.

One can also view *technology as a trigger of structural change* and this model is devoted to the perspective of Barley (1986, 1990) who regards technology as an intervention into the relationship between human agents and organizational structure, which potentially changes it. Orlikowski (1992) and Orlikowski and Robey (1991) were among the first to use structuration theory for studying the interaction between IT and organizations. They proposed the structural model of technology in which the dual nature of IT is at the heart of the structuration process. In this model, organizations are not only shaped by IT but they are also strongly influenced by social and political processes and by the actions of members of the organization. In another study Yates and Orlikowski (1992) offer the theoretical concept of genre in a structural perspective as a useful concept for theorizing communication and media; giving a historical account of the evolution of the memo genre, which traces its links with e-mail. This provides an example of a form of theorizing, in which structuration theory, or concepts from it, are used in conjunction with other theories, and then applied to the IS field.

Now the concern in research is the interplay of people with technology—the structure of human-computer interaction, the structure of systems design and use and the possibilities for somehow improving the human condition through applications of information technology to society. In a field such as

IT often dominated by technical considerations, any informed account of social practices is supposed to and helps to redress the balance. Insight and a richer understanding of social action obtained by theorizing and analyzing may also pass into the store of mutual knowledge that informs and develops IS practice. In response to this development Walsham (1995) has advocated "multilevel" research covering influences at the level of society, organization, and individual. There is also an awareness today that there are inter-linkages in the change process among technology components, individual actions, groups, organizations and larger social activities. The value of structuration theory is that it can accommodate all these multiple perspectives, possibilities and levels of analysis.

## 2.5 A chapter summary

In this thesis I will use a theoretical framework integrating cognitive theories about schema use and mental representations, knowledge management and structuration theory as a tool analyzing the data obtained during the research process. I assume that integrating knowledge management with structuration theory makes it possible to fulfill the overall theoretical purpose of this thesis, which is to develop concepts and relations between concepts about how a knowledge workers exercise of knowledge might be influenced by and influence knowledge management activities. Structuration theory focuses on social practices, the continuous conduct that takes place in time and space.

In earlier research Giddens concept "the duality of structure" has primarily been used to study information systems. But new information and communication technology influences what takes place at many different levels both inside and outside a person and an organizational setting, which can be captured by model 2.1 that shows how an organizational setting is structured. I include knowledge as a resource in this model. I also include it as a mental schema for how to do things which means that knowledge is part of the structure. Giddens defines structure as rules and resources while Sewell defines it as schemas with a purely virtual existence and then resources are the media and outcome of the operation of structure. Giddens thinks that rules have a structuring quality that can be studied in encounters between people. I think that this quality can also be studied in encounters between people and technology.

I assume that integrating knowledge management with structuration theory makes it possible to capture the complexity of what takes place when a knowledge worker threads between transformation and routine in an organizational setting. Giddens writes that the second biggest influence today is that of technological change. Information technology is altering many of the ways in which we work and in which we live. The nature of many of the jobs we do have also been transformed.

In this thesis I explore the encounter between new technology and how knowledge is exercised by a knowledge worker in a specific organizational setting. Using the theoretical framework that I have presented in this chapter makes it possible to contribute to and develop concepts related to both structuration theory and theories about knowledge management.

# Chapter Three

## Methodology, method, research design and process

This chapter describes social constructionism as a way to think about and study social reality. It also gives an account of how I have tried to fulfill the purpose of this study and answer the research questions presented in chapter one. My aim has not been to give a full description and interpretation of all possible implications of computerizing a patient record at a hospital clinic. I do not think that is possible since new information and communication technology might have different implications at different workplaces. As a social constructionist, I believe that the construction process of a patient record looks different at different clinics at different hospitals in different countries depending on who participates in the process. In the rest of the chapter I discuss the choices I have made, why this is an interpretative study and why I have explored three parts of a process at four different sites using interviews and observation. Then I outline how I have analyzed the research material and what I mean by systematic reflection. The chapter concludes with a discussion about quality in interpretative research and a summary of how I have conducted this project.

### 3.1 A view of the world

The overall perspective guiding this research is that we belong to several thinking collectives (*denk-kollektiv*) each characterized by a special thought style (Fleck, 1934/1997) and that parts of our world are socially constructed (Mead, 1934, Blumer, 1969/1998, Schutz, 1953/1962, Berger and Luckmann, 1966/1991, Sjöstrand, 1997). My purpose in this section is not to describe and discuss social constructionism in detail since others before me have done it so much better (Sandberg, 1999). I will just repeat that the common features of social constructionism is a rejection of a dualistic ontology,

of an objectivist epistemology, of the individual as the foundation of knowledge and of language as a mirror of objective reality.

Instead social constructionism regards subject and object as an inseparable relation. In the social construction of reality there is an ongoing dialectical process between subjective and objective reality. It can be described as externalization, objectivation and internalization. During primary socialization we internalize language, greetings and gender, things that regulate the most common activities and interactions among people. Later secondary socialization includes processes in which individuals internalize aspects of reality such as professions. As we increasingly become part of reality through primary and secondary socialization, we begin to reproduce it ourselves. So what is going on in our everyday world is an ongoing reproduction rather than an ongoing production of reality. Reality is mediated through our lived experiences. Our descriptions of phenomena are always colored by our specific historical, cultural and linguistic understanding of reality. Social interactions between people are the primary vehicle for developing this knowledge. And language does not achieve its meaning primarily through a correspondence with objective reality, but rather through the way we socially define and use it. Mead (1934) looks at language as a principle of social organization that has made the distinctively human society possible.

A thinking collective is a group of people exchanging thoughts and ideas. They carry the history of an area of thinking, a certain amount of knowledge and a certain culture among themselves. A thinking collective can be a professional, a national or a political group of people that act within a certain framework. Normally humans belong to several thinking collectives and sometimes they overlap. When writing this thesis I have belonged to the Department for Organization and Management at the Stockholm School of Economics. The school in itself is another collective that has influenced the outcome of this study. I also belong to the modern society and share its faith in efficiency as a goal for its activities and see new information technology as one way to reach this goal. The people I have studied belong to collectives like health care, anesthesia and of course the modern society. When interpreting and reflecting over the results in this study, all these different collectives have influenced me.

Like Searle (1995) I believe that there are things that exist only because we believe them to exist, but there is also a reality that is totally independent of us. What are constructed are certain objects, ideas and words like "facts, truth, reality and knowledge". As an example the patient record is something you can touch, it "exists", but the idea and the specialist domain behind it is socially constructed. Like Foucault (1972) I also believe that the symmetry between subjective and objective reality can never be complete, there is more objective than subjective reality available. The interaction is always asymmetrical in terms of knowledge and power. A person with power can impose his or her construction of a phenomena on others while a person with knowledge, or here I prefer to use the word insight, may question this construction.

To understand what a social construction is one can read Hacking (1999). He discusses how "child abuse" became a socially constructed phenomena. It has always existed but first when people gave the phenomena a name it took on a life of "its own". The same type of construction processes takes place with diseases like anorexia, ADHD, "burn-out", "depression" and so on. They did not "exist" until someone "constructed" them. People might have felt depressed but they did not know what it was that they felt since it did not have a name. Another example of a social construction is the map. A map of the world exists, it is something you can look at and touch but how it looks is a social construction. When you look at a map of the world in Asia the proportions of the world and how the continents are placed are different compared to when you look at one produced in Europe. This is because the map is constructed according to how local people view the world.

Also Polanyi (1969) writes that "no one-scientists included-looks at the universe this way (objective) whatever lip service is given to objectivity. Nor should this surprise us. For, as human beings, we must inevitably see the universe from a center lying within ourselves".

Giddens (1984) and many others believe that a researcher should integrate the micro and macro levels in order to understand how reality is socially constructed. This is because only focusing on face-to-face interaction fails to understand how that interaction is framed by institutionalized contexts of which it is a part, while an approach that focuses on the broader social context and culture fails to recognize how that social context and culture are produced and maintained in our daily face-to-face interactions. Giddens also claims that reality is only partly constructed through discursive practices or "discursive consciousness". Instead he believes that the greater part of the social construction of reality takes place in "practical consciousness". Practical consciousness consists of all the things which actors know tacitly how to "go on" in the context of social life without being able to give them direct discursive expression. Giddens thinks that subjective and objective reality can exist simultaneously. In his view the dialectic relation between subjective and objective reality can be described as a "duality of structure". By duality of structure he means that social structure is both constituted by human agency and yet is at the same time the very medium of this constitution.

The simultaneous dialectic between subjective and objective reality is also the most central feature of Berger and Luckmann's (1966) theory of social construction. In the social construction of reality they see an ongoing dialectical process between subjective and objective reality, which they describe as externalization, objectivation and internalization, as I have mentioned above.

## 3.2 Research design and process

This thesis is the outcome of a personal interest for "the knowledge society", a topic discussed in certain groups and organizations such as the OECD since

the beginning of the 1990's. It is also an outcome of the many discussions about the organizational problems in the Swedish health care sector that took place at the end of the 1990's. From 1996 and onwards, downsizing and reorganizations became a common feature of most health-care worker's daily life. At the same time the possibilities for modern information and communication technology when trying to improve work processes, became obvious. More advanced software and the introduction of internet in 1996 created an IT-boom that spilled over into areas such as healthcare. All these things together, and a personal interest for knowledge per se, are behind this thesis. In the preceding chapter I presented a theoretical framework and now I'm going to report how I have conducted the research process.

The introduction of structurational thinking into information systems research has moved the field from the study of technology to the study of action, from predicting direct affects of technology on people to exploring the recursive shaping of technology and people over time. But there is no single methodological path to the discovery of useful insights into structuration. As Giddens (1984) concedes, "I do not try to wield a methodological scalpel. I do not believe there is anything in either the logic or substance of structuration theory which would somehow prohibit the use of some specific research technique." Some social theorists, including Giddens, have argued that structuration researchers should include ethnography in their program. Others go further to say that only an ethnographic approach to the study of structuration will do (Jones, 1999). At the same time Giddens also admits that quantitative approaches can be useful for the study of structuring moves where many observations or cases are available for analysis and when indicators of structuring moves can be developed. But the more mainstream view of information systems maintains that an insider's view of a social system that is adequate can be captured by means other than ethnography, including interviews or surveys.

In chapter two I wrote that according to social theory social actors are social theorists, who alter their theories in the light of their experiences, and they are receptive to incoming information that they may acquire in doing so. There are no particular logical difficulties in understanding what is going on in such circumstances, even though there may be social barriers to the reception of some scientific ideas. The natural sciences can in principle demonstrate that some of the things that the lay member of society believes about the object world are false, while others are valid. It is more complicated in the social sciences. The findings of the social sciences, as I have emphasized both in the preceding chapter and here, are not necessarily news to those whom the findings are about. Still they can be of value and make awareness and change possible.

So, what I have found is that structuration theory is often used in studies in connection with what is called *adaptive structuration*, *mutual shaping* and/or *actor's organizing*. Adaptive structuration studies try to make sense of the interaction between IT and human action in terms of relationships between

dependent and independent variables while mutual shaping and actor's organizing studies embrace process approaches, as I do. Reviewing research on structuration in IS, one can easily see that while early studies largely adopted a single type of methodology, more recent work combines different types, such as interviews and observation, as I do in this thesis.

### 3.2.1 Four directions of research

Research that is informed by structuration theory can take place in four different ways. These are: (1) hermeneutic clarification of frames of meaning, (2) investigation of context and form of practical consciousness, (3) identification of bounds of knowledgeability and (4) specification of institutional orders, according to Pozzebon and Pinsonneault, 2001 and Poole and DeSanctis, 2002. These four directions of research can be described like this:

1. All social research presumes a hermeneutic moment, but the presumption may remain latent when research draws upon mutual knowledge that is unexplicated because researcher and research inhabit a common cultural *milieu*. Advocates of quantitative research repress the significance of this presumption in two ways. They either take it to be purely descriptive rather than explanatory, or they fail to see that it enters into the formulation of their research work at all. But research concerned with (1) may be both explanatory and generalizing. Research that is geared primarily to hermeneutic problems may be of generalized importance if it serves to clarify the nature of a person's knowledgeability and thereby his or her reasons for action across a wide range of action-contexts. As an example pieces of ethnographic research are not in themselves generalizing studies. But they can become such if carried out in sufficient numbers, that judgements of their typicality can be made.
2. Studying practical consciousness means investigating what agents already know, but it can be illuminating for them if it is expressed by someone else in the metalanguage of social science. Only for ethnomethodology is the analysis of practical consciousness a circumscribed "field" of study. For all other types of research, the interpretation of practical consciousness is nevertheless a necessary element of broader features of social conduct whether this is implicitly understood or explicitly stated.
3. Identifying the bounds of a person's knowledgeability in the shifting contexts of time and space is fundamental to social science. Doing so, however, presumes some experience with (1), (2), and (4). The study of the unintended consequences and unacknowledged conditions of action can and should be carried on without using functionalist terminology. But what is "unintended" and "unacknowledged", in any con-

text or range of contexts of action, is not always such an easy matter to determine.

4. The specifying of institutional orders involves analyzing the conditions of social and system integration via identification of the main institutional components of social systems. The most important institutional forms are those which can be specified as overall “societies”, in terms of designated structural properties. But it is only with many reservations that the main unit of analysis in social science can be said to be a “society”. Institutional orders frequently cross-cut whatever decisions can be recognized between overall societies.

It is in the relation between (1) and (2) on the one hand and between (3) and (4) on the other that a division between what is called qualitative and quantitative methods often is located. A fondness for quantitative methods has long been a trait of those attracted to objectivism and structural sociology. From this type of standpoint, the prime analyzing conditions of social life that stretch well beyond any immediate contexts of interaction is science, and grasping the nature of the institutional components of social life can best be accomplished through classification, measurement and statistical methods. Those who advocate qualitative methods as the foundation of empirical research in the social sciences, on the other hand, emphasize (1) and (2) in order to show the necessarily situated and meaningful character of social interaction. They tend often to be directly hostile to the use of quantitative methods in social science, on the grounds that quantification and the use of statistical method impose a fixity on social life that it does not have.

Once the point of this is fully understood, the idea that there is either a clear-cut division or a necessary opposition between qualitative and quantitative methods disappears. Quantitative techniques are likely to be required when a large number of “cases” of a phenomena are investigated, in respect of a restricted variety of designated characteristics. But both the collection and interpretation of quantitative materials depends upon procedures methodologically identical to the gathering of data of a more “qualitative” sort. (1) and (2) are thus as essential for understanding (3) and (4) as vice versa, and qualitative and quantitative methods should be seen as complementary rather than antagonistic aspects of social research. Each is necessary for the other if the nature of the duality of structure is to be “charted” in terms of the forms of institutional articulation whereby contexts of interaction are co-ordinated within larger social systems.

### 3.2.2 Requirements for a study using structuration theory

I believe that an analysis of structuration in an organizational setting should identify the order of relevant structures that constitute the system. This may involve identification of both potential and active structures. It may also include identification of structures in other systems that make up the context

in which the focal system operates. It should also try to clarify relationships among structures, including complementarities and contradictions between structures, or how one structure supports another or conflicts with another. It must also develop a description of how the social system works. This requires identification of actions that characterize the system's operation and actors interpretive maps. It also requires determining what features of the context influence structuration. It must identify moves or activities by which agents produce and reproduce structures. Referring to the institutional level of analysis, Giddens (1979) labeled them modalities. The impacts of context on structuring moves should be included in the analysis. It ultimately should also shed light on how social context is reproduced or shaped by the process in question.

According to Giddens actors are the intelligent agents in the system and they choose to produce and reproduce structures. Hence we have to account for the roles of human actors in the social system, their positions relative to one another and the expectations and contextual demands on their actions. A structuration study must also undertake a critical inquiry into the power dynamics underlying the structuration process and possible relations of dominance among different classes of actors. Giddens (1984) emphasizes power imbalances which, covered by societal ideologies of rationality or equality, strongly shape structuration, creating relative advantage for certain parties at the expense of other parties and perpetuating preexisting biases in social institutions.

These requirements are the components that make up a fully realized empirical agenda. Working on one single component can produce insights into others. For example, characterizing the structuring moves in microlevel interactions, as I do in this thesis, may lead to identification of additional structures and insights as to how the system operates. And insights into how structuration shapes social institutions may shed light on structuring moves through illuminating constraints. The ideal is to incorporate these multiple and multi-layered analyses into a complex, but coherent, whole when using structuration theory in a research project.

### 3.2.3 Choices in structuration research

There are at least five choices involved when designing a study using structuration theory within information system research.

#### *1) Level of analysis*

The structuration process can be studied on at least three general levels (DeSanctis and Poole, 1994). *Microlevel analysis* attends to the immediate, visible indicators of structures in use. The analysis is based on the specific, visible actions that take place as structures are produced or reproduced by actors. Microlevel analysis seeks to examine production and reproduction of structure

in an immediate, visible venue within the system of interest. Next is the *global level* of analysis, which pulls the microscope away from immediate evidence of human action to examine more persistent production and reproduction of structures across venues. Here, a series of memos or meetings might be studied, or collections of project team activities; or significant cross-organizational transactions might be tracked for a period of time. Finally, the *institutional level* looks at deeply embedded structuration, systems as they occur, over extensive venues and time periods. Any individual researcher should choose a level of analysis that is most relevant to the phenomena and research question of interest. But research on structuration benefits from studies within levels and across levels of analysis.

### 2) *Structural focus*

A second important choice is the focus of the study: Will it concentrate on a *set of related structures*, one or more structures that have rules or resources in common, or will it consider the interrelationship among a *diverse set of structures*? Structures may complement one another or they may oppose one another.

### 3) *Framing*

This choice depends on the ratio of action to structure that the researcher decides to concentrate on. On the one hand, there may be a strong emphasis on *structural influence* on action. In such a study the researcher presumes that structure is the lead player; the focus is on how structure shapes and constrains actions. Other types of studies emphasize the role of *agency* in the operation of structures. How a study of structuration is framed relates to the two general strategies for research on structuration described earlier: the analysis of strategic conduct and institutional analysis. Giddens (1984) argues that these are the two possible frames for structuration research. Thus the researcher has three options with regard to research framing: (a) structure view, (b) actor view and (c) alternating structure and actor views.

### 4) *Dynamics*

This choice concerns the ratio of production to reproduction that the study incorporates. Some studies focus primarily on *change* due to structuration. The alternative is to focus on *stability*, or how structuring processes are contributing to the stabilization of technology or other structures. Of course, it is also possible to consider both change and stability in the same study, giving one or the other primacy.

### 5) Stance

In structuration research there are three important stances. The *positive* stance takes the existence of structuration as given and seeks to explore how it occurs and how it influences use of IT and outcomes for the system. The *critical* stance presumes that power inequalities and ideologies drive structuring processes and seeks to uncover them. The *skeptical* stance is taken by those who believe the utility of structuration as a model is still open for each case. They wish to interrogate each situation in order to determine the utility of the structuration model. Giddens himself takes a critical stance toward structuration.

### 3.2.4 What I do

To fulfill the purpose of this thesis I have performed an interpretative study focusing on three different parts of a process at four different sites. I have used interviews, observation and reading of text, when trying to answer the research questions presented in chapter one. I have described, analyzed and interpreted what takes place. I have alternated between interviewing and observing at the empirical sites and reading and reflecting over what I have found. I have searched for patterns in the empirical data that relate to the purpose of this thesis. Then I have analyzed and discussed the findings using the theoretical framework presented in the preceding chapter. When it comes to dynamics, I focus on transformations due to structuration. The structural focus is on a set of related structures and how they constrain and enable transformations in a specific organizational setting. This means that I try to identify structures (schemas and resources) that are influenced by constructing and implementing a computerized patient record and the relationship between these structures. I try to identify how the social context is reproduced or shaped by the process in question and the power dynamics underlying the structuration process and possible relations of dominance among different actors or agents as Giddens calls them. Most of my study takes place at the micro-level but I also realize that a computerized patient records have implications at other levels in a setting. When using the word multi-level I mean that I investigate what takes place both inside and outside the anesthetist. As an example a mental scheme might be transformed by computerizing a patient record as may resource allocation in the OR or the way an anesthetist moves around in the surgery room.

### 3.2.5 A pilot study

I started this research project 1998 by conducting a pilot study interviewing twenty people. The purpose behind this was to get valuable insight into the health care sector. At the same time I searched for a research question and a project to take on. I interviewed people in many different positions at Karo-

linska hospital, Södersjukhuset, Danderyd's hospital and St Göran's hospital in Sweden. During these meetings I increased my own knowledge about problems related to information and information structures within health care. I tried to find out how employees looked at information and knowledge in their own organization, how they worked with information and knowledge and what problems they saw as important in connection with future change projects related to management of information and knowledge. These interviews resulted in data and information on which the rest of this research project is based. Initially I wanted to follow a process of upgrading and computerizing a patient record at the same hospital. But it soon became obvious to me that it would take too long waiting for the same hospital and clinic to go through with both processes. Instead I decided to study three parts of the process at four different hospitals. Two of the hospitals are in Sweden and the others in Austria and the USA. The four different sites will be described in more detail in the next section.

### 3.2.6 Three parts of a process at four sites

Karolinska hospital in Sweden hosts the main case-study in this thesis complemented with empirical data from three minor case-studies, Allgemeine Krankenhaus in Austria, St Lukes Hospital in USA and Sundebyn hospital in Sweden.

Case studies are common in organizational research and learning. Organizational researchers, as well as medical doctors, use cases to enhance both their own and others knowledge. As an example cases can be used when a researcher wants to explore a social phenomena, an organization, a company or an individual from different angles with different methods like interviews, observation or questionnaires. Then it is possible to analyze the results at several different levels. Case studies into practical knowledge can be pictured as studies in particular localities or efforts to elicit the impact of a certain particular environment and the problems it presents on a phenomena researched. (Janik, 1994) The rigor of a case study is always related to how the actual research and collection of data is conducted. For the researcher one way is to be thorough in documenting and analyzing processes. Careful reporting includes for example how the interviews and other data were recorded and analysed and how the iterative process between data and theory took place and evolved over time.

Walsham (1995) discusses generalizations in studies with interpretative approaches and distinguishes between four types of generalizations: development of concepts, generation of theory, drawing of specific implications and contribution of rich insight. In this project I have tried to contribute rich insight and develop useful concepts. Sometimes it is not possible to generalize from cases but a desire to tell interesting and relevant stories about the problems that arise in a given profession, that help professionals and others to understand their predicaments, might be a satisfying goal.

I think that case studies have particular advantages for research on structuration. They enable researchers to look at a phenomena in depth, which is necessary to unearth the multiple layers of action involved in structuration. Most cases are reconstructions based on interviews and whatever records were deemed appropriate to preserve. Researchers may make site visits to observe meetings or actors' interactions with technology, but such visits often tend to be limited in duration and the resulting data is descriptive (rather than ethnographic). In this thesis a substantial amount of data has been obtained after extensive observations at the different sites. Empirical evidence plays an important role for how the findings in this thesis have been obtained. I will write more about this under the heading "Observation".

Following four sites are included in this study:

- Karolinska hospital – here I have explored how anesthesia is performed and how a patient record is constructed and modified on paper.
- St Lukes – here I have studied the strategy behind computerizing an anesthesia patient record.
- Sundebyn – they failed to implement a computerized patient record in the anesthesia and intensive care units but still some initial implications could be recorded.
- Allgemeine Krankenhaus – here I have investigated implications of computerizing the anesthesia patient record.

Karolinska hospital that is the main case was chosen as a research site because they were constructing a new patient record on paper. I picked Sundebyns hospital near Luleå as a second site, since the anesthesia clinic was the first in Sweden that attempted to implement a computerized patient record. Allgemeine Krankenhaus in Vienna was chosen as a third site since it is the closest clinic that has successfully implemented a computerized anesthesia patient record. They also used the same software as Sundebyn hospital and had the same number of employees. St Lukes have developed a computerized anesthesia information system but not yet implemented it.

A description of the four sites follows:

- Karolinska hospital

Karolinska hospital opened 1940 and has close to 9,000 employees. The first Swedish anesthetist was employed at Karolinska in 1940. Today the hospital has three anesthesia and intensive care units, one at Astrid Lindgren Children's hospital, one at Thorax and one in the main building which is the subject of this project. The main anesthesia and intensive care unit employs around 95 doctors and 140 nurses, totally about 280 people. In December 21, 1998 a Specification of Requirements was produced for a computerized anesthesia and inten-

sive care patient record. At the beginning of 1999 the clinic started the project of constructing a new patient record on paper.

- St Lukes hospital/Jacksonville, Florida.

The Mayo Clinic is a non-profit, self-funding organization in the US, which comprises several hospitals. They are known for receiving very sick patients with serious, complex conditions and preparing them for treatment or surgery more quickly than other hospitals in the US. The Mayos philosophy is to make it possible for a patient to be treated by several specialists at the same time. This means that a patient can meet 6-7 specialists in one day. They may work on a patient separately, or together. This case takes place at St Lukes hospital in Jacksonville, Florida, which is at the forefront when it comes to implementing a computerized information system. The entire hospital has been computerized for five years, and the IT-strategy is to become paperless. The last units to be computerized are the emergency room and the surgery and anesthesia unit. They have more or less the same number of employees as the A/I-unit of Karolinska hospital.

When I conducted interviews and observations at the clinic, they had just finished constructing a computerized patient record. They are trying it out but have not yet decided when to implement it.

- Sundebyn hospital

The Swedish government invested 1.5 billion crowns in Sundebyn hospital, which is the biggest national health care project in Sweden during the 1990's. From the beginning the strategy was to become an "IT-hospital" and "paperless", and the goal was to support all care processes at the hospital with new information and communication technology. Physicians work as anesthesiologists or intensive care specialists. Many different kinds of patients pass through the clinic. The intensive care clinic implemented software specialized for anesthesia, but the implementation was not successful. Eleven physicians and 36 nurses work at the anesthesia and intensive care unit. When I spend a day at the clinic interviewing the two project leaders, they had failed to implement a computerized patient record but could summarize their experiences from this failure.

- Allgemeine Krankenhaus

The anesthesia and intensive care unit of the Heart Thorax at Allgemeine Krankenhaus in central Vienna treats very serious heart patients. When I conducted interviews at the clinic, they employed 32 nurses, 15 physicians, 5 technicians and 3 information technicians. The physicians and the nurses work both as anesthesia and intensive care personnel. The clinic has its own local laboratory, a pharmacy, a local bloodbank, its own server and 15-16 computers. They have had

a computerized patient record since the beginning of the 1990's. They implemented the same software as at Sundebyn.

To sum up, during my visits to all the empirical sites I have been met with friendliness and support. I have had no problems with access. Everybody I asked they have willingly let me interview them and observe them working.

### 3.2.7 Interpretative research

One of the questions I have had to struggle with during the research process is what it means to be an interpretative researcher. How do I justify that my "hunch" or "feeling" that something in the research material is interesting is worth attention? And what do I really do when interpreting what others say or do? I began by searching for other people's descriptions of what interpretation meant. I liked this one: "Interpretation is the work of thought which consists in deciphering the hidden meaning in the apparent meaning ..." (Ricoeur, 1974). My goal as an interpretative researcher must be to investigate, make visible and interpret how others make sense of and interpret what happens to them in their every-day world. People say something but what do they really say? People do things but what do they really do? I am also supposed to interpret texts that I myself have produced after the interviews: "What has to be interpreted in a text is what it says and what it speaks about, i.e. the kind of world which it opens up or discloses" (Paul Ricoeur, 1978/1997). So, I am looking for a world of a group of people, to understand a phenomena. This world also includes myself to some extent. This is because "interpretation does not spring from nowhere; rather, one interprets in order to make explicit, to extend, and so to keep alive the tradition itself, inside which one always remain" (Ricoeur, 1974).

One way to start interpreting a phenomena is to look for and compare similarities and differences. Interpretation becomes possible when we realize that there are several ways to see things. The way we have been taught to see situations is not the only way. Another way to start interpreting a phenomena is to search for an analogy or a metaphor that enhances the interpretation. When the projectleader explained the project of constructing a new patient record on paper as ... this is like squeezing all of the bible into one page ... the word "bible" offered me a perspective on how to think about my project. Alvesson (1993) writes that a metaphor is created when a term is carried over from one system or level of meaning to another, and giving light to some central aspects of the latter. Here the word "bible" provided me with insight into the importance of the patient record and why people even might fight about what should be included in it.

Interpretative researchers normally conduct research using ethnographic or thick descriptions of the world. In ethnographic research the researcher spends at least a year at the research site, close to what he or she studies. Thick description gives the context of an act, states the intentions and meanings

that organize the action, traces the evolution and development of the act and presents the action as a text that can be interpreted (Geertz, 1973/2000). A thin description simply reports facts, independent of the circumstances that surround the action while a thick description goes beyond fact to detail, context, emotion, and web of affiliation and micro-power (Denzin, 1983). My goal has been to give a descriptive account that is so well grounded in observational and interview data that it is possible to understand “what is going on here” and analyse “how things work” (Wolcott, 1994). I believe that a description that is “good enough” can be a diagnosis and also an explanation of what is taking place. Based on this and on personal preferences I have asked, listened, observed and read at four different sites. Then I have been involved in sensemaking and interpretation of the data that I have obtained

### 3.2.8 A few personal remarks

My education, that is relevant to this thesis, is a master of science from Stockholm School of Economics in international business, focused on political risk assessment. I have also studied political science and international politics at the University of Stockholm and cognitive neuroscience at Karolinska Institute. I have personal experiences both from private business and the media and have been able to use these experiences when getting access and insight into what people in this research do and how they live their lives. I have been able to see similarities and differences and what is interesting in the material because of my earlier personal experiences. I think that the value of personal experiences, especially within social research, is of importance for being able to understand and contribute. I have neither worked within health care myself or have any personal relations such as relatives working in this sector. But I thought that was something good and hope that I have been able to investigate what takes place with an outsider’s untainted view.

I admit that it has been a bit bewildering to find my way between journalistic and scientific writing. But from the beginning I decided that I wanted to learn the rules behind producing a thesis and how to write scientifically. I also had to choose between using English or Swedish. I know that I would be able to express myself more easily in Swedish. But English became the obvious choice when I realized that I also want to communicate with researchers in other countries. In this thesis I have written in a rather straightforward manner spiced up with citations. I have tried to be a communicator, as is demanded of a social scientists, but stay within the limits of what is considered academic writing. I do not only want to contribute theoretically I also have an interest in my results being read and taken advantage of by the people concerned. To be able to contribute empirically has been important to me. This has also influenced how I present and discuss these results.

Finally I also want to mention that Karolinska and Huddinge hospitals have recently been merged into one big university hospital, but my empirical description of Karolinska is based on how it looked between 1999 and 2002.

### 3.3 Method/Data sources

In this study I have collected data at the research sites through unstructured and semi-structured interviews, observations and reviews of the different versions of the patient record. Data collection focused on topics such as the production and use of information in this setting and the transformation process connected to constructing a new patient record. I sought information on how the new document looked and why it looked like it did. Data collection and analysis proceeded iteratively with the earlier stages of the research being more open-ended and later stages directed by emerging ideas and concepts such as "the clinical eye" which resulted in that the data collection became more structured.

#### 3.3.1 Interviews

The first interviews were conducted more like informal conversations discussing health care and problems related to information use and information management with many different people. These interviews were open but with certain thematic limitations. The goal was to establish a "community of interpretation" (Sandberg, 1994) When I had a formalized project from April 1999 at Karolinska hospital the interviews became semi-structured and oriented towards answering the research questions in this study.

I look at the outcome of interviews as something that is constructed jointly by the interviewee and myself. The interviews have a purpose but at the same time I'm open to their leading in a direction I didn't expect from the beginning. My role as a researcher has been influenced by my perspective that information and knowledge is important, but at the same time I have been aware that a computerized patient journal is just one of many urgent projects for the employees at the clinic. When I came to the interviews I had a few questions on a paper but never a complete interview protocol. An issue for all interviewers is the balance between passivity and over-direction. I have prior experience of interviewing and know how to handle the imbalances that might appear in a situation of asymmetric information. In this case the employees at the clinic know more about their work and what was going on, but I know more about what I was searching for and the purpose of this research project. As I learned more about how the people I interviewed worked the quality of the interviews improved.

Another important issue in interviewing concerns reporting media since it is vital in an interpretative study to capture in detail what people say and do. In this study I have used a tape-recorder combined with rough but extensive notes during all of the interviews. The interviews have rarely taken more than one hour. In general they have been easy to conduct since most of the employees had often been thinking about some of the things I wanted to discuss with them. I finished all interviews by asking the employees if there was something more they wanted to add.

1) *Interviews at Karolinska hospital*

At Karolinska I started by interviewing management, employees at the human resource department and the computer department. The purpose of these interviews was to collect information about the situation at Karolinska, how the anesthesia patient record was used and why it was upgraded and computerized. I had a meeting with professor Sten Lindahl, head of the anesthesia and intensive care unit, at Karolinska hospital April 28, 1999. He gave me free access to the clinic and told me to participate in any meeting I wanted. We agreed on a long-term project, three years as a beginning, and that I could terminate my research when it suited my purposes. So, I started reading documents about the hospital and the clinic. I met Ingeborg Ignacio, a civil engineer, who described technical aspects of anesthesia and gave me a copy of a letter of intent, dated December 1998, for buying a computerized anesthesia information system. Below are the interviews done at the clinic.

Position	General	About upgraded patient record	Total
Head of the clinic	2		2
Chief anesthetists	5		5
Head nurse	3	3	6
Anesthetists	5	5	10
Nurses	5	5	10
Engineer	1		1
Secretary	1		1
Project Leader	3	3	6

Figure 3.1 Number and character of interviews at Karolinska hospital

September 1, 8, 9, and 30 1999 I interviewed four physicians at the clinic, all of them were heads of different units, asking questions about information, patient records and anesthesia as a profession. I then continued with several meetings with both nurses and physicians at the anesthesia reception desk, central operation and the intensive care unit.

At the beginning of year 2000 I met the projectleader in the project of constructing a new patient record on paper. We met again August 21 the same year for a long interview.

August 22, 2000 I had my first interview with Sten Lindahl, head of the clinic, asking questions about information use in this environment and a reorganization that was going to take place at the clinic. I participated in several meetings at the clinic listening to employees discussing their work. I also interviewed doctor Börje Hallén, who wrote a thesis about a computerized anesthesia record in 1973.

In May 2001 I interviewed employees at plastic surgery and the ear section about their reactions to the upgraded anesthesia patient record. I video filmed anesthesia work during case-induction time May 30, 2001. September 10, 2001 I interviewed the project leader once more. I also interviewed the chief nurse Berit Lundgren and video filmed anesthesia work a second time September 11, 2001. March 21, 2002 I met the project leader at KS the last time.

During 2001 I have also spent four days, May 28, September 17, 19 and October 15 at the anesthesia reception desk observing evaluations of patients and the degree of access physicians had to necessary information. Most of these observations consisted of watching when an anesthesiologist took notes of work practices, how they performed their duties and what they talked about.

2) *Interviews at St Lukes*

At St Lukes I conducted 4 interviews with anesthesiologists, 4 interviews with nurses and two interviews with the project leader for the project of developing a computerized patient record at the Mayo Clinic. I also participated in a meeting for/against a computerized patient record together with employees, the company developing a patient record and people from two university clinics in Florida and Alabama. My questions during these interviews focused on the strategy behind developing a computerized patient record.

Position	General	About the computerized patient record	Total
Project Leader	1	1	2
Anesthesiologists	4	4	8
Nurses	4	4	8

Figure 3.2 Number and character of interviews at St Lukes

The interviews at St Lukes took place December 19-23, 2001.

3) *Interviews at Allgemeine Krankenhaus*

In April 2001 I spent 2 days at the Heart-Clinic of Allgemeine Krankenhaus in Vienna. I interviewed 4 anesthesiologists, 4 nurses, the head of the clinic and the person responsible for computers and technical questions at the clinic. First I met the head of the clinic and he then recommended that I interviewed the person responsible for technical questions. After that I interviewed physicians and nurses working the days I was there. They were picked for their ability to speak English. My questions during these interviews were about the advantages and disadvantages of the computerized patient record. Other questions were about implementation, the support from management, the strategy be-

hind their software choices, the role of a projectleader during implementation, and technical support.

Position	General	About the computerized patient record	Total
Head of the Clinic	1	1	2
Anesthesists	4	4	8
Nurses	4	4	8
Technician		1	1

Figure 3.3 Number and character at interviews at Allgemeine Krankenhaus

#### 4) Interviews at Sundebyn

In September 2000 I spent a day at Sundebyn outside Luleå in north of Sweden. I interviewed the project leader for the physicians and the project leader for the nurses and the rest of the clinic. I asked about what the process looked like, why it looked like it did and why they think that the project failed. Since the project of implementing a computerized anesthesia patient record failed I did not interview any other employees at the clinic.

### 3.3.2 Observation

The results obtained in this project are based not only on extensive interviewing but to a large extent on many different kinds of observations. At Karolinska hospital I have involved myself in observation during case induction, surgery and emergence time to get a feeling for how anesthesia work is performed and how employees use information. Case induction time is when anesthesia is given before surgery starts, emergence time is when it is time to wake a patient and monitor pain after surgery. I have also spent time at the anesthesia reception desk watching the patients and listening to discussions between nurses and doctors both in front of and behind the desk. During evaluations I have been sitting quiet in the background taking notes. After each patient the anesthesist told me what information he or she lacked for an optimal decision about how to act. At Karolinska I have also participated in three meetings when employees discussed their work and what took place at the clinic. I participated in one meeting early in the morning before surgery took place. Then I sat in the operating room and observed and videotaped what took place on two occasions, May 30<sup>th</sup> and September 11, 2001. I observed how they used the patient record during different kinds of activities. One day I also spent at the pain management desk to get insight into how they work with anesthesia and pain management.

At St Lukes I observed one evaluation of a patient. I also spent time and video filmed in the surgery room during surgery of a heart patient. During this

heart operation at St Lukes in December 2001 I noticed how the anesthesiologist Neil Feinglass uses five pages when recording data. Suddenly he drops all the papers on the floor: "*This is what we want to avoid in the future*", he says when he grasps for the papers. It is a stressful atmosphere at the anesthesia clinic and in the OR. It is difficult to get an anesthesiologist to sit down calmly and discuss something. On the wall in the OR there is a big poster that says, "You need a big strong doctor to scare the werewolfe away". Another sign says, "Watch out Santa sees what you do!" I characterize the atmosphere as slightly crude, but at the same time humorous. People in the OR make comments about each other and each other's partners. The conversation around the operation table is full of sexist jokes. Implementing a computerized patient record into this environment has been delayed several times because it involves parallel processes. This means that during a period a physician must write both a computerized patient record, a manual patient record on paper and take care of the patient during often very difficult circumstances, including high risk. The project leader characterizes this as a very "unpleasant" situation. I observed what took place during a morning meeting at the clinic when they planned the work for the rest of the day. I also participated in a meeting between anesthesiologists and the company that developed a computerized patient record. I also observed and took pictures of when they tried to work with the computerized patient record. A picture of this is shown in chapter six. During breaks between operations I spent time with people at the clinic in the room where the employees sit and talk, listening to them discuss work and also use the computers in the computer room.

In Austria I observed how nurses and physicians used the computerized patient record. They showed me how it functions and what was good and bad about it. I observed when a patient woke up in intensive care after surgery. I observed what took place in the computer room and in the room for employees during a break. Sitting behind the reception desk gave me a feeling for how work was planned and coordinated. I also observed the different rooms that the physicians work in and how they learn and teach. The atmosphere is tense and hectic. The first thing that a visitor meet is a big reception desk where many employees run back and forth and ask for the days schedule, answer questions over the phone and search for all kinds of general information. Further down in the corridor is a room where the employees at the clinic rest, drink coffee and sometimes also sleep on a couch. In the same corridor is a room with computers and books. This room is reserved for the technicians, the "computer nerds" as they are called.

At Sundebyn I observed how the clinic looked and listened to some discussions in the kitchen and so on. But I spent only a few hours there when I interviewed the two project leaders. Still it gave me useful insight.

An observation can be open or "hidden" (Holme and Solvang, 1996) A hidden observation takes place when the subject is unaware of the observer. It might result in a truer observation than an open observation, but at the same time it is difficult for the researcher to take notes or video film. Open obser-

vation gives more freedom to the researcher who can walk around, pose questions and investigate how things work in the chosen organizational setting. I decided on open observation. Physicians, nurses and patients at all the sites were informed about what I was doing at the clinic.

From the beginning I decided to keep a certain distance to the phenomena I studied. It is a balance that sometimes is difficult to keep since I got more involved as time passed. Then there is the question of how I influence the research objects and how they influence me. Interviews, observation and interpretation are all based on my perspective that knowledge and information in organizations are important. I have to ask myself if the people I interview are more interested in information as a phenomena because they think that that is what I like? Does the anesthetist document more during surgery because I am watching? Does the project leader demand a computerized patient record because she knows that is what I am interested in? These are questions I have to ask myself in connection with this project.

What an observer observes depends on experience, knowledge and expectations. An observation is always preceded by a theory. There is always a perspective and a problem behind an observation (Popper, 1972, 1994, Chalmers, 1975/1994, Fleck, 1934/1997).

Fleck writes that to see anything at all under a microscope you have to be trained in what to see. You have to know what you are looking for. So I decided what to observe and how it should be observed before I went out observing. How an observer interprets what she sees changes with increased knowledge.

As an observer I have never stopped observing. I have noticed how employees behave when standing outside the office of the secretary, in the coffee-room both at Karolinska hospital, at St Lukes and Allgemeine Krankenhaus. Some of the things I have seen will not be included in this thesis, especially since it is not an ethnographic study, but still it has influenced my view of the organization and the people I study.

For the study of structuration in connection with implementing an information system observations typically consist of videotapes of users interacting with technology, stored logs of human-computer interaction, or records of speech acts made in meetings or documents in which the new information system is discussed. Whether conducted in the field or laboratory, observational studies have the potential to capture social structure in action, as people are observed *in situ*. But observational studies are not ideal like other research methods, they have both strengths and weaknesses.

In general observational studies seem to have the following advantages for those who study structuration: (1) Given favorable observational access, they enable the development and testing of process theories of structuration, which meets an important requirement of structuration research. (2) Again, subject to constraints on access, observational studies do not restrict the constructs that scholars can utilize as much as interviews or archives, which by their very nature represent selections. Although there are likely some restric-

tions on what can be preserved, the right kinds of information are more likely to be preserved since it is the investigator who collects the data rather than a possibly self-interested participant or archivist. (3) Presuming the videotapes, computer log files, field notes, or other data are kept for repeated review, then deeply layered analyses are possible.

But there are challenges as well: (1) Observations alone do not enable the researcher to completely capture the meaning of events for the participants. The observer must deduce what participants think or feel in order to make claims about meaning or interpretations. In view of well-established attributional biases, these deductions seem unlikely to be entirely accurate. Several observational studies have attempted to address this drawback by conducting interviews or surveys of actors. It is also possible to have participants read and comment on any reports or conclusions. (2) There is a tendency for observational studies to focus on micro level aspects of structuration, making it more difficult to see macro level or global dynamics. Few observational studies deal with multiple levels of analysis like I do (for an exception, see Yates, Orlikowski, & Okamura, 1999). (3) While observational studies often have larger sample sizes than case studies, they still employ somewhat restrictive samples compared to experiments or surveys. One important concern is the selection of cases and observations so that they are representative of the phenomena of interest. I solved this problem by focusing on anesthesia work related to the patient record, not anesthesia work in general.

Some observational studies have focused on single structures or sets of structures, but most have considered the inter-relationships among structures, especially the structural potential of information technology and the norms or social routines within the group using the information technology. Action tends to dominate observational studies, with context serving as a backdrop. Change and stability are both considered in characterizing dynamics, but change is the larger component in the ratio since it is easier to identify change in direct observation than to sort out continuities.

### 3.3.3 Reading of text

I have been reading the patient record on paper to see what data and information that is important for an anesthesiologist. Reading has also taken place when comparing changes in the new patient record to the old one. Then I have tried to see how these changes relate to problems in health care mentioned in chapter one. The results in this thesis have been obtained by comparing the old and the new patient record on paper. I discussed the results with the project leader Ingvor Ultenius at KS 21/8 2000, 10/9 2001 and 21/3 2002. In May and September of 2001 I also interviewed nurses and anesthesiologists at the clinic asking for reactions to the new patient record on paper. On all these occasions we were comparing the new and the old document.

### 3.3.4 Analyzing data

Functional and constitutive analyzes, as I have used in this project, complement and support each other to provide a comprehensive picture of structuration processes.

Functional analysis looks at systems from the outside; from the perspective of the observer interested in understanding the factors that cause system behavior and that yield outcomes. Constitutive analysis attempts to get more of an inside perspective on the system, to study the interpretations that give meaning to events and the actions and interactions that constitute the system, its processes and actors responses to exogenous influences. Constitutive analysis is interested of the actions, cognitions, interpretations, feelings, and intentions of the actors.

Constitutive analysis aims to elucidate the processes that constitute the variables, causes and effects that the functional analysis identifies. Each mode of analysis involves a different, complementary approach to the study of structuration. A constitutive analysis takes the functional analysis as a starting point, shows how the system operates in terms of actor-structure interaction, and then adds additional rich detail from the actors viewpoints about these processes. A constitutive analysis is a useful supplement to functional analysis because it reveals the “whole picture” behind seemingly deterministic facts. A constitutive analysis can often help by resolving inconsistencies in causal relations and showing why expected causal relationships do not hold. Although certain aspects of IT implementation can be captured via functional analysis, the unique adaptations and the give-and-take of interaction are generally best understood using constitutive analyzes (Lee, 1999a & b).

**Open coding:** the analytic process through which concepts are identified and their properties and dimensions are discovered in data.  
**Phenomenon:** central ideas in the data represented as concepts.  
**Concepts:** the building blocks of theory  
**Categories:** concepts that stand for phenomenon  
**Properties:** characteristics of a category, the delineation of which defines and gives it meaning.  
**Dimensions:** the range along which general properties of a category vary, giving specification to a category and variation to the theory  
**Subcategories:** concepts that pertain to a category, giving it further clarification and specification.  
**Axial coding:** the process of relating categories to their subcategories, termed “axial” because coding occurs around the axis of a category, linking categories at the level of properties and dimensions.  
**Selective coding:** the process of integrating and refining the theory.

Figure 3.4 Definitions used by Strauss and Corbin, 1998

When analyzing the data I first did a detailed write up of the interviews mentioned earlier in this chapter. Then I read all the interview transcripts to search for topics, replies and comments that relate to the purpose of this study. During open coding, "the analytic process through which data are fractured, conceptualized, and integrated to form theory" (Strauss and Corbin, 1998), I went through the data searching for concepts such as "the clinical eye".

Strauss and Corbin write that a concept is a labeled phenomena. It is an abstract representation of an event, object, or action/interaction that the researcher identifies as being significant in the data (1998, p. 103). A concept can be developed in terms of specific properties and dimensions. Properties are the general or specific characteristics or attributes of a concept; dimensions represent the location of a property along a continuum or range. Developing a concept has to do with answering questions such as why, when, whom, where, how and where.

When analyzing the data I have alternated between visiting the empirical site, reading the notes, comparing with the theoretical framework and then going back to the notes from interviews and observation. I have compared the cases and searched for a pattern in what I have seen.

My goal during this process has been to establish a clear link between research objectives and findings, and ensure that these links are both transparent (able to be demonstrated to others) and defensible (justifiable given the objectives of the research).

Strauss and Corbin think that beginning analysts should keep in mind that it is not the notion of conditions, actions/interactions and consequences that is significant; rather what is important is discovering the ways that categories or concepts relate to each other. It is not until the major categories are finally integrated to form a larger theoretical scheme that the research findings take the form of theory.

Eisenhardt (1989) lists several strengths from building theory from cases. One is its likelihood of generating novel theory. A second strength is that the emergent theory is likely to be testable with constructs that can be readily measured and hypothesis that can be proven false. A third strength is that the resultant theory is likely to be empirically valid. This is because the theory-building process is so intimately tied with evidence that it is very likely that the resultant theory will be consistent with empirical observation. Intimate interaction with actual evidence often produces theory that closely mirrors reality. Weaknesses of theory building from case studies can include for example that the intensive use of empirical evidence can yield theory that is overly complex. Another weakness is that building theory from case studies can result in narrow and idiosyncratic theory.

### 3.3.5 Systematic reflection

What is normally meant by systematic reflection is the same thing as “philosophy”, a reflective inquiry into how things are. It is considered professional reflection and takes place within the context of an existing body of knowledge, which is formed by personal experiences as well as professional discussions, seminars, books and scientific papers. For me systematic reflection means to go through the research material over and over again, evaluating and reflecting over every statement in the interviews, comparing empirical evidence with theory and trying to get as much as possible out of all the data I have collected.

When reflecting over the data I have interacted with the empirical material through interviews and observation. Then I have interpreted what I have seen relating it to the theoretical framework. I have also tried to be self-critical which means to reflect over my own language (my own text, selectivity, authority).

One way to engage in systematic reflection is to write a journal or take notes in a notebook continuously. Ricoeur’s (1974) uses the term “textualization” for the process by which unwritten behavior, beliefs, values, rituals and oral traditions become fixed, automatized and classified as data of a certain sort. I have written down not only the results from interviews but also other things I have seen and heard at the sites. I have written down personal thoughts and experiences.

In this study I have stayed away from what is called confessional research that takes the idea about self-reflection even a step further. The researcher confesses her reactions and personal development during the whole research project in writing. Confessional research is said to be self-reflexive, self-revealing, self-critical, honest and unflattering by people who like it. It’s opponents, (like Geoff Walsham at Cambridge), characterize confessional research as self-indulgent, disingenuous, manipulative, deceitful and boastful.

## 3.4 Quality in interpretative research

As a researcher I’m supposed to produce research that is valid and reliable. To establish validity requires determining the extent to which the conclusions I have made effectively represent empirical reality and assessing whether concepts that I have identified represent or measure the human experience that occurs. Reliability exists when repeated measurements of a studied phenomena give similar results.

How should I present my conclusions to convince others, both researchers and practitioners, of their validity. “How valid is valid enough”, asks Wolcott in his book “*Transforming Qualitative Data*”. (1994) An interpretative researcher often excuses herself or himself with the words that “this is my interpretation of this phenomena. Someone else might have made another one”. But then

I have to ask myself if what I have done is scientific? And what the difference is between science and journalism or even literature?

A problem in interpretative research is the temptation to reach far beyond the case itself in speculating about its meaning or implications. Wolcott (1994, p. 36) advises new researchers that it is better to err on the side of too much description than too little interpretation. The anthropologist Clifford Geertz thinks (1973/2000) that a good interpretation of anything—a poem, a person, a history, a ritual, an institution or a society—takes us into the heart of that of which is the interpretation. "What we call our data is really our own constructions of other peoples constructions of what they and their compatriots are up to". (Geertz, 1973) Van Maanen (1979) calls the interviewees constructions first-order concepts and the constructions of the researcher second-order concepts.

In an interpretative study truth depends on the perspective taken. One final truth does not exist. Sandberg (1995) writes that achieving truth within the interpretative research tradition is an ongoing and open process of knowledge claims correcting each other. Inspired by Sandberg (1994) and Kvale (1989) I have tried to apply "communicative and pragmatic validity" and "reliability as interpretative awareness" to the results in this study.

- Communicative validity involves establishing an ongoing dialogue in which conflicting knowledge claims are debated throughout the research process. This is done by using a few open-ended questions and discussing them rather than asking at the beginning of the research project to establish a community of interpretation between yourself and the people you study. Oral descriptions of what is important in anesthesia work have been generated and transformed into text. Then when analyzing the descriptions generated, the researcher must communicate with the text in order to achieve descriptions of any value. A third way of validating my interpretations has been through dialogue with other researchers and professionals in the practice being investigated.
- Pragmatic validity involves testing the knowledge produced in action. According to Sandberg (2000) striving for pragmatic validity increases the likelihood of capturing knowledge in action rather than "espoused theories" about what is going on. Pragmatic validity have been achieved by observing the people at work and comparing what I have observed with what they have said in the interviews, and then observing their reactions to my interpretations of some of their statements.

The respondents might validate a theoretical scheme. Participants should be able to recognize themselves in what is being told. To build internal validity one can also search evidence for the "why" behind relationships. Theoretical saturation is achieved when marginal improvement becomes small (Eisen-

hardt, 1989). The final product of building theory from case studies may be concepts, a conceptual framework, propositions or midrange theory. If theory building is the goal, then findings should be presented as a set of interrelated concepts, not just a listing of themes.

- The concept, “reliability as interpretative awareness”, means that a researcher cannot escape from his or her interpretation but must deal with them throughout the research process. I have used systematic reflection to achieve interpretative awareness. For me that have meant giving myself time to go through all my interviews from the beginning, reflecting over what people have said and letting ideas I have had about the material mature. I have also made comparisons with previous research on the same topic and recognized some of the findings.

To address questions of validity and reliability I have used audio and videorecording. I have tried to give a detailed description of the phenomena studied and extracts in the text from interviews. To assess the relevance of results I have used stakeholder checks. They involve opportunities for people with a specific interest in the research to comment on categories or the interpretations that I have made. I have constructed a thesis about what is valuable for the people researched. If they recognize what I have seen as important, I believe that my research has substance.

The fact that no such thing as a definitive, true-for-all-time interpretation exist is no justification for “anything goes”. There is better or worse interpretations. The better ones provide a fuller, richer and more detailed account of what is going on than the weaker ones. They have more substance, live on longer and initiate “recognition” among the researched subjects. They also seem logical and clear. If an interpretation is beautiful and seems obvious, if it is consistent, then it is a good interpretation. Someone has compared an interpretative study to a puzzle – you know when all the pieces fit.

To sum up, to assure the quality in this thesis I have reported within which perspective I have worked. I have given excerpts from interviews in the text. I have participated in seminars with other researchers. I have tried to keep a balance between description and interpretation and I have discussed my own role. I have used audio and video recording of what I have heard and seen. And I have tried to be truthful to the material through reading the interview material many times.

### 3.5 How to read this document

After having introduced this thesis project, a theoretical framework, and how I plan to work in chapters one, two and three, I describe the empirical setting in which this research takes place in chapter four. The purpose of chapter

four is to give insight into anesthesia as a specialist domain and identify a cognitive style that influences how an anesthesiologist exercises his or her knowledge. The point of chapter five is to describe how the content of a new patient journal on paper is constructed, why it is constructed as it is and reactions to and implications of the transformations for the employees concerned. First I give a brief background to the project, how the project-group was formed and what the original goals were. Then I describe the transformations in the new patient record on paper. Under the heading "the optimal information level" I analyze what took place and then I present the empirical contributions under the heading "conclusions" at the end of the chapter. In chapter six I will recount the strategy behind and implications of computerizing an anesthesia patient record. In chapter seven I present and discuss the theoretical contributions and in chapter eight I summarize this thesis with a few concluding remarks.

### 3.6 A chapter summary

The social sciences study real life situations and create concepts. When reflecting over whether this study could have been done differently, I think that quantitative research could have answered other types of questions. But to fulfill the purpose of this study, to investigate what happens when something interferes into the activities of a knowledge worker in a specific organizational setting, I believe it was necessary to perform fieldwork at the empirical sites. I have also been able to use my intuition and work experiences in connection with arranging interviews, aiming access, getting something out of the interviews and interpreting what the interviewees have said. The strength of this type of research is that I get close to the people I research. The weakness may be that the findings and implications are local. To sum up this chapter I have performed an interpretative study consisting of three parts of a process at four different research sites, using interviews, observation and the reading of text, when trying to answer the research questions presented in chapter one. I have described, analyzed and interpreted what takes place. I have alternated between interviewing and observing at the empirical sites and reading and reflecting over what I have found. I have searched for patterns in the empirical data that relate to the purpose of this thesis. Then I have discussed the findings and developed concepts using the theoretical framework I presented in the preceding chapter. I have presumed that power inequalities and ideologies drive structuring processes. In addition to this I have focused on what kind of transformations that takes place due to structuration. I have tried to identify structures that are influenced by implementing a computerized patient record and the relationship between these structures. My aim has been to try to identify implications of constructing and implementing a computerized patient record on a multi-level basis.

# Chapter Four

## The care and documenting process in anesthesia

Now it is time, I think, to explore why and how anesthesia is performed and by whom and where. Another ambition in this chapter is to find out if an anesthesiologist has a special cognitive style and/or preferences for particular tools and methods. In addition to this I inquire into the importance of the patient record in this specialist domain and summarize how the care and documenting process looks like in anesthesia. Most of the empirical data that is presented in this chapter has been obtained at Karolinska hospital in Sweden. I have spent a substantial amount of time at this site and it is here I have gained insight into what anesthesia is. This insight is also supported by data from the other empirical sites. In the following pages I first give a short historical background to anesthesia as a specialist domain and then I describe the anesthesia and intensive care clinic at Karolinska hospital. The next section reports on how work is performed at the anesthesia reception desk and in the operating room; then I continue to provide information about the importance of the patient record and why some think it should be computerized. Finally I analyze the empirical data under the heading “we call ourselves emergency people”, and offer several empirical contributions under the heading “conclusions”. This chapter ends with a summary of its content.

### 4.1 Anesthesia as a specialist domain

This section reports on the history of anesthesia, how the anesthesia and intensive care clinic at Karolinska hospital is organized and how work is carried out at the anesthesia reception desk and in the OR.

### 4.1.1 The history of anesthesia

Anesthesia as a specialist domain has grown out of surgical procedures and can serve as an example of how a new medical field is born and establishes itself. One of the early pioneers of anesthetics was John Snow (1813-1858). When Snow studied at the University of London, he became interested in anesthetics and decided to specialize in the subject. He performed many experiments using both himself and animals. Snow is even believed to have died at the age of forty-five from inappropriate use of anesthesia. One of his inventions was an improved ether inhaler. John Snow published the results of his many experiments in 1847 and became the leading anesthetist in London. His book "On chloroform and other Anesthetics" from 1858, is one of the first textbooks in the field of anesthesiology. During the next century anesthesia established itself in a more definite way. The first Swedish anesthetist Torsten Gordh was employed at Karolinska hospital when it opened in 1940. And Martin H:son Holmdahl, the first Swedish professor in anesthesia, was installed in Uppsala 1965. Since the 1940's one important driver for expanding anesthesia as a specialist domain has been the development of new medical-technical equipment (Levay, 2003).

### 4.1.2 At the anesthesia and intensive care clinic

When trying to get insight into what anesthesia is and how the anesthesia patient record is used, I have conducted many interviews and observations at the central anesthesia and intensive care clinic at Karolinska hospital. This clinic is organized into three units: peri-operative, operative and intensive care. The patient is evaluated at the peri-operative care unit, before being anesthetized and subject to surgery in the operative care unit. After surgery the patient wakes up in the intensive care unit where pain management takes place. Together the three different units of the clinic are supposed to manage the outcome of an anesthesia in the best possible way for the benefit of the patient. During observations May 30 and Sept 11 2001, I saw how an anesthetist injects anesthetics before the operation, then the anesthesia nurse monitors the substance during surgery. Anesthetics are substances, such as ether, that in a controllable manner produce loss of consciousness and a general or localized insensibility to pain.

"The history of anesthesia is an increased sub-specialization. But our philosophy is that the whole should become more than the sum of the parts, and this influences how we organize ourselves", explains the head of the clinic.

He describes and summarizes how the scope of anesthesia during the years has been broadened with critical care medicine, acute and chronic pain management and the development of more sub-specialities such as neuro, cardiac and pediatric anesthesia. One part of the clinic performs anesthesia for obstetrics and gynaecology and another for surgery of the ear, nose and throat. A third part conducts orthopedic anesthesia.

When I conducted this research the different units of the clinic were spread out all over the hospital. The peri-operative care, or the anesthesia reception desk, was located on the first floor in the main building. The operative and intensive care were housed on the fourth floor in the same building. The rest of the offices, the library, many meeting rooms and the office of the head of the clinic were located in another building. All together close to 300 people, among them nearly 95 doctors and 140 nurses, worked at the anesthesia and intensive care clinic.

According to one anesthesiologist at the pain management desk a widely used saying about an anesthesiologist is that he or she “goes to where the problem is”. Another saying about the anesthesiologist, according to the engineer at the clinic, is that he or she is the one “that sees the human being in the patient”. This implies that the anesthesiologist not only evaluates the patient before surgery, but when the surgeon performs surgery the anesthesiologist also observes how the patient reacts and decides if any interventions are needed.

An anesthesiologist can be described as a spider in nets that includes almost all the other clinics at the hospital. “We work in a network. It means that we send anesthesiologists to urology, the ear-section, plastic surgery and so on. Our employees rotate. Our goal is to keep a certain amount of general knowledge among employees but also allow some specialization. This way of working results in some stress, but it is still a balance we try to keep, says the head of the clinic. “Many clinics at the hospital want our help and it is difficult to reach out to everybody. The surgeons prioritize and we feel like a “*mädchen für alles*”, explains the head nurse.

A lot of communication, exchange of information and sensemaking in this context, takes place during meetings between people. “I prefer to meet people face to face and chat rather than read about things”, says the head of the clinic. “I base my work on verbal communication”, says the head of the anesthesia reception desk. When I performed interviews and observations at the clinic there was a meeting every morning at 7:30 for the physicians. A meeting for nurses took place at the same time. In the past physicians and nurses used to participate in the same meeting, but that changed when they realized that they had different things to discuss. Every Monday morning between 10-11 am the head of the clinic has a meeting with intensive care people, and between 11-12 am with anesthesia personnel. Once every month there is a conference and once every second month all the anesthesiologists connected to the clinic, gather during an informal meeting. Then they sit together in a small room and talk. One Friday every month all the physicians at the clinic also meet in the library to discuss urgent matters.

I observed that some employees use PC and others Mac. The clinic has 15-20 different types of software implemented for different administrative purposes that do not connect. Employees have to get out of one program and into another when using them and that is inconvenient and takes a lot of time. When it comes to computerized information systems the structure at the anesthesia and intensive care unit is very fragmented, like at the rest of

the hospital. Opera, a system for administrative data, planning of operations and some medical data was implemented 1992. I observe how a device called Datex is used in the operation room for recording surveillance of parameters like pulse and blood pressure, but it is not possible to print the information. It has to be written down in the patient record manually. And medication must be documented by hand in a special record. There is a lot of double and triple documentation done. As an example, one of the nurses tells me that antibiotics and liquids are documented at three different places. Anesthesia is documented only in the anesthesia patient record.

At Karolinska hospital a patient record on paper designed by T. Gordh in the 1940's was used until 1966 at the central department for anesthesia. On one page notes were made with a copy of both the pre-anesthetic status of the patient and the course of the anesthesia. In addition to this the medication and orders for the immediate post-operative care were written down on the same page. In such a restricted space only a very limited amount of data could be noted and parallel clinical records had to be kept for research purposes (Halle'n, 1973). From 1966 and onwards a paper record supplemented by a database was used. Sometimes the database was called a computerized patient record but actually employees had to manually feed information into it.

Today Karolinska hospital has implemented BMS, a general system for computerized patient records from IBM, that not many people are happy with. It cannot however be used to record the anesthesia curve for example.

#### **4.1.2.1 At the anesthesia reception desk**

When surgery is scheduled at Karolinska hospital a note is sent to the patient. Then he or she is called to the anesthesia reception desk, a peri-operative unit. At this unit an anesthetist evaluates the patient to see if he or she can go through with surgery or not. When the patient arrives at the anesthesia reception desk he or she registers with the nurse. Then the patient sits down and waits for a meeting with an anesthetist.

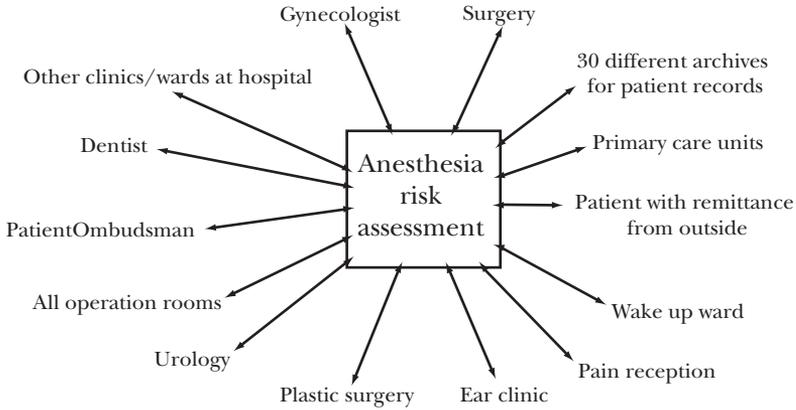


Figure 4.1 The anesthesia reception desk and its information network

Since the anesthesia reception desk receives and evaluates patients from most of the wards and the clinics at Karolinska, it is in touch with units such as surgery, gynecology, the ear clinic, plastic surgery, urology, all operating rooms and recovery wards, the dentist and the Patient Ombudsman. It is also in touch with many primary care units outside the hospital and at least 30 different archives with patient records on paper. Figure 4.1 shows how complicated and rich this network is. I have been able to construct this figure after several interviews with the head anesthetist and the head nurse for this unit of the clinic. The head nurse in particular let me listen to all the phone-calls she made to gather and give information about the patients. I have also observed what takes place sitting both behind and in front of the anesthesia reception desk. In addition to this I have participated in evaluations and heard how the anesthetist works when it comes to gathering and giving information about the patients.

When participating in risk assessments or evaluations of the patient I have seen that they take between 40 to 60 minutes. During the evaluation the anesthetist investigates all possible problems that might appear with the patient, check all available data about the patient, tries to make sense of the data and informs the patient about what kind of anesthesia that is advisable. This is done during an intimate conversation between the anesthetist and the patient in a room with closed doors. Sometimes translators, relatives and others also participate in this meeting.

In connection with evaluations of 23 patients at Karolinska hospital I saw that the physician had all the necessary information in only 4 cases. “We almost never have all information about the patient at the anesthesia reception desk”, says a female anesthetist. “I worked within the air force before and there the logistics is much better. I complain to my superiors but nothing happens”, says a male anesthetist who was a pilot before becoming an anesthetist.

He is supposed to evaluate a cancerpatient but lacks necessary information. "This happens all the time", he says to me when I interview him.

During an evaluation it is desirable to have the following information: the patient record, lab results, EKG, a date for when surgery is planned and an old anesthesia patient record to see if a problem appeared the last time the patient was operated on. At Karolinska hospital I can see that when information is not available the anesthetist often takes the easiest way out and that is through verbal communication with the patient or a colleague. Then the anesthetist has to evaluate how reliable the source is and that is a problem when it comes to the patient. When patients are old they do not always remember things like medication, allergies, other sicknesses and so on. Then an anesthetist has to make a choice between cost and reliability of the information source and that causes stress. One anesthetist at the anesthesia reception desk says to me that the cost of cancelling an operation because of insufficient information is not a popular choice but it must be taken if there are too many questions about the patient that are not answered in a satisfactory way. During observation I can also see that an anesthetist makes the decision about what kind of anesthesia to give to the patient by herself but he or she also consults with colleagues, other specialists and nurses. He or she prefers to consult with a colleague that has a good reputation and is trustworthy. The final decision about whether the patient can go through with surgery or not is taken by the anesthetist that works the day that operation is scheduled to take place.

#### 4.1.2.2 In the OR, operating room

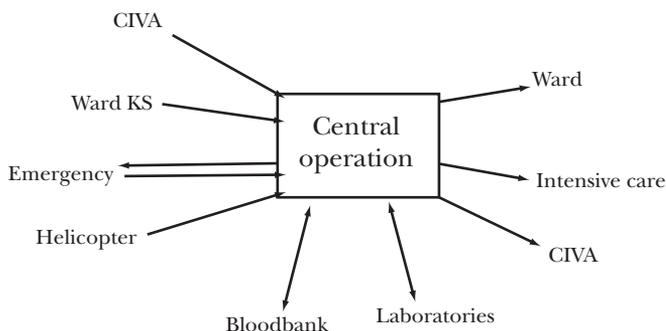


Figure 4.2 External information network for central operation

The figure 4.2 shows how the external information network for central operation looks at Karolinska hospital, and figure 4.3 shows how the information network in the OR looks. I have been able to construct these figures after observing and videofilming anesthesia work during two occasions at Karolinska and one occasion at St Lukes hospital. I have also gathered information about the external information network through interviewing the head nurse for central operation, the head physician and the project leader at Karolinska

hospital. At St Lukes the project-leader supplied me with information since he also worked as an anesthesiologist during the heart-operation that I observed there.

I have seen that in the operating room there are several different disciplines represented by the surgeon, the anesthesiologist, the anesthesia nurse, a surgeon tech, a resident, a medical student and an OR nurse. The anesthesia nurse comes into the OR first and takes care of the patient. Then the anesthesiologist enters and gives anesthesia. This is how I described what happened after sitting in the OR observing surgery at Karolinska hospital September 11, 2001.

... a door to the operating room opens. A female patient is pushed in lying on a bed by two operation nurses and one anesthesia nurse. The anesthesia nurse asks the patient about her date of birth and a few other personal things. Then the anesthesia nurse starts the Datex machine and checks pulse and bloodpressure. She continues to make it comfortable for the patient. They talk about what is going to happen ...

The patient record on paper is placed on a tray just beneath the Datex machine, together with some other papers. The anesthesia nurse moves back and forth between the patient and the paper record taking notes. Then she is checking parameters like pulse and bloodpressure once more writing them down in the paper record. She goes back to the patient. All the time she is moving around in an area close to the head of the patient. The female anesthesiologist comes into the room and puts on gloves. She explains what is going to happen to the patient, what kind of anesthesia the patient is going to get. The patient is made to sit up in the bed with a naked back. The anesthesiologist prepares the anesthetics to be injected into the spine of the patient. The nurse stands beside the patient giving support. The anesthesiologist and the anesthesia nurse talk and move around the patient. Then the anesthesiologist leans over the bed behind the patient and starts injecting anesthetics into the spine.

It takes time, a hypodermic puncture from the back of the patient and the anesthesiologist asks the patient how she feels. But according to the patient everything is OK! The surgical nurse moves around in the background. Then the anesthesia nurse helps the patient to lie down. The anesthesiologist pushes up the pillow and goes to the table and writes in the patient record. When she is ready the anesthesia nurse goes there and she also writes something in the patient record. The anesthesiologist and the anesthesia nurse move back and forth around the head of the patient checking how the patient is doing. The anesthesiologist goes to the patient record and writes something more while the operation nurse starts preparing for surgery. A shield is put up between the upper and lower part of the body of the patient ... (Recorded on video, Sept 11, 2001)

I can see that during surgery the anesthetist is supporting the surgeon at the same time as the anesthesia nurse is supporting the anesthetist. Figure 4.3 shows how the operation table is divided into two parts. The part to the right is where the head of the patient is located and the part to the left where the lower part of the body of the patient is located. The anesthetist and the anesthesia nurse work all the time close to the head of the patient while the surgeon most of the time works close to the bodily part of the patient. The exception is during activities such as brain, ear or plastic surgery of the face.

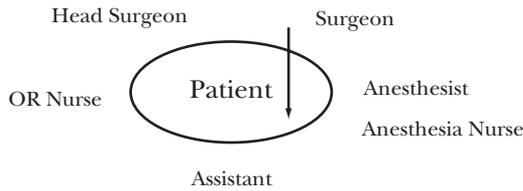


Figure 4.3 Professionals participating in surgery and exchanging information in the operating room

Both interviews and observations at Karolinska hospital and Allgemeine Krankenhaus in Vienna made it visible to me that there are two critical occasions during an anesthesia. The first one is case induction time ("take-off") and the second is emergence time ("landing"). At Karolinska hospital I saw how the anesthetist puts the patient to sleep during case induction time and it takes about 45-60 minutes. Then the anesthetist informs the surgeon whether the patient is optimised for surgery or not. This includes information about medical conditions and how stable the patient is.

**Case induction time:** "It takes 45-60 minutes to put the patient to sleep". "The information system automatically documents many procedures like the anesthesia curve". "Everything else I remember, like time and what took place". "I am thinking about what I have done, when and where medicine and therapies were used". "The surgical work starts and then I start documenting. It takes about 10 minutes". (Excerpt from interviews with anesthetists in Austria)

During surgery an anesthetist records something called vital signs, which are the level of oxygen in the blood, the heart rate, medication and the degree of awakesness and pain. He or she is required to rapidly interpret and respond to a large number of clinical parameters, while selecting appropriate treatment for the patient among many different options. Work in the OR is characterized by intense patient care and "requires a keen awareness of what is happening to the patient and what is happening in the OR. You need to be aware of what everybody else is trying to do and understand why they do what they do", explains the project leader at St Lukes hospital.

For the anesthesia nurse patient care in the OR means helping with intubation and keeping the position of the patient well maintained with proper

devices. Patient care in the OR also means to make sure that the patient knows what is happening to him or her, to be understanding, and to provide comfort and safety. “The patient must feel he or she can sleep safely. The patient must trust us and know that we will take well care of him”. The project leader at Karolinska says that the patient often asks “am I ever going to wake-up again” before an anesthesia is given.” We must make the patient feel safe so that he or she can fall asleep without too many worries”, she says. The anesthesiologist and the anesthesia nurse must also be able to handle people that react differently during different conditions. “In this environment a lot of communication is wordless”, concludes the project leader at Karolinska hospital. By this she means that the employees see, smell and feel. During emergence time, when the patient wakes up, anesthesia personnel also monitor the situation. This I can see during observations at Karolinska, Allgemeine Krankenhaus and St Lukes hospital.

**Emergence time:** “I have to manage the situation, and be in control”, “This is a critical time in normal anesthesia work to extubate”. “We have to shorten the time in the operating room as much as possible”. “I have to keep my eyes on the patient, to see if he or she still is bleeding, and then document”. “Normally a heart patient is not woken up in the operating room. This takes place in the intensive care room. But if it is a patient that is stable it takes 10 minutes in the operating room”. (Excerpt from interviews with anesthesiologists in Austria)

I have found that the data that is recorded in the OR must be absolutely reliable and retrievable. This is something that all anesthesiologists and the projectleader both at Karolinska hospital and St Lukes point out to me in almost all discussions we have about the importance of information in this specialist domain. This data is “mission critical”, which means that the anesthesiologist cannot go back later and get this data; he or she must get this data as it is being derived. According to legislation both in Sweden and other countries a physician must have generated a document at the end of the surgery with this data.

## 4.2 The anesthesia patient record

This section particularizes the anesthesia patient record as a professional artifact. It also describes why some employees want to computerize it.

### 4.2.1 The anesthesia patient record as a professional artifact

A patient record is an artifact, used both by the physician and the nurse, and it contains high quality information. “It is a diagnostic instrument and a ther-

apeutic instrument. To write a good record means to describe a problem in such a way that a diagnosis, or several, can be presented on how to solve a problem", explains one of the physicians I interviewed in this study. Different specialists use and write patient record differently. Psychiatric and medical records can be described as a sort of extensive narratives about patients while an anesthesia patient record is highly technical and originally showed only a curve and what has happened with certain parameters during surgery.

At the anesthesia reception desk I have seen how a young physician learns how to use and write a patient record through repeated action supervised by an older and more experienced colleague. This takes place at the same time as he or she is socialized into his or her role as a medical doctor, as a specialist and into the culture that characterizes the hospital and the ward where he or she is working.

Today the anesthesia patient record on paper consists of three parts: the perioperative record, the anesthesia curve and the anesthesia report. Both the anesthesiologists at Karolinska hospital and at St Lukes describe the three parts of the patient record like this: The first part is produced during the evaluation/risk assessment before surgery and gives advice about what anesthetics to use. It proceeds by organsystems, what the significant diseases that affect these organs are and what diagnostic testing has been done to evaluate the status of these organs. The anesthesia curve is produced during surgery. It includes physiological parameters and pharmacologic manipulations, fluids and blood replacements. The anesthesia report is produced after surgery and includes the condition of the patient, pain status, pain management and how the patient responded to this.

#### 4.2.2 Computerizing the anesthesia patient record

The process of documenting at the anesthesia and intensive care unit has traditionally required manual documentation, but now new information technology has increased the demand for improved information management. "The anesthesia patient record is the one that looks most alike all over the world. Still it is the last one to be computerized", said the project leader at St Lukes hospital, Mayo Clinic.

Several systems for the acquisition, storage and retrieval of anesthetic data have also been created and applied at Karolinska hospital during the years. "KS was one of the first clinics in the world that implemented a computerized information system. But that system influences not our work so much. Because first we wrote on paper and then it was transferred into a huge computer base", explains the head for central surgery at Karolinska hospital. By computerizing the charting process today, physicians and nurses could have easily accessible data and be able to devote more time to patient care and process improvement. The need to access the anesthesia patient record is described like this:

“It can be interesting to go back and check how the patient was put to sleep earlier, what happened, if there were any complications, how much anesthesia did this person need, and so on. It can be useful for us. But often this information does not exist. It has disappeared, been lost, or someone thought that the anesthesia patient record can be thrown away, or they forget it at the ward, they forget to send it with the rest of the papers ...” (Excerpt from interview with anesthetist at Karolinska hospital)

The projectleader at St Lukes says that a well functioning information system is expected to lower levels of stress among employees. This is also what the head nurse at Karolinska hospital hoped for. But at many hospitals the entire critical care process still occurs with virtually no computerized information system.

### 4.3 “We call ourselves Emergency People”

Earlier in this chapter I have presented the data that I have obtained during interviews and observations at Karolinska hospital. Under the above heading I will use the theoretical framework presented in chapter two to analyze and interpret all this data. The purpose is to explore whether there are some peculiarities that characterize anesthesia as a specialist domain. In addition to this, the aim is to investigate the importance of the anesthesia patient record as an artifact used by the anesthetist and the anesthesia nurse. Based on the insight I have gained in this chapter I will then continue in chapter five to investigate what happens when a patient record on paper is constructed and in chapter six when a patient record is computerized. At the end of this chapter I will present a few empirical conclusions that I have drawn from analyzing all this data. In chapter seven a theoretical discussion of the results takes place.

#### 4.3.1 Anesthesia workers

In this study I have conceptualized an anesthetist as a knowledge worker since he or she accesses data, uses information, employs mental models and applies significant concentration and attention when exercising his or her knowledge. In addition to this, anesthesia is based on continuous learning and scientific improvements. Performing anesthesia can be looked on as a reproduction of institutionalized practices with a repetitive character, I assume. How these take place is based on the anesthetist and the anesthesia nurse belonging to the same thinking collective (Fleck, 1934). By studying how their colleagues in the group they belong to behave and talk they get an idea about how they themselves should act (Blumer, 1969/1998). A knowledge worker learns to use a specific knowledge frame when exercising knowledge (Abbott, 1988). Giddens writes that all human beings are knowledgeable agents and “know a great deal about the conditions and consequences of what

they do in their day-to-day lives". He continues "the knowledgeability of human actors is always bounded on the one hand by the unconscious and on the other by unacknowledged conditions/unintended consequences of action" (1984, p. 281).

### 4.3.2 The practice of performing anesthesia

Performing anesthesia is a situated practice that takes place in time and space. In this thesis I also conceptualize anesthesia as a medium-range knowledge-intensive activity since the "producer" is well educated and exercises knowledge based on scientific improvements, while the "consumer" of the services, in this case the patient, does not need any education at all. The interviews show that the main reason to perform anesthesia is to put the patient to sleep during surgery. "The core business is to put the patient to sleep", says the head of the operative care unit at Karolinska hospital. When anesthetized, the patient does not manage to breathe by himself. So the anesthesiologist and the anesthesia nurse observe the patient and intervene if there is a problem. "We have to help the patient to breathe. It still happens that the patient dies on the operating table because of this, but it is not common", continues the head of the operative care unit. To check the patient means to keep track of vital signs such as pulse and blood pressure. "Good respiration and circulation are important, we monitor the blood pressure all the time. It can lead to serious complications if it is not monitored. We check blood pressure every fifth minute; that is the most important data in the anesthesia-curve. Then I check the oxygen, every 15th minute. 90 percent of my attention is concentrated on pulse and blood pressure".

There is a continuous flow of patients passing the anesthesia reception desk and the OR everyday. They are evaluated, analyzed and taken care of in a way that develops into a recognizable pattern of questions, answers and movements. When I observe anesthesia work being performed during surgery at Karolinska hospital I can see that it is what Giddens calls a "continuous flow of conduct" that influence and is influenced by structures such as mental schemas and sets of resources that empower and constrain social action, and at the same time tend to be reproduced by that same action (Sewell, 1992, Giddens, 1984).

To sum up the core in anesthesia, according to the project leader at Karolinska hospital, is to evaluate the patient, give anesthesia and then find a balance between keeping the patient asleep so that he or she does not feel pain during surgery but at the same time continues to breathe.

### 4.3.3 At the anesthesia reception desk

I have already concluded that anesthesia is performed at two organizational settings, at the anesthesia reception desk and in the operation room. In both settings a structuring takes place as actors draw on and make sense of institu-

tional patterns of signification, domination and legitimating, to construct roles and interpret persons, objects and events in their environment (Giddens, 1984). Anesthesia employees give what takes place around them a meaning, exercise power and live by a certain morality depending on what is seen as accepted in the context within which they perform. "The patient comes first" is an expression that is often used. It is an example of the modes of discourse that takes place at the clinic. The head of the anesthesia reception desk discusses this and says that employees are socialized into thinking like this. "Even if they do not do so from the beginning they learn to like the patient. It is almost strange how much they like the patient", he says to me.

Modes of discourse also imply that the anesthetist bases his or her evaluation of the patient on earlier experiences and research about what is important to know about a patient in order to decide whether he or she can go through with surgery or not, if the patient is allergic to certain substances and what kind of anesthesia to administer. I soon realized that new knowledge is created in this very specific organizational setting by managing conversations, mobilizing knowledge activities and globalizing local knowledge (von Krogh, Ichijo and Nonaka, 2000). At the anesthesia reception desk I could see how a younger anesthetist learns from an older discussing cases. The young one asks: "What do you think about this patient, what is wrong with her?" The head of the anesthesia reception desk answers: "Well, on the basis of my experience I believe this is what is wrong ... but it could also be this ... You better check these parameters ..." Discussing cases like this is also done during many of the meetings at the clinic. Then sensemaking takes place as the physicians agree on how to diagnose and act. How an anesthetist reasons and makes sense of data was also visible during the evaluations that I participated in at Karolinska hospital. Scientific and educational efforts are also integrated into work since most of the physicians are involved in different types of research projects at the same time as they perform daily work.

When an anesthetist exercises his or her knowledge it can be described as "the individual capability to draw distinctions within a domain of action based on an appreciation of context or theory" (Tsoukas and Vladimirou, 2001). Within this individual capability there is a territory within which all anesthetists make personal choices based on experience about how to make sense of what happens and then act. The projectleader at Karolinska hospital describes it so that they "feel" when they do something right. One of the anesthesia nurses at plastic surgery describes work as getting "it" into your hands. "It" is an expression of tacit knowledge. It is a feeling for how to perform anesthesia. One of the anesthetists in Austria also describes work as "using all my senses". He means eyes and hands and the nose.

During observation of 23 evaluations I could see how the meeting at the anesthesia reception desk at Karolinska hospital is an act that is constructed by the anesthetist and the patient together, in a face-to-face situation. It soon becomes a structured activity. The anesthetist sits in a chair behind a desk in a room and the patient at a chair in front of the desk. The anesthetist evaluates

the patient, going through the human organs systematically. A mental schema, or interpretative schema as Giddens calls it, for how to evaluate the patient is developed. Both the anesthetist and the patient act out this interpretative schema together. I could see how they together construct this very specific situation.

By the concept interpretative schema Giddens means standardized elements of stocks of knowledge applied by actors in the production of interaction. An interpretative schema is a way of organizing information about the world relevant to a particular task and it can also be described as a filtering mechanism. It influences how communication takes place between the patient and the anesthetist. I have already concluded that how the interpretative schema is constituted and how communication takes place depend on what theory of coding exists, depending on what modes of discourse that signify anesthesia.

The anesthetist asks questions, the patient answers. "Does this make you cough?" "Yes!" "What kind of cough is it that you get?" "Like this?" "Yes!" "Does the medicine make you break out?". "Do you have problems breathing?" What questions to pose soon becomes routine. Sometimes the patient asks questions about the operation, what will happen and so on. They both have to make sense of a situation that requires a decision about action. The anesthetist must decide if an operation is going to take place or not, the status of the patient, and what kind of anesthesia to give. Evaluating the patient becomes a routinized activity. The nurse is outside the room but still included in what takes place, since he or she searches for information and take EKG, pulse and bloodpressure. Sometimes relatives or interpreters participate in the meeting between the patient and the anesthetist. Sometimes a trusted colleague is also used.

I can see that at the anesthesia reception desk the anesthetist often spends almost 40 minutes evaluating the patient. He or she is supposed to use as much time as is needed to make a correct evaluation and also to talk to the patient, to respond to some of the worries that the patient might have before surgery. At the same time there are other patients waiting outside so the evaluation should preferably be as fast as possible. The anesthetist must find a balance in how much time to use, but he or she must at least have enough time to finish evaluating the patients that have been called to the anesthesia reception desk that day. When lacking information during the evaluation, discussing with colleagues and searching for more information might take an unreasonable amount of time. Then the schedule for the day is disturbed and other patients have to wait.

The way patients are evaluated is mediated through resources such as time and eyes, but also data and information that is included in the patient record. Demands to complete certain points of the patient record influence what questions are asked during the evaluation of the patient and the way an evaluation takes place, but these blanks to fill in also exist because of the way anesthesia is performed. Another schema that is transformed is how anesthesia

is given. It is expressed through the use of resources such as eyes, hands, time, anesthetics and blood. How to dilute medication is also transformed and mediated through the use of drugs, hands and time. Finally ways of documenting are expressed through the use of resources such as eyes, hands, time and how the patient record looks and that schema is obviously transformed. An anesthesiologist is used to using a pen when recording data. It becomes a routine. The head of the clinic at Karolinska hospital says that he prefers using a pen. One of the nurses at Karolinska hospital says that she feels safe using a pen. But another nurse complains and says that she does not want to be a secretary. At St Lukes the anesthesiologist and project leader drops all the papers during a heartoperation that I observe. He says to me that this is what they want to avoid by computerizing the patient record. One example of a place schema (Fiske & Taylor, 1991) is the way an anesthesiologist gets used to moving around the operating table close to the patient's head in the OR during surgery. During two operations that I observe at Karolinska hospital, I recognize a certain pattern in how all the people around the operation table move back and forth between the Datex machine, the patient record on paper and the operation table.

#### 4.3.4 In the operation room

During observation at Karolinska hospital and at St Lukes I could see that what takes place around the operating table is an act that is constructed by a group of people together. This act soon becomes a structured activity. I can see that it is what we call teamwork that takes place around the operating table. This means that all are working toward a common end and everyone has a sense of the common end interpenetrating the particular function that he or she is carrying out (Mead, 1934). Employees are supposed to know how to behave in relation to each other and the patient. "This is a limited space for many high-risk tasks ..." says the project leader at St Lukes about working in the OR. "Working in the OR requires a keen awareness of what everybody else is doing ..." An anesthesiologist informs the surgeon about the status of the patient, whether an operation can take place and the necessary interventions during surgery. In every new situation the anesthesiologist has a theory about the status of the patient that is influenced by prior knowledge and experience. On the basis of predictions and evaluations he or she makes a judgement about the situation and decides on necessary interventions. Then the anesthesia nurse services and communicates with the anesthesiologist. In this setting work is often characterized by high risk and sometimes panic. High risk and panic are words used about anesthesia work by Dr Börje Halle'n who wrote a thesis about a computerized patient record in 1973, the project leaders at both Karolinska hospital and St Lukes hospital and several other employees.

The people around the operating table have to make decisions under conditions that may not always be suited to accuracy or thoroughness. They face uncertainty and complexity when trying to understand what the problems

are, identify alternatives for how to act and appraise possible outcomes of their actions. "You need to be flexible, understanding and accommodating to do this kind of work. At the same time it takes an aggressive person to do OR work, otherwise you won't get the work done", says the projectleader at St Lukes hospital in the United States. "Also work is heavy, a lot of trauma and worries, things are not allowed to go wrong", says one anesthetist at Karolinska hospital. She prefers to work at the anesthesia reception desk rather than in the operation room. "Everything must be very quick. Something that takes more than 5 seconds is considered long by anesthesia personnel", explains the project leader at Karolinska hospital.

Sensemaking takes place all the time at the anesthesia reception desk and in the OR. The purpose is to reduce ambiguity and develop a shared meaning so that the group that is involved in taking care of the patient may act collectively. An anesthetist constructs his identity, for example as "emergency-people", in interaction with others around the operating table. Sensemaking is retrospective which means that the anesthetist judges what is happening with the patient, depending on what he as an anesthetist has experienced before. How he or she makes sense of what takes place also depends on how the other people around the operating table make sense of what happens.

If an accident or maltreatment occurs during surgery in Sweden, they may all be exposed to sanctions administered by The Swedish National Board of Health and Welfare.

Organizational knowledge in this setting may be described as "the capability members of an organization have developed to draw distinctions in the process of carrying out their work, in particular concrete contexts, by enacting sets of generalizations whose application depends on historically evolved collective understandings" (Tsoukas and Vladimirou, 2001). What Tsoukas and Vladimirou call sets of generalizations is what I call mental schemas. Schemas can be defined as "generalizable procedures applied in the enactment/reproduction of social life" (Sewell, 1992).

During social interaction, resources are effects of schemas and schemas are effects of resources. Sewell (1992) defines structures as "schemas with a purely virtual existence and resources are media and outcomes of the operation of structure". A structure is dynamic, not static; it is the continually evolving outcome of a process of social interaction. Schemas not empowered or regenerated by resources would eventually be abandoned and forgotten, just as resources without schemas to direct their use would eventually decay. Without the socially constructed profession of performing anesthesia nobody would probably use substances such as anesthetics, or they would at least have to find another use for them.

Physicians are individualists and different anesthetists also perform anesthesia differently, according to the projectleader at Karolinska and also at Sundebyn. Every anesthetist and anesthesia nurse develop their own way how to dilute medications based on personal experiences.

“Dilution of medication involves a lot of counting, both forward and backward. We are educated in dilution of medication, it is part of our professional identity. But it is easy to make mistakes. I say to myself, now I believe this is OK. It is many years of experience that makes me know when it is OK! It is a feeling that I have that it is probably right to do like this right now. It is difficult to explain”, says the projectleader at Karolinska.

Anesthesia work is influenced by the fact that time is in short supply and space has a limited packing capacity. In addition human beings have a limited capability to participate in more than one task at once, coupled with the fact that every task has a certain duration. So, movement in space is also a movement in time for an anesthetist. Both time and space have boundary effects, at the anesthesia reception desk and in the OR. How equipment in this space is arranged influences how employees move around. How employees move around influences how equipment is arranged in this space.

This is also something I can see in Austria where both anesthetists and nurses complain about how the computers, beds and chairs are located in the room. How employees use their bodies when exercising knowledge also appears frequently in the interviews.

“I need free hand to work with the patient. All my senses go through my hands. I get information from looking at the patient. To free my eyes and hands are important”, explains one of the anesthetists at AKH in Vienna. “When transferring speech to text it is important to be quick. We must keep our eyes on the patient”, say another anesthetist at Karolinska. Hands and eyes are important resources for an anesthetist and anesthesia nurse, when taking in information and exercising their knowledge. “A lot of communication in this environment is speechless”, says the project leader at Karolinska hospital.

An anesthetist reads the face of the patient, feels, smells and touches. He or she uses both eyes and hands to interpret what state the patient is in and as a consequence of this, several employees characterize their work as “a craftsmanship”.

Time is a very important resource in this environment. “Every thing that takes more than five seconds is considered long”, says the project leader at Karolinska hospital. “We live with stress, but we like it, it is positive stress”, says the head nurse at Karolinska. “We get trained into being able to do several things at the same time. I can talk about one thing while doing something else with my hands”, explains one anesthetist that I interview in Vienna.

Taken together the interviewees give a picture of anesthesia as a practice that consists of many contradictions. It is intellectual work but also a craftsmanship. It involves reading and calculations but also observing and feeling. It is technical, since an anesthetist is surrounded by many machines and devices, but also physical often including long hours of standing, walking and dragging heavy beds and operation tables. An anesthetist have to manage many high-risk-situations. During work anesthesia employees must feel secure

and safe, but at the same time they have to be prepared for sudden and unexpected things to happen, several of them explain during interviews.

Anesthesia work is characterized by emergency, drama and a lot of responsibility always related to what is happening with the patient. "You have to realize that you work with people. You have to get "it" into your hands", explains the headnurse at Karolinska hospital.

"People who endure this working environment are special. We call ourselves emergency-people", explains the headnurse at Karolinska hospital in Sweden.

#### 4.3.5 The clinical eye

In this thesis I conclude that the clinical eye is a cognitive style that characterizes an anesthetist. At one of my first meetings a civil engineer at Karolinska hospital says "the anesthetist is the one that sees the human being in the patient. He or she uses the patient record for information but it is also important for an anesthetist to be able to keep his or her eyes on the patient during operation". "To keep his or her eyes on the patient" and the expression "the clinical eye" has become a theme among most of the people I have interviewed when they were trying to describe the essence of how they work and reactions to a changed patient record. "You sweep with your eyes all the time over the patient, to see if he is warm, wet ... explains the project leader at Karolinska hospital.

For an anesthetist the clinical eye is a way to take in information and exercise knowledge. It is a resource when enacting certain mental schemas such as giving anesthesia, evaluating the patient and documenting.

The expression "the clinical eye" emerges as a concept that I think is connected both with intuition and tacit knowledge in this specialist domain. A physician formulates a diagnosis of what problem the patient might have that is based on data in the patient record, visual perception, prior experience and verbal information from the patient. "The clinical eye" is important both for the anesthetist and the nurse and something they have trained themselves to get. If the patient record demands too much time it will disrupt the harmony in how the patient is taken care of. This recursive relationship between the patient record and the anesthetist is an example of "the duality of structure" (Giddens, 1984). It is also an example of the dynamic relationship between schemas and resources, schemas depend on resources and the resources depend on schemas (Sewell, 1992). A mental schema for performing anesthesia is influenced by a resource such as "the clinical eye". And "the clinical eye" influences mental schemas such as performing anesthesia and documenting. I will write more about the importance of this concept and theorize about the clinical eye in chapters five, six and seven.

### 4.3.6 The patient

Emergencies in this specialist domain always have to do with patients, and since the patient comes first everything else have to wait. “Patient safety” is also used for protesting against implementing a computerized anesthesia patient record at Sundebyn and for not making many other necessary changes. “The patient comes first” is a common expression in health care. It also turns up in the slides used by the project leader at the American hospital, St Lukes, where it is abbreviated, PC First. (Patient care first)

At Karolinska hospital the patient is constructed as kind, deserving better and as having a lot of patience. And it is disgusting to call the patient a customer or a client since the patient does not have a choice. The patient is described by health care employees at Karolinska hospital as “owned” by the Swedish health care system. Here are a few quotes from an interview with the head of the anesthesia reception desk:

“... and then they say, lets call the patient a customer ... then you go crazy. A customer can actually go out on the streets and order what he wants with his money ...”, “... most people, myself included like the patient ... it is almost a bit strange how well the general health care employee wishes his patient, and if they do not do that from the beginning ... they are trained into wishing the patient the best ...”, “... most patients are very kind and have a lot of patience, they deserve better ...”

“... a customer is a disgusting expression for a patient ...”, “It is everybody’s anesthesia record and most of all the patients and it is important that the right things are documented, things that are of use, most of all for the patient.”

I view the expression “the patient comes first” as a norm that guides action in health care. It is a norm that must be respected and dealt with during daily work-life. Change processes are difficult because employees do not want to “take time” from the patient. The new patient record is difficult to use because “the patient comes first”. But at the same time change processes are initiated because of the patient. “We will start sketching a new anesthesia patient record, for what’s best for the patient of course...” says the project-leader at Karolinska hospital.

In relation to documentation one anesthesist in Austria expresses it like this: “The patient comes first, then you document what you have in your head”. And when it comes to completing the project of constructing a new patient record on paper at Karolinska hospital, a nurse says: “The patient comes first, we do not want to take the patients time, its been ok before, what is the use?”

### 4.3.7 The patient record

The patient record, the focus in this study, is an artifact, "an object produced or shaped by human workmanship". It contains "high quality information", as one anesthetist expresses it. It is a diagnostic and therapeutic instrument. Patient records look different in different specialist domains. But an anesthesia patient record is highly technical and originally showed a curve and what happened with certain parameters such as blood pressure and pulse during surgery. Today it consists of three parts: the perioperative record, the anesthesia curve and the anesthesia report. Working with the anesthesia patient record has to do with fulfilling demands, and being without it results in problems like guessing, having to keep things in your head and a risk of documenting numbers that are too optimistic. You are not a professional if you do not have the patient record. You cannot be sure to make the "correct" decision, according to one of the anesthetists at Karolinska hospital. Work becomes more of craftsmanship than a profession depending on "doctor's temperament", as one of the anesthetists says when I observe him working evaluating a patient at the anesthesia reception desk. The anesthesia documentation has developed a lot since the 1960's. Then it consisted mainly of pulse and blood pressure. Now it includes surveillance and monitoring. How documenting takes place is expressed like this:

"The patients come first. Then we document what we have in our heads", says the chief nurse at Karolinska hospital. "During emergencies we have most of the information in our heads". "You document what you have in your head. You make a kind of picture of the course of the anesthesia. Sometimes the numbers are too optimistic", explains one of the anesthetists in Austria.

A physician reads different things out of data under different circumstances and at different time periods. Data might say different things, depending on what knowledge the physician has. Therefore different physicians might make different diagnoses based on the same data. When making a diagnosis a physician uses explicit, tacit and pseudotacit knowledge. What can be read out of data also depends upon the scientific knowledge in the medical community, and that changes all the time. The availability of data and information is not something that anesthetists determines themselves. The anesthetist can ensure that he or she herself writes a good patient record but access is always uncertain, at least as long as the patient record is not computerized. The benefit of a computerized patient record is that it includes data and information that is always accessible, at least as long as the information system functions. Reasons like time, complexity and volume of information make a patient record a tool that both helps and interferes in what is taking place, both at the anesthesia reception desk and in the operating room. The patient record influences work, but its appearance and its content, are influenced in turn by how work is performed. A recursive relationship exists between the patient

record and the social system in which it is used. A patient record is created by the anesthesia employees, but when used it also shapes the anesthetist and his or her actions. The patient record both enables and constrains the anesthetist in situated practice. It is given a certain meaning, embodies a certain power and is used according to certain norms. In Sweden at Karolinska hospital it is talked about as a patient record, while in Austria they talk about the patient record as a knowledge management system. In Sweden both the nurse and the anesthetist write in the same patient record while they use different documents at Mayo Clinic. At Mayo they include billing in the new information system while in Sweden a patient record does not include this kind of information.

During observation I have seen how a special way of working is organized around the patient record on paper. On the two video films I made at Karolinska hospital I can repeatedly see how the patient record is put on a tray in the operating room during surgery. Then the anesthetist and the anesthesia nurse move back and forth looking after the patient and then making notes in the patient record. The same movements are repeated until they become a kind of pattern. A shield is put up between the upper and the lower part of the patients body. The anesthetist and the anesthesia nurse move around in an area close to the head of the patient, asking questions, checking, going to the Datex machine, then writing in the patient record. Ways to document evolve into a mental schema in which resources such as hands and eyes are used in a special way. "Without a pen I feel helpless", explains one of the nurses at Karolinska. The pen is used as a way to concentrate and focus attention to pulse and bloodpressure. The head of the clinic also likes using a pen. "I have not yet found anything that beats the pen", he says. One important concept in structuration theory is routinization, the habitual, taken-for-granted character of many activities of day-to-day social life. An anesthetist gets used to documenting in a certain way, "using a pen", diluting medications and administering anesthesia in a certain way. If this method is transformed he or she might temporarily feel insecure until a new routine has established itself.

In the section that follows I will present several empirical contributions based on data obtained during interviews and observation and the analysis in the preceding section. The last section summarizes this chapter.

## 4.4 Conclusions

First of all, I conclude that anesthesia work is performed by the anesthetist and the anesthesia nurse before, during and after surgery at the anesthesia reception desk and in the operating room. I picture anesthesia as a service function both to the surgeon and the patient. The work includes assessing the patient before surgery, making a plan for giving anesthetics during surgery, following this plan and documenting interventions and changes in the con-

dition of the patient. Performing anesthesia also includes pain management after surgery.

The OR is a unique environment, with many people involved in work, using complex equipment in a limited space. Tasks are of high intensity, acquiring data is mission-critical and loss of data often unacceptable. The anesthetist uses information to assess the status of the patient, if the patient is alive or if some sort of action besides surgery has to be taken. I conclude that management of the OR includes managing and coordinating resources such as employees, information, drugs, blood, eyes and hands, equipment, supplies and time.

All the people working in the OR want to make sure that the patient is safe and that the outcome of the surgery is good, but everybody has their own separate job to do. Working in the OR includes giving anesthesia, diluting medications and documenting. These activities are all performed differently by different anesthetists. Every anesthetist develops his or her own way of exercising his or her knowledge. When performing anesthesia important resources, in addition to eyes and hands, are blood, anesthesia substances, medication and time.

The expression "the clinical eye" appears as a concept that I think is connected both with intuition and tacit knowledge in this specialist domain. It represents a special cognitive style characterizing an anesthetist. I conclude that a physician formulates a diagnosis of what problem the patient might have that is based on data in the patient record, visual perception, earlier experience and verbal information from the patient and others concerned.

I also conclude that an anesthetist documents this work in order to satisfy legal requirements but also to provide other health care workers with the knowledge of what was used to keep the patient unconscious. Patient records might be used for teaching and statistical purposes, and for discussions and comparisons. Some of the key findings from research are used to set new guidelines for how an anesthetist should act.

## 4.5 A chapter summary

In this chapter I show how anesthesia as a specialist domain consists of many contradictions. It is intellectual work relying on mental schemas such as evaluation of the patient, dilution of medication and administering anesthesia, but it can also be described as a craftsmanship including seeing, feeling and touching. It can be understood as a service function to both the surgeon and the patient. An anesthetist informs the surgeon about the status of the patient and puts the patient to sleep before surgery and helps with pain management after surgery. I have found the clinical eye to be a cognitive style that characterizes an anesthetist when he or she is taking in information. An anesthetist is the one that sees "the human being" in the patient, and he or she also "goes to where the problem is". This expression means that an anesthetist works

with many other specialists at the hospital connected in a network. It is a stressful working environment with many “high-risk tasks”. Anesthesia employees call themselves emergency people. Emergencies are always related to what happens with the patient. Time is an important resource in this environment. Everything that takes more than 5 seconds is considered long. I have found that the patient record is a tool that both helps and interferes with what takes place at the anesthesia and intensive care unit. An anesthesiologist must document according to legislation, and information and data are mission-critical, which means that it must be recorded when it is derived. From being a very practical or “matter of fact” activity anesthesia is becoming more and more intellectual, based on analysis and scientific improvements. One influential driver for expanding anesthesia as a specialist domain has been the development and introduction of new medical-technical equipment. One important concept in structuration theory is routinization, the habitual, taken-for-granted character of many activities of day-to-day social life. In this case I have seen how an anesthesiologist becomes accustomed to documenting in a certain way, “using a pen”, diluting medications and administering anesthesia. Work becomes routine. If this way of working is transformed he or she might temporarily feel insecure until a new routine has established itself.

The purpose of this chapter has been to contribute valuable insight into what anesthesia is and set the stage for the rest of this thesis. In the next chapter I will explore what happens when an anesthesia patient record on paper is socially constructed and designed.

# Chapter Five

## To socially construct and design an anesthesia patient record on paper

The ambition in this chapter is to explore and analyze how the content of a new patient record on paper is socially constructed and designed at Karolinska hospital in Sweden, why it is constructed as it is, and what the implications are of the transformations made in the document for the employees concerned. I start by giving a brief background to the project, how the project group was formed and what the goals were. Then I describe the transformations in the new patient record on paper. Under the heading “the optimal information level” I analyze and interpret the transformations and then I present the empirical contributions under the heading “conclusions”. The new patient record on paper is presented at the end of this chapter. The old one is shown in an appendix at the end of this thesis. In the preceding chapter I gave several, and as I hope valuable, insights into anesthesia as a specialist domain. This insight is supposed to make the reader understand how a tool such as the patient record influences and is influenced by what takes place in its surroundings. What is presented in this chapter is the first part of a process that includes upgrading a patient record on paper and then computerizing it. In the next chapter I recount the strategy behind and implications of computerizing an anesthesia patient record.

### 5.1 ... and so it starts ...

In this section the construction and design of a new patient record on paper is pictured as a formative process that is characterized by many goals to fulfill and many agents to employ. I want to point out that the importance of the anesthesia patient record for the employees concerned is showed by it being called “a bible” by the projectleader.

### 5.1.1 A formative process

The anesthesia and intensive care unit at Karolinska hospital in Sweden is constructing a new patient record on paper. The project started at the beginning of 1999. At that time I meet the head of the clinic and get permission to interview the participants in the project and observe what takes place. The project starts because of new legislation produced by The Swedish National Board of Health and Welfare about what should be included in an anesthesia patient record and a desire by some people at the clinic to computerize it. This is what the head of the clinic tells me, as well as the head of the anesthesia reception desk, the head of operative care, the civil engineer at the clinic and the project leader. They also tell me that the last time the anesthesia patient record on paper was upgraded was in 1992.

During the research process I gained insight into the formative process that is the constructing of a new patient record on paper that includes the project leader and the employees at the clinic. The project also involves "Health Care" and "Anesthesia", The National Board of Health and Welfare and The Association for Anesthesiologists as institutions, the chosen hospital and the Anesthesia and Intensive Care Unit as organizations and finally also the patient as a non-participant individual. The National Board of Health and Welfare and The Association for Anesthesiologists contribute directions concerning care, legislation and ideas for ethical behavior. As institutions they supply norms, such as "the patient comes first", that regulate interactions in situations related to anesthesia care. The employees at the hospital and the anesthesia and intensive care unit contribute ideas for and reactions to changes made in the patient record. Different anesthesiologists have different opinions about what should be included in a patient record; therefore anesthesia patient records look different at different hospitals. Still anesthesiologists all belong to the same thinking collective, which makes them agree on many things (Fleck, 1934/1997).

The interviews with the projectleader show how the construction process of a patient record soon becomes a formative process of fitting together the activities of all its members (Blumer, 1969/1998). During this process many different versions of the patient record are being created and discarded before the employees at the clinic agree on how a new patient record on paper should be constructed. The patient is not active in the construction process but nevertheless a participant. Both The National Board of Health and the employees at the clinic try to figure out what kind of information should be included in the patient record, information that would benefit not only themselves but also the patient. That the patient is a player in this project is also shown by comments about the project such as "take time away from the patient". "Patient safety" is also used as a reason for not implementing a computerized patient record at some hospitals.

A project group of four people is constituted during the fall of 1999. The projectleader is an anesthesia nurse that has worked at the clinic for nearly thirty years. The project group is supposed to answer following questions:

"What is it that we do? What would we like to document that is not documented today? How are we going to document so that it is possible to follow the course of an anesthesia? "The projectleader tells me how they start the construction process by making an inquiry asking the employees at the clinic about what they think should be documented in a new patient record on paper. The results from the inquiry establish a base for the project group to continue working from.

### 5.1.2 Goals in the project

Following goals have been formalized for the construction of a new patient record on paper at Karolinska hospital, according to the projectleader:

- to comply with the new legislation
- to have physicians and nurses do documentation in the same record together, "care and medicine goes together"
- to incorporate pictures
- to include a summary of the course of an anesthesia
- to include preop, intraop and postop information
- to include trauma information
- to use only terminology drawn from the Swedish health care – sector database
- to coordinate various parts of the clinic, ("within IVA/Anesthesia there is a considerable degree of contact with one another's work"), and
- to eliminate double and triple documentation

The projectleader describes the project of constructing a new patient record on paper like this: "This project is not only about producing a new patient record, it is about finding out what we do and why we do it". According to her the project is also like "squeezing all of the Bible into one page". I have already mentioned how a metaphor like this makes me realize the importance of the patient record.

There is a problem in agreeing on how much information to include in a new patient record since the anesthesists at the clinic are involved in many different types of activity from multi-trauma to ear-operations and pain management. As I show in chapter four a physician is involved in several different and often extensive networks. Information use in these networks is not always at its best since it often happens that necessary information is not available. It is also considered a problem that nurses and doctors have different documentation languages: "It is two different ways to look at things, two different needs. Physicians have a language, we are searching for one", explains the projectleader during an interview September 10, 2001.

Another problem is that earlier this specialist domain has used many different words to express the same thing. “We have been writing the same thing in many different ways. We have not had such a solid common base as other professions may have but we are beginning to get it. Today we have common search words that we must use when constructing a new patient record. Now we have a common vocabulary and that unites us”, says the projectleader.

A new director joins the hospital during the spring of 2000 and my department is supposed to save money. The situation is turbulent both at the clinic and the hospital with many people leaving and recruiting new employees difficult. A reorganization that takes place at the clinic during the fall of 2000 is described as a “patient-oriented” change. The reorganization is described like this: “One should work oneself into the patient group and a diagnosis, and streamline the information flow. One should not have to run around and “save” situations. One should feel that one has taken good care of the patient”. (Excerpt from an interview with the head of the clinic)

The project of constructing a new patient record on paper continues even though the clinic understaffed ten anesthesiologists and ten anesthesia nurses. In December 2000 the project group sends a transformed patient record for printing. The new record is tried out by anesthesiologists and anesthesia nurses during May 2001. In August 2001 changes in the project group takes place. One person is taking a leave of absence another is leaving for good. The new project group has a meeting at the beginning of the fall of that year. The projectleader says that it is difficult for employees to take time off from their daily duties to work with the new patient record on paper. But after listening to reactions from employees, which I describe in more detail under the heading “The Optimal Information Level”, some final modifications are made in the paper document. A new patient record is printed and arrives at the end of March 2002. It will be tested at the clinic over a long period.

“We are satisfied with the changes made but realize that this is the kind of work that will never stop. It is always possible to make improvements regarding what the employees at the clinic need”, says the projectleader when we meet for a final interview on March 21, 2002.

## 5.2 Transformations done in the new patient record on paper

When comparing the new patient record on paper, which is presented at the end of this chapter, and the old one that is presented in an appendix at the end of this thesis I have found following transformations in the document:

1. A description of how the patient comes into the care of an anesthesiologist has been expanded to include information on emergency alarm, trauma alarm and helicopter/ambulance as well as informa-

- tion about level of trauma. This is added to the existing options: primary care, secondary care and elective care.
2. Information about demands for blood from the bloodbank has been included.
  3. Pre-hospital is a new section: medical information and a summary about what happened in connection to ambulance care when the patient has been taken from the place of an emergency or the home to surgery at the hospital.
  4. What kind of post-operative care that will take place after surgery.
  5. Which staff that are involved in the work that will take place in the OR and their pager numbers.
  6. The medical-technical equipment that is used during surgery is included. The ID number of the anesthesia machine is included along with information about whether the equipment has gone through a security check.
  7. Pictures front and back of both the patients body and head have been included.
  8. Information on the care provided by the anesthesia nurse is included.
  9. A summary of the course of the anesthesia has been included.
  10. What kind of anesthesia that has been given before surgery, divided into airway A and local anesthesia B.
  11. A greater possibility to use more text has been added since the space for comments has increased from 28 to 44 lines.
  12. Information about the patient's belongings is included: medication, false teeth, hearing aids, eye-glasses. This includes whether these items go with the patient when she or he is discharged.
  13. The order of section is changed. Earlier ventilation and circulation followed right after each other. The new order looks like this: ventilation, medication, circulation, care, supplies, losses and analyses can be found on one page.

During our last meeting I have discussed these transformations with the projectleader. I have also interviewed anesthesists and anesthesia nurses at plastic surgery and the ear-and-nose section about their reactions to the new patient record on paper. In addition I have read commentaries written by employees on the paper document when trying it out. In section 5.3.3 I write more about the implications of the new record for the employees. The ambitions for the new record are high, and there are many things the employees want to include in a document with limited space. During the research process I have found that there is always a discussion going on about what the concept "the optimal information level" means. The optimal information level does not exist. It is a construction negotiated and agreed on among the employees at the clinic and the project group.

What they want to achieve is a document that includes enough information so that the anesthesia employees can diagnose and act as well as possible, but not so much information that it confuses and inhibits action. Many of the reactions among employees are related to an important resource such as “the clinical eye”. In chapter four I identify this concept as a cognitive style that I think characterizes how an anesthesiologist works. I will write more about that in section 5.3.3 and in chapter seven. In section 5.3.2 I will elaborate more on the characterization of the strategy behind constructing a document such as the anesthesia patient record as “enhancement” and “coordination”. Depending on how the employees and the project group view the document and what strategy they have for it, enhancement and coordination are what the clinic might achieve when implementing and using the new paper document.

## 5.3 “The Optimal Information Level”

During the research process I have seen how the decision about what to include in a patient record is negotiated among the different parties involved. These negotiations are often complex and not so easy to complete in a satisfying manner. There are things that must be included by law and, there are other things that employees want to include, and finally there is also a discussion going on in society about how a re-organization in health care should be done. These discussions influence the idea behind what a patient record is and what it can be. All these things together influence the strategy behind the construction and transformation of a new patient record. The purpose in this section is to analyze how the content of a patient record is constructed, why it is constructed like it is and the implications of this for the anesthesiologist and the anesthesia nurse in the light of the theoretical framework presented in chapter two. I want to remind the reader that these are the three research questions that I introduced in chapter one. I also want to repeat that the overall purpose of this research is to explore what happens when somebody or something, such as a major transformation of a tool, interferes into a knowledge worker’s everyday work-life.

### 5.3.1 How is the content of a patient record on paper constructed?

When exploring how the content of a patient record on paper is constructed, I distinguish four different trends, or prevailing tendencies, in the same document: one narrative, one visual making pictures, one integrative of activities both at the clinic and outside, and finally one inclusive of several services that do not really pertain anesthesia in itself. But I view these trends as a way to start transforming the patient record into a knowledge management system.

Trend 1. One of the first things I can see, when comparing the content of the old and new patient record on paper, is that the core, what kind of anesthesia has been given before surgery, has been complemented with a summary of the course of an anesthesia. I assume that this is an effort to give the patient record a more narrative structure and to summarize what has happened in words, and not only numbers. Originally the anesthesia patient record consisted only of a curve constructed out of numbers. But when anesthesia as a specialist domain grows, and the demand on the anesthesiologists to involve themselves in many more tasks also grows, the need to document more also increases. "Now we have more space for narrative documentation, not only medication and technical data, and that is good. But it is a problem when we have small anesthetics; then documenting can become more extensive than the care that takes place. We must change that somehow," comments the projectleader at Karolinska hospital after having gathered opinions from employees at the clinic. With my own eyes I can see a narrative trend in the new patient record on paper. The patient record as an informational tool has expanded and improved since the possibility of using more text arose. One example of this is that the lines an anesthesiologist can write commentary on has expanded from 28 to 44.

When designing the content of a new anesthesia patient record on paper the key problem is finding "the optimal information level", as the projectleader at Karolinska hospital expresses it. "What is the optimal information level, both for the patient and for myself so I can read it, the next time without having to guess what happened during the course of an anesthesia?", she asks. Sometimes the new patient record includes too little information and sometimes too much. Actually there is no such thing as an optimal level of information, what is considered "optimal" is negotiated between the parties involved. I want to repeat that the optimal level of information is a construction. To reach an agreement on how much data and information to include is an ongoing construction process. But the relationship between information and performance is not linear, and a threshold may be reached where information increases the level of ambiguity to levels that inhibit an anesthesiologist's ability to take action. Then too much information affects the quality of decision making negatively. Therefore it is important to decide on a level of information that is acceptable for everybody. One of the anesthesiologists at Karolinska hospital says when evaluating the new patient record on paper: "It is too much information for a normal operation and too little information for a big operation".

Trend 2. At the same time, a trend in the opposite direction to the narrative one takes place and involves including pictures instead of using only words and numbers. In the patient record at Karolinska hospital, the back and the front of a head and the back and the front of a body are included. I infer that pictures are included because they have many advantages that can be taken even further in a computerized patient record. One advantage is that a single

mark on one place on the body saves many words. It is easier to make a mark or a point with an electronic pointer on a body to describe with several sentences where on the body a therapy takes place. One point might include as much information as perhaps three sentences.

Trend 3. The project group is also trying to produce a patient record that integrates work at the whole clinic, which means trauma, perioperative care, intensive care, postoperative care and pain management. A description of how the patient comes into the care of an anesthetist has been extended with emergency-alarm, trauma-alarm and information about level of trauma. I realize that information about pre-hospital treatment and what kind of post-operative care will take place includes the employees in a patient-centric care process. Giddens (1984) refers to this as system-integration between “absent agents”, which means agents who are physically and/or temporally situated in different settings, which admits the possibility of intersituational articulation of systemic patterns. Almost all employees that I interview at Karolinska hospital tell me that one important goal for the project group when constructing a new patient record on paper has been to reduce double- and triple documentation. Previously every section of the clinic had their own patient record, and there were between 9 and 14 patient records in use in the same time in the same clinic. Now some of the information that the anesthesia employees and intensive care employees use can be reported in the same document. “We have cooperated with intensive care so that now some double documentation is gone. This patient record will be used at all the units of our clinic”, explains the projectleader.

Trend 4. Additional services that are supposed to improve the quality of a work process at the anesthesia and intensive care clinic are also included, such as what employees are involved in work in the OR and their pager numbers, what kind of technical equipment and devices used during surgery, the ID number of the equipment and whether it has been checked, and whether items such as eye-glasses and hearing-aids and other belongings to the patient have been returned or not. This might seem unimportant to an outsider but it saves time for the employees not having to run around and search for items that might have been lost. Including pager numbers for employees that are involved in surgery also makes it easier for other employees who want to get hold of them as soon as possible if necessary.

### 5.3.2 Why is the content of a patient record on paper constructed as it is?

The project group at Karolinska hospital has experienced a need to coordinate documentation between different units at the clinic. One example is that the same data and information should not be documented both at perioper-

ative and operative care. Enhancement means to use the patient record as a tool when improving diagnosing, decisionmaking and different dimensions of performing anesthesia such as dilution of medication. Enhancement I think is connected to a vertical movement in this organizational setting and can be described as improved quality in a work process. “Coordination” stands for a horizontal movement that improves integration. I think that “coordination” och “enhancement” characterize what the project group and the employees at the clinic want to achieve by constructing a new patient record.

Employees in health care, such as anesthesists and anesthesia nurses, work in many different networks as can be shown by the figures in chapter four. These networks are often large, complex and difficult to get an overview of. For example anesthesia employees at the anesthesia reception desk at Karolinska hospital have contacts with many clinics and units at the same hospital but also with primary care units and other hospitals outside their own hospital. I assume that improved coordination in these networks also means improved work processes. For example “patient centric care” means that different medical services are organized around the patient instead of having the patient to adjust to how care is organized in different units. I have already written that I view coordination as a horizontal movement that ties together units both inside and outside the clinic. Transformations characterized by coordination and enhancement makes it possible to lift a network of agents to a higher level of efficiency and improved quality. In this case I have seen how a patient record can be used as a tool to help to coordinate and integrate what takes place both outside and inside the hospital and at the clinic.

### 5.3.3 What are the implications of constructing a new patient record?

Below I will identify seven different implications of constructing a new patient record on paper that I have found after interviewing employees and observing at the anesthesia and intensive care clinic at Karolinska hospital. These implications can be identified at several different levels, both inside and outside the anesthetist. Both virtual and material resources as well as mental schemes are influenced when the tool is modified.

1. In chapter four I have already written that within this specialist domain there is a saying that “the anesthetist is the one that sees the human being” in the patient. She or he uses the patient record to access necessary information, but it is also important for an anesthetist to be able to keep his or her eyes on the patient during surgery. In chapter four “the clinical eye” appears as a concept that influences how information is sought, work performed and knowledge exercised in anesthesia. “The clinical eye” is important both for the anesthetist and the nurse, and it is something they have trained themselves to acquire. It is related to explicit and tacit knowledge. One implication of con-

structuring a new patient record on paper is that the clinical eye, a resource and a cognitive style that characterizes the anesthetist, is influenced. If the paper document demands too much time, it will disrupt the harmony in how the patient is taken care of. I want to point out that the recursive relationship between the patient record and the anesthetist is an example of “the duality of structure” (Giddens, 1984). It is also an example of the dynamic relationship that exists between schemas and resources; mental schemas depend on resources and the resources depend on schemas (Sewell, 1992). A mental schema for performing anesthesia is influenced by a resource such as “the clinical eye”. And “the clinical eye” influences mental schemas such as performing anesthesia and documenting. When the new patient record on paper is tested on May 23, 2001 among the anesthesia employees in plastic surgery, nurse B says: “The clinical eye weakens” with increased documentation. “The clinical eye weakens-you forget about the patient”. Nurse A says: “Writing all those search words is difficult-I have no time to see the patient.”

The patient record that was tested at the clinic includes “Too much text. Too many search words”. “It is not good to have to look for blanks to fill in”, according to the nurse at plastic surgery. Nurse K and nurse E at the ear-section both say that the new patient record on paper is “difficult to visually grasp and digest”. “It is difficult to get an overview of the information”, according to nurse E. This shows how the employees get used to the way the patient record looks. They have developed a mental schema for how to document, and now they have to transform how they work when using the new patient record. If they have to look for blanks to fill in, the “clinical eye weakens”. They forget about the patient and that is of course not good since “the patient comes first”. “I used to know how the patient looked, every millimeter. Now they do not know at the wards anymore. It is a different way to work. We do not know what patients we have. They are divided into green and red groups, just like at the day care center”, says the nurse at plastic surgery.

2. Another implication of the new patient record on paper is that it influences the way anesthesia is given by monitoring how much of a resource such as blood is used. Earlier blood was not recorded in the patient record. This meant that employees did not have any control over how much blood they used. Now they write down how much blood is ordered from the blood bank and how much blood is used during surgery. This service can also be included in a computerized patient record as it is at Allgemeine Krankenhaus in Vienna. It gives the anesthesia and intensive care unit the possibility of actively monitoring the use of this often scarce resource used during surgery. In this case blood can be said to be part of the structure in the sense that it is a material resource. Access to blood influences the outcome of anesthesia and surgery.

3. In one versions of the new patient record on paper, the part anesthesia employees use most during surgery is undersized. "The part we work with during surgery, the anesthesia curve, is the smallest, complains one anesthesist at Karolinska. How the document has been designed can be questioned since circulation and ventilation are not right beside each other. "Ventilation and circulation are too far away from each other". "Blood pressure cannot be registered at the time it was taken. "We register blood pressure every fifth minute, sometimes every minute". "Blood pressure and pulse end up in the wrong place". The implication of this is that the mental schema for how to perform anesthesia is disturbed. In addition to this a mental schema for how to document is also disturbed. Together this means that a balance in how to perform anesthesia during surgery is affected.
4. Signing information in health care is important, and employees are not satisfied with how that should be done in the new patient record on paper. "Where am I going to sign? At the figure, name or at the stroke of the clock?", asks one of the anesthesists. In this instance a mental schema for how to document is disturbed. They cannot sign information in the new patient record in the same way as they did before.
5. To dilute medication is another important part of performing anesthesia and the space for medication is not big enough, according to some interviewees. One of the anesthesists criticizes this and writes on the document that he wants this space enlarged. This also influences a mental schema for how to dilute medication that is part of the structure in this organizational setting. The practice of diluting medication becomes more rigid. Prior to this everybody worked according to an individual mental schema they had established.
6. When a new patient record on paper is constructed there are several integration mechanisms taking place. Earlier research shows that searching for a common language and/or an identity is vital when working with knowledge management since this is supposed to influence and improve integration mechanisms (Kogut and Zander, 1996). It is supposed to tie a thinking collective of knowledge workers more closely together. This is also what I can see happen in this project. Earlier anesthesia employees used different words for the same thing; now they have decided to use words that can be found in a database created by the national health authorities that everybody agrees on. They have established a platform to continue working from. A platform makes it easier to agree on how to do other things in the future. To me this corresponds to an enhancement of a work process. This shows how a patient record can be a tool in both social and system integration, both in face-to-face situations and in situations with "absent agents" (Giddens, 1984). The first of these means that employees at this clinic adjust the language they use to a general-

ly accepted language that should be used all over Sweden at all the anesthesia clinics. This language has been decided by the national health authorities.

Moreover the nurse and the anesthetist also try to adjust and coordinate their language and document in a patient record used by both. But there is a problem of putting “medicine and care” in the same document. Physicians are responsible for “the medicine” and nurses for “the care”. Physicians already have a language while nurses are “searching” for one, according to the project leader. Having a common language makes it easier to build, create and transfer knowledge in an organizational setting. A common language makes it possible to coordinate activities and mobilize knowledge.

7. What the nurse does with the patient is included under the heading “care”. There is a certain critique towards this section that planned to use 11 search-words for what takes place during an anesthesia. Still there are only four lines to write on. The value of this information is questioned by some of the anesthesia nurses at the ear section and at plastic surgery. “If something unusual happens during an anesthesia I have no time to document”. This touches again at the formative process of trying to find out what can be agreed on as “optimal information” among a group of employees.

To sum up this section, I have found that modifying the patient record influences and is influenced by several mental schemas and resources. These constitute structures in this setting. Transforming the patient record contributes to transforming the structuring process at the anesthesia and intensive care unit. In the next section I will report on some of the empirical contributions that this study has generated.

## 5.4 A few empirical conclusions

In this chapter I conclude that a transformed patient record on paper fulfills the original goals of the project group. It makes it possible to comply with the new legislation, physicians and nurses can use the same document, pictures are included, a summary of the course of an anesthesia is included, preop, intraop and postop is included, trauma-information is included, it coordinates parts of the clinic and double and triple documentation is reduced.

The new patient record on paper results in that:

- Certain double and triple documentation disappears
- Text is more easily readable
- The use of blood can be controlled
- The anesthetists document in accordance with the new legislation

The changes in the document are substantial and show an awareness of some of the problems in today's information structure. One is that care takes place in networks and that resources are utilized badly in these networks. Pictures are used as a way to ease communication. This will continue into the computerized anesthesia patient record. Pictures make it possible simply to mark where on the body a therapy is conducted, instead of using a long sentence to describe where a treatment takes place. I conclude that using pictures saves both space in the document and energy for an anesthesiologist and an anesthesia nurse.

Several "services" are added to the patient record that makes it more useful. A description of how the patient came into the care of an anesthesiologist has been expanded with emergency alarm, trauma alarm, helicopter/ambulance and the level of trauma. The following options already existed: primary care, secondary care and elective care. A description of what kind of post-operative care will take place after surgery is also included. Another service that is included is information on whether the patient brought any personal items such as eyeglasses or hearing aids to the operation. Because of this they do not get lost when the patient leaves surgery and the OR.

## 5.5 A chapter summary

This research shows the importance of a tool such as the patient record in the structuring process in an organizational setting. It seems to me that what a group of employees at a clinic want to achieve with a new patient record on paper depends on how they view it. It can "just" be a patient record including necessary data about the patient's condition. But it can also be a tool that helps to structure what takes place in an organizational setting such as at the anesthesia and intensive care unit on many different levels. As early as in connection with the construction phase it was possible to enforce a strategy that include both coordination and enhancement of medical networks. Construction here means both socially constructing and designing a new document. A patient record can be viewed as a structuring technology and in this study I have seen how its modification transforms certain important elements of the practice of performing anesthesia, such as evaluating the patient, diluting of medication, giving anesthesia and documenting these activities. The use of a resource such as blood becomes a more structured activity with the new patient record. A narrative trend with more lines to write on can be noticed in the new document. The inclusion of pictures is a way to include more information but in a way that at the same time saves energy. Many of the thoughts that develop about what can be improved in a patient record on paper can be taken further into a computerized patient record.

In the chapter that follows I will outline the strategy behind and implications of computerizing an anesthesia patient record.



**KAROLINSKA SJUKHUSET**

Datum: \_\_\_\_\_

Klinikkod: \_\_\_\_\_ Avd.namn: \_\_\_\_\_ Avd.kod: \_\_\_\_\_

Öppen vård   
  Elektivt / Akut   
  Akutlarm   
  Helikopter/Ambulans  
 Sjukvård   
  Traumalarm   
  Traumanivå: \_\_\_\_\_

**Pre-op anteckningar (fylls på Pre-op)**

Patient fastar enligt ordination:  Ja  Nej  Kl

Patient fått information:  Ja  Nej

VAS smärta 0-10: \_\_\_\_\_ Checklista ok:  Ja  Nej

VAS illamående 0-10: \_\_\_\_\_ Vakt/Längd: \_\_\_\_\_

Klart beställt från blodcentralen:  Blodkyl på OP  IVA  Blodcentralen \_\_\_\_\_ enh E-konc \_\_\_\_\_ enh Plasma \_\_\_\_\_ övrigt \_\_\_\_\_

Blodgrupp finns:  Bastest giltigt t o m: \_\_\_\_\_

**Övrig medicinsk information, prehospital/sammanfattning, etc**

Stämme inte. Ordinerad premed  
kan ej slivas här för ord.  
premed

Premedicinering: \_\_\_\_\_

Opererande klinik - kliniker: \_\_\_\_\_ Operationsavdelning: \_\_\_\_\_ Anestesiavdelning/sektion: \_\_\_\_\_ Operationssal: \_\_\_\_\_

**PERSONAL SÖKARNUMMER**

Operator/sök: \_\_\_\_\_ Assistent/sök: \_\_\_\_\_

Operationssjuksköterska/sök: \_\_\_\_\_

Anestesiolog/sök: \_\_\_\_\_ Sign: \_\_\_\_\_ Underläkare/sök: \_\_\_\_\_ Sign: \_\_\_\_\_

Anestesisjuksköterska/sök/sign: \_\_\_\_\_

**MEDICINSK - TEKNISK UTRUSTNING**

Kontroll enligt lokal checklista godkänd:  Ja  Nej  Anmärkning \_\_\_\_\_ Anestesiapparat id: \_\_\_\_\_

Övervakningsutrustning id: \_\_\_\_\_ Vätske/blodvärmare id: \_\_\_\_\_

Volymspump/ar id: \_\_\_\_\_ Cellsaver id: \_\_\_\_\_

Rumstemp på op.sal: \_\_\_\_\_ Annat:  !? Ta bort. Övrig utrustning id: \_\_\_\_\_

MR-utrustning/Angioutrustning. Kontroll enligt lokala föreskrifter:  Ja  Nej

**ANESTESIJOURNAL Nr:**

PAT. BRICKA

Uppdatera journal

Dec. 2001

CAVE/OBSERVERA

Ja Patient är i pre-op  
 Vad är detta här för egentlig dokumentationstyp? Det finns i journal.

Preoperativa planering kommer slås ihop här

VAS smärta 0-10  
 VAS illamående 0-10  
 Vakt/Längd  
 Klart beställt från blodcentralen  
 Blodkyl på OP  
 IVA  
 Blodcentralen  
 enh E-konc  
 enh Plasma  
 övrigt  
 Blodgrupp finns  
 Bastest giltigt t o m  
 Opererande klinik - kliniker  
 Operationsavdelning  
 Anestesiavdelning/sektion  
 Operationssal  
 PERSONAL SÖKARNUMMER  
 Operator/sök  
 Assistent/sök  
 Operationssjuksköterska/sök  
 Anestesiolog/sök  
 Sign  
 Underläkare/sök  
 Sign  
 Anestesisjuksköterska/sök/sign  
 MEDICINSK - TEKNISK UTRUSTNING  
 Kontroll enligt lokal checklista godkänd  
 Ja  
 Nej  
 Anmärkning  
 Anestesiapparat id  
 Övervakningsutrustning id  
 Vätske/blodvärmare id  
 Volymspump/ar id  
 Cellsaver id  
 Rumstemp på op.sal  
 Annat  
 !? Ta bort.  
 Övrig utrustning id  
 MR-utrustning/Angioutrustning. Kontroll enligt lokala föreskrifter  
 Ja  
 Nej

Figure 5.1 The new anesthesia patient record







# Chapter Six

## To socially construct, design and implement a computerized anesthesia patient record

In the preceding chapter I investigated implications of constructing and designing a new patient record on paper at Karolinska hospital in Sweden. In this chapter I will give an account of how a computerized patient record is constructed and designed at St Lukes in the USA, identify some implications of implementing one at The Heart Clinic at Allgemeine Krankenhaus in Austria and describe efforts to implement one at Sundebyn hospital in Sweden. The next section gives the background to the projects mentioned in the preceding sentence. Then I analyze and interpret how the content of a computerized patient record is constructed, why it is constructed like it is and implications of this. In the last section of this chapter I will present the empirical contributions that I have procured from analyzing the data under the heading “conclusions”. This chapter, like the others, concludes with a summary that reviews some of its content.

### 6.1 Computerizing and implementing an anesthesia patient record

This section describes the strategy behind and the history of the two parts of the transformational process mentioned above, taking place at three different research sites. The purpose is to frame the phenomena studied here and place it in its particular context.

### 6.1.1 Thinking strategy

The strategy behind developing a computerized patient record at St Lukes hospital in Jacksonville, Florida is to develop one that is suitable for a whole medical center and then adjust it to anesthesia. It should "become part of our institution-wide electronic strategy, integrated, not interfaced, into the total care process of the patient", explains the projectleader during a meeting at the clinic between the employees and the company that sells the software. He adds: "It must support a patient-centric care process".

This strategy is in accordance with the strategy for the entire Mayo clinic, and it puts the patient in the center letting specialists come to him or her instead of the opposite. The clinic has picked SurgiNet, a soft ware that addresses the needs of the surgery and anesthesia market. The project of adjusting SurgiNet to the needs of this particular hospital and clinic started in February 1999 together with X, the company that has developed a computerized patient record for all of the hospital, and it continued until the beginning of 2002. "The goal is to improve datacollection with easy accuracy, get more dependable and defendable documentation and more accurate information from legal and research point of view", according to the projectleader. He repeats this during the two interviews that take place. An appendix at the end of this thesis presents a prototype of the software that will be used at St Lukes.

At Allgemeine Krankenhaus in Austria a decision about buying and implementing a new information system was taken by the two chief anesthesists of the clinic. "We visited St Georges in London and L'Hopital St Lazare in Paris before deciding on what system to choose", says the head of the clinic to me when I interview him. Then they bought and implemented Chart Plus and Visual Care, from a company called Y. It is an American company but its European head office is based in Barcelona. During surgery Chart Plus registers data such as pulse and bloodpressure while Visual Care registers therapies, how they are performed and their outcome. When buying the software the two anesthesists decided on "quality". The head of the clinic says: "We wanted the best!" The head of the clinic continues: "We wanted automatic data sampling, an overview of what happened with the patient, longer trends, fluid balances and ordination of drugs, in the system". He adds: "We also wanted to use the software in intensive care in connection with ordering drugs, we wanted a structure for planning inventions and a task planning feature. Not only registering vital signs like in anesthesia".

At Sundebyn the projectleader says: "Someone somewhere in Umeå – it was a political decision – decided to buy an information system that should be integrated with a system called VAS Bedside, which we already used. The new system must be able to register information from VAS. It should also include data from anesthesia, digital pictures, be able to transfer data and so on. We decided to buy a structure or rather a platform called Care Suit from P, that we could develop, expand and adjust to our own needs".

In chapter three I wrote that the goal of the Swedish authorities was to build a new hospital in Sundebyn that supported all care processes with information and communication technology. Inherent in this strategy was of course a decision to implement a computerized patient record. However there was no explicit strategy for implementing an information system at the anesthesia and intensive care unit or for how to use it. “We wanted the cheapest possible solution”, says the projectleader for the physicians. “We never asked ourselves the questions “what are we going to use the system for” and “how are we going to communicate”, explains the projectleader.

To summarize, strategies both at St Lukes in the USA and at the Heart-Clinic at Allgemeine Krankenhaus in Vienna have as a goal to improve datacollection by implementing automatic datasampling in a computerized patient record. In addition to this they have different ideas about how to expand the services provided in a computerized informationsystem that they try to realize. In Austria they even call the informationsystem that they have implemented for a knowledge management system. But in Sweden there existed no strategy behind what they wanted to achieve with a new information system at the anesthesia and intensive care unit of Sundebyn hospital.

### 6.1.2 Project history

In Austria the two heads of the clinic decided to implement a computerized information system 1989. They were early compared to Sweden where most a/i-units still use paper. The two Austrian heads of the clinic are both professors in anesthesia and did not, like their Swedish colleagues, think that a computerized patient record would threaten patient safety. In Austria the two heads of the clinic wanted “quality”. “We wanted the best”, says the head of the clinic. When they implemented the software in Austria they decided on not having a projectleader. “We learn from each other”, says the head of the clinic. No exceptions were allowed. “Everybody who works at the clinic must use the system”. The head of the clinic adds: “We started with all the beds at the same time”. In Austria they had a “big bang” implementation while in Sweden they tried to implement the new software carefully.

In a room filled with computers and books I meet two of the people that have worked with implementing the new software. “We have implemented the new informationsystem in three steps”, explains the technician who functions as the head technician at the clinic. He describes himself as a computer nerd ready to spend nights at the hospital to make everything work. During vacations he climbs mountains in Nepal.

“First we implemented Chart Plus, then we implemented a SQL server and upgraded Chart Plus and bought Visual Care. The third step included buying an Oracle server and upgraded versions of Chart Plus and Visual Care”, he says. Chart Plus registers mission critical data such as pulse and blood pressure while Visual Care shows what therapies are given to the patient. The problem now is speed and to do things “the native way”. There is always a pres-

sure to upgrade, according to the head technician. "During step four we will replace certain hardware. With flat-screens, new chairs and keyboards there will be more space in the rooms to perform work. We also need more power in the computers", he says.

Today the clinic is paperless, "there is no paper anymore at the bedside", according to the head of the clinic. He says that a computerized patient record has contributed to improving the information structure at the clinic, and there are no duplications of paper anymore. Employees look at the system as a way to explore data, but not as a tool to administer drugs. In addition to this, the use of blood has also decreased with the use of the information system. "Now we can't work without the system", concludes the head of the clinic.

The clinic at Sundebyn in Sweden started implementing the new software on January 20, 2000 at one module involving three operating rooms. They elected one projectleader for the nurses and one for the physicians. Some of the anesthesists were against changes that would benefit both themselves and the patients. They accused the new information system of threatening patient safety. "I was out there helping my colleagues all the time so that we wouldn't risk the patient. We were thinking about patientsafety", said the projectleader. At the end of March the clinic had 31 technical problems. These were user-problems, hardware problems and problems with integrating the new system with the existing one. Employees also had problems transforming their way of working. During a stressful situation they gave up directly since they were allowed to document later. The projectleader for the nurses said: "They look at me and the male projectleader for the anesthesists as resources taken away from work. We do not participate in "care production". She also said that she has felt lonely. "It is stimulating but it would have been better if we had been more people in the project group". The male projectleader says: "We have had problems with integrating the software with VAS. It is more difficult than you can believe with two-way communication. We decided to start before everything was ready. We actually needed Visual Care". The nurse also says: "We should have bought Visual Care". They both complain about lack of technicians that could program. "They sent the technicians to Barcelona and the European headoffice of the company selling the software. Instead they should have stayed here, learned the functionality of the soft-ware and worked."

The projectleader for the nurses complained about a lack of leadership at the hospital: "Who leads?" "Who governs?" "Who is responsible?" She also says: "Is the head of the clinic interested or not?" "The leadership must take the consequences of their decisions".

When it comes to questions about money and who are going to pay for what, both she and the male projectleader say: "Who is responsible? The supplier or the clinic?" Even though Sundebyn is a new hospital, there is already downsizing of employees taking place and at the same time a shortage of employees. It is a new hospital but in spite of this the staffing situation is prob-

lematic. They have to work with personnel contracted in from a temp agency. "Using contract personnel becomes a weakness since advanced information systems requires education". "The leader should lead, I'll try to do my best but I cannot work with this in absurdum. The management must take the consequences of their decisions".

"When implementing a new information system it is important to have a well functioning organization and enough employees. Now we contract employees for short periods. That is a weakness. An advanced information system requires education". Both projectleaders say that they have to start the whole project all over again. The clinic is also involved in problems with the company delivering the software. They have decided not to pay until they get what they want. The project at Sundebyn failed because "we picked the wrong software. We wanted "the cheapest possible solution". "We never asked ourselves: "What do we need the system for? How are we going to communicate?" In Sweden the software was implemented "carefully" at one module. Many exceptions were allowed. The software was not used during weekends, nightshift and so on. During the summer employees stopped using it totally. The female projectleader had to carry most of the responsibility, a heavy burden. She said to me: "I have been alone. It is stimulating but it would have been better if we had been a few more working with this. We are considered as resources taken away from care production".

The technical support in Sweden was inadequate with one and a half technician while the clinic in Austria had five technicians and three information technicians as support for 15-16 computers. The technicians in Austria were "computernerds" and worked at the clinic day and night. In Sweden the hospital did not understand that they needed their own technicians to participate in developing the software at the clinic, still they bought a platform that needs to be developed. In Sweden they sent the technicians to Barcelona. In December 2000 the new information system still had not been used at heart medicine in Sweden. In surgery only one module consisting of three operation rooms uses it. In Austria head technician says: "The closer the relationship is between the user and the technician the better the product becomes. Now most of the complaints are about time and how to do things "the native way". There is always a pressure to upgrade

To summarize, while The Heart Clinic at Allgemeine Krankenhaus in Vienna practiced what can be called a "big-bang" implementation, Sweden started implementing a new information system gradually. In Austria everybody had to use the new information system from day one, no exceptions were allowed and they didn't use a projectleader. In Sweden they implemented the new information system only on a few computers, exceptions were allowed, and they had two projectleaders. In Austria they made substantial investments in technical support, while that was done only halfheartedly in Sweden. It is not my purpose here to investigate the reasons behind Austria succeeding and Sweden failing in implementing a new information system. Instead I want to re-

peat that the purpose with the above section has been to frame the rest of the reseach project.

## 6.2 How, Why and Implications of a CPR

The preceding presentation gave the background to what now follows. In this section I will analyze how the content of a computerized patient record (CPR) is constructed and designed, why it is constructed as it is and the implications of this for the employees concerned. I view computerizing a patient record as a major transformation of a very important informational tool that ties together activities not only at the anesthesia reception desk and in the OR, but also outside the clinic. I have seen how the computerized patient record is integrated into a routinized behavior that gets interrupted and then transformed. It means that although employees have influenced how the new patient record looks, it is now the computerized patient record that also influences how work is performed at the clinic.

### 6.2.1 How is a computerized patient record constructed?

A patient record on paper is not easy to transform into a computerized patient record since it is possible to write on both sides of a paper. It is also possible to fold a patient record on paper. This is not possible in a computerized patient record. At St Lukes they have solved this problem with a three -page software design called Monitor, Fluids and Medication. I will write more about this below. But first I want to establish that anesthesia information management is the same activity as working with and trying to improve preop testing, patient assessment, salaries, equipment, drugs, supplies, invasive monitoring, intraop testing, postop recovery and pain management at the anesthesia and intensive care unit of a hospital.

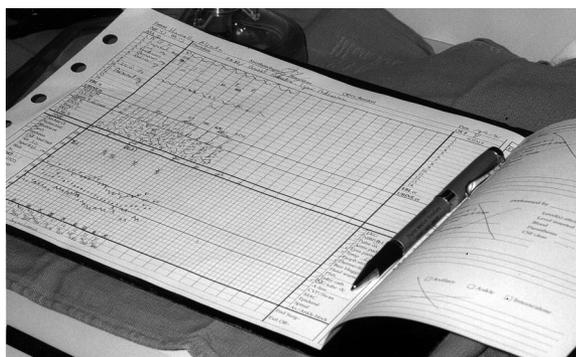


Figure 6.1 The anesthesia patient record on paper at St Lukes before being computerized

A computerized Anesthesia Information System might support a quality assurance function, outcomes assessment, education/research and medico-legal protection. It might also support tabulation of services, costs and resource utilization. The anesthesia information system at St Lukes hospital that I studied includes:

1. Pre-anesthesia evaluation
2. Intra-anesthesia record
3. Remote monitoring of cases
4. Anesthesia staff assignment
5. Scheduling accessibility
6. Personal daily schedule care overview
7. Quality assurance and data analysis report
8. Automated charge services

In other words, it includes: automatic recording of things like blood-pressure and pulse during surgery, pre-operative information about how the patient was evaluated before surgery, post-operative documentation after surgery, a possibility for databaseanalyses and access to old data, a possibility to print reports and automatic production of a bill for the work that was done. The information system also makes possible better planning of how employees and other resources are used.

Following measures are used to assure safety: fingerprint-identification, electronic trail and log-ons. These safety measures are supposed to make it impossible for anyone to access a patient record without the right to do so. Log-ons make it possible to go back and see who has read the document and electronic trails make it possible to follow where and how a document is used among units and employees.



Figure 6.2 A computerized anesthesia patient record tested in the operating room

I have already mentioned that I have seen how the software at St Lukes has a simple design of three pages: Monitor (blood-pressure and pulse), Fluids and

Medication. It is easy to move between these pages. The software also included functions such as a daily overview of staff on duty, operating schedules, quality assessment tools, data analysis and automatic billing.

The bill is itemized into costs for total time of anesthesia, how the anesthesia was performed, the bodily position of the patient, medication, type of anesthesia, the age of the patient and a few more items specific to the American system. In addition the system supports the e-mailing of the next day's schedule to the appropriate caregivers.

According to the project leader this strategy surpasses the original goals for a new information system at the anesthesia and intensive care unit. It also includes functions that were not included in a patient record from the beginning. On the basis of my observations of staff members trying to learn the use of the computerized patient record in the operating room, they say that they like what they see but at the same time they feel confused and ask many questions. They also find it more difficult to move around in the OR.

In Austria the strategy behind buying software was that they wanted automatic data sampling, fluid balances and ordination of drugs, a structure for planning interventions and a taskplanning feature. They also wanted the ability to follow longer trends and access to an overview of what has happened to the patient. In Austria they use Chart Plus and Visual Care, two different applications of the same software that have to be adjusted to the specific needs at the clinic. Chart Plus registers data such as pulse and bloodpressure. During my observations of staff using the computerized patient record during work, both the nurses and the physicians explain to me how it functions and point out what is good and bad with the system. "You get the most important information on one page". "You get everything about the patient at the same moment". Visual Care registers therapies. "It is positive that it is easy to change between Chart Plus (data) and Visual Care", says one of the physicians.

As with a paper chart, designing a computerized patient records always includes extensive discussions about what is the optimal amount of information in a patient record, as I write about in chapter five. One of the anesthesiologists in Austria says: "It is important and difficult to decide how much information to include in the information system. Too much information is confusing". When I ask what the concept userfriendly means in this context an Austrian anesthesiologist replies: "Userfriendly is when all necessary information about the patient can be found on one page. "Userfriendly is the same as "easy to get into". Another male nurse answers: "For me userfriendly means easy to access, good security with a pincode and fast". The new information system in Austria is slow when it includes too much information. "A problem is that if the patient spends a long time here (2-3 weeks) it is difficult to get into the system. It gets jammed!" "The system is slow when the patient has been here too long". In spite of this they demand more space for free text. "More space for free text is important", one of the nurses says. This is in line with a tendency to document more in patient records and include more narrative sections.

The anesthesia patient record originally included only data such as pulse and blood pressure, now it includes many different services.

So to sum up, the content of what is included in a patient record has expanded both in Austria and at St Lukes in the United States when it was computerized.

### 6.2.2 Why is a computerized patient record constructed as it is?

In this project I have seen how much more information is included both in the new patient record on paper at Karolinska hospital and in a computerized patient record. When these functions are included in the computerized patient record the notion of what a patient record is and can be is expanding. When computerized the patient record is transformed into what I call a knowledge management system. It enables the streamlining of information, improves a work process and integrates different parts of a hospital, such as St Lukes. It also provides a possibility for improving integration mechanisms at many levels in the organization where it is used and outside the organization: among different employees at the same clinic, at the hospital and in society.

### 6.2.3 Implications of computerizing a patient record

In both chapter four and five I describe how certain dimensions of performing anesthesia, enacted as mental schemas supported by certain resources, are influenced and transformed in connection with working with the patient record. As is evident, implementing a computerized patient record influences how to document information in this specialist domain. Instead of using a pen an anesthesiologist is forced to start using a computer. When describing why a computerized patient record is good, employees describe the way they document like this:

“We try to document as fast as possible. It is often during the afternoon or in the evening, but at the same time this is a critical period since the relatives normally show up and want to talk”. (Excerpt from interview with anesthesiologist in Austria)

“Today maybe only 60 percent of the information is documented. Sometimes important information is lost. And when we ask what happened later, the person that knows is not there or he doesn't remember”. (Excerpt from interview with anesthesiologist in Austria)

“Today we document 2-3 hours after interventions. Important information is normally lost in the intensive care unit”. (Excerpt from interview with anesthesiologist in Austria)

Employees have to document what takes place during surgery, but a lot of information also remains in their heads. Unfortunately only parts of this information is made visible to others later on. In connection with emergencies it also happens that important information is lost. Computerizing the patient record might solve this problem.

Both nurses and anesthesists in Austria have many comments related to one of the very important resources in anesthesia, time. The nurses and anesthesists say: "To be able to be fast is important". "With one movement you can see what happened during the last 24 hours". "Sometimes we have to wait too long for lab-data that is needed quickly". "A good system is a system that allows me to work fast". In chapter four I pointed out that this group of employees calls themselves "emergency-people". For emergency-people involved in emergencies, time is a scarce but very important resource that might influence the outcome of work.

At Sundebyn the project leader says: "People in the OR did not document so much before. Now they have to document according to legislation". "Now our patient records are better and include more details". This follows a trend visible everywhere in health care and in the rest of the society that increased documentation takes place in many professions. Surgery and anesthesia used to be mostly "hands on activities" performed by surgeons and anesthesists using hands and eyes when doing what they do. Now the content of anesthesia work is becoming more and more involved with analysis and documentation.

In Austria one of the anesthesists say: "It is less work using a computer compared to a patient record on paper". I assume that less work means that the employees have to spend less energy accessing information and documenting when using a computerized patient record. To spend less energy is a goal behind implementing a tool such as a computerized patient record. "Now I can read, before the handwriting could be a problem", says one of the anesthesists in Austria. This has to do with the ease of reading what is in the patient record when it is on a computer. And the anesthesists say: "What is good about computers is that you do not need to decipher reports written with a difficult handwriting. The old reports were good if they were well written, but that was seldom."

Ways of documenting develop into a mental schema that influence and are influenced by certain resources. Now the employees have to transform their mental schemas for how to document and that costs energy. Documenting has also become a more structured activity. It involves less flexibility when it comes to what to write in the patient record but more flexibility when it comes to performing anesthesia and being able to access old data and information.

Several of the employees that I have interviewed and observed talk about freeing eyes and hands as something good, as something that improves their ability to perform in a more efficient way. "I need free hands to work with the patient. Through my hands goes all the senses and I get information from

looking at the patient. To free eyes and hands are important,” says one of the anesthesists in Austria.

Implementing a computerized patient record reduces the flexibility in how the anesthesist administers anesthesia but increases the flexibility around the operating table since the anesthesist gets more time to interact with his or her colleagues, according to the projectleader at St Lukes hospital.

A mental schema for how to administer anesthesia is transformed. At the same time as these transformations take place, a structuring of knowledge also takes place. For example, diluting medication becomes a more structured activity, but making it automatic may also mean deskilling the anesthesist. In Sweden one of the nurses at Karolinska hospital also says “you have to get it into your hands”. Because of this, using computers is not good, at least not from the beginning, especially not for the young anesthesists.

How to dilute medication is improved and that increases safety in how work is performed, both with a more advanced patient record on paper and with a computerized patient record. Since many mistakes in health care have to do with giving the wrong medication a computerized patient record improves both the knowledge of what medicine a patient received and how medication was diluted. A male nurse says: “Now it is easy to calculate what comes out of an infusion. Otherwise it can be difficult”. Even if the project failed at Sundebyn it resulted in at least one success: “One good thing is that now we have well developed routines for dilution of medication”.

Positive reasons for including standardtherapies in the software are verbalized by one anesthesist in Austria: “The more standardtherapies you can find in the software, the faster and more easily different situations can be handled. Then the results of the therapies are improved. I want to have as few steps as possible when working. Today there are standardtherapies but 70-80 percent of them must be modified”.

When formalizing a strategy for how a computerized patient record should be constructed it is necessary to find a balance between verbal and visual data and information. Design decisions behind a computerized patient record also include descisions about using colors such as green, red and yellow to remind employees about things that must be done. Reasons for using colors in the software are expressed by one of the Austrian nurses like this: “The red color reminds us about things that must be done. The green color represents things that already have been done. This is good because certain things should be done every third hour and others every sixth hour. Yellow is used when something changes. For example look here: The patient needs 900 mg of this substance but has only received 600. Now he needs 300 more.”

Important factors are also visual: “The size of the numbers on the screen are sometimes too small and difficult to see”. Pictures and a sign for a pacemaker might also be included in a computerized patient record. One anesthesist in Austria explains the advantage of pictures like this: “It is positive with pictures with points for different wounds. Some of the places can be difficult to describe in words. One body with many wounds with many different

therapies can be difficult to describe in words". A female nurse continues: "Now we can also scan pictures of wounds into the record. It is good with pictures in the record. This is because sometimes it is difficult to describe a body with many wounds with different therapies".

An alarm is connected to the information system and it signals if something happens with the patient. Another physician says: "One convenient thing is that I just have to press the sign for pacemaker in the software, I do not even have to write down the word."

Improved safety is important in health care. Not everyone should be able to access information about a patient. A computerized information system makes it possible to keep track of who reads the patient record. "Now we get good safety with a pincode", says one of the nurses. In Austria they use pin-codes and at St Lukes they have both log-ons that make it possible to go back and see who has been reading the document and electronic trails that make it possible to follow where and how a document is moved and used among units and employees at a hospital.

A nurse says that most of the criticism of the computerized information system has to do with the system being slow or the software inexplicably closing down.

Some of the complaints among the nurses in Austria relate to ergonomics. "It is difficult to move around among all the machines. It is a clumsy work situation". "The mouse is not good". "I wish I had a good chair to sit on near the patient in the bed". "We use plugs in the wall to take out and put back when we want to close down the computer. It takes time and is not very convenient. We have to take out the plug instead of closing down the computer through pressing a button on it".

The mouse is not good, according to the employees in Austria. The nurse would also like to have another type of chair when sitting close to the patient. She shows me how the chair hardly fits in because the computers take so much space from the area around the bed. Another problem is that they have to take out the plug when closing down or restarting the computer instead of using a shutdown button. When the sun shines into the room, it is also difficult to see the numbers on the screen, it is difficult to move around in the room, and the hardware is not convenient. These comments make it obvious to me that it is not only important how the computerized patient record itself is designed but also the environment surrounding it.

To sum up what I have written above, computerizing a patient record has many implications on many different levels, both inside and outside an anesthetist. He or she has to transform the mental schemas that he or she uses when performing work. How an anesthetist moves around in the OR is also transformed. I want to repeat that what employees get out of a computerized patient record depends on what strategy they have for it. How a strategy is formalized depends on what role employees allow the computerized patient record to play in their daily work.

In the next section I shall present several empirical findings generated by this research.

## 6.3 Conclusions

After observing anesthesia work at St Lukes and Allgemeine Krankenhaus, I conclude that there is a limited amount of room in the OR for people who work with a lot of complex equipment. Patient care is intense and requires awareness about what is happening not only with the patient but also in the operating room. It is a stressful working environment. The data that is generated in the OR is mission-critical and cannot be lost. It must be reliable and retrievable. An anesthesiologist cannot go back to get this data later so he or she must get it while it is being generated. He or she must have enacted a patient record at the end of the procedure. Therefore constructing and implementing a computerized patient record is considered as a difficult transition period and a “*high-risk*” situation.

1. One of the empirical findings is that the design of a document like a computerized anesthesia patient record should utilize the insight that vision is the quickest way to process information. Reading is slower and listening the slowest way to process information. Very complex situations, such as a patient with several problems at the same time, can be communicated much more quickly with a picture than with many words. One body with many wounds with many different therapies can be difficult to describe in words. Then it is easier to use a picture, which can function as a simplified representation of a complex situation. In Austria I have seen how a picture in a computerized patient record makes it possible for the anesthesiologist to mark a spot at the body for a therapy with a computerized pointer instead of describing the place with several words and/or sentences.
2. When it comes to text there is a conscious choice about what and how much text to use. Constructing and computerizing a patient record involves an active search for the “optimal” level of information. An anesthesia employee prefers to get everything about the patient on one page, or that there are two pages that are easy to alternate between.
3. The size of the numbers on the screen becomes crucial. The efficiency and safety of what takes place at the anesthesia and intensive care unit might be improved by using colors for different types of data and including functions such as a sign for a pacemaker in the software.
4. Computerized patient records make possible many more standard therapies, which make it easier to work. Less modification of

standardtherapies decreases the workload for a physician. Then the results of the therapies improve. Different situations can be handled in a more efficient way. The work of an anesthetist demands fewer interventions when more standardtherapies are available in the software.

5. Computerized patient records decrease double and triple documentation, as in Austria. It also makes it possible to read what has been written in the record, which is a change from when it is on paper. More vital sign data points and more notes and drug information per case is also recorded. With a computerized patient record information is always available, and the text, if designed properly, is easier to read than in handwritten documents. It eliminates distractions, such as trying to make sense out of sloppy texts, and it makes some activities automatic, such as writing down pulse and blood-pressure, and redesigns what is going on in the OR, such as how people move around in the OR.
6. When computerizing a patient record, employees are forced to define work routines. One of the examples: routines for dilution of medication are produced. Following is the case: In anesthesia there are many problems that might appear, one of them has to do with using medication. To produce a more structured behavior for diluting medication is therefore seen as something good.
7. Anesthetists are, like all physicians, individualists. They develop their own routines for how to give anesthesia to a patient. When a computerized patient record is implemented, they are forced to a more uniform behavior. The behavior gets structured. The flexibility in their own work is decreased but at the same time flexibility in the operation room is increased. They can follow what happens around the operating table and communicate with colleagues more freely than when they write with a pen on paper, or sit with a paper-record on the lap.
8. Both a new patient record on paper, as described in chapter five, and a computerized patient record make it possible to control the use of blood during surgery. In Austria the use of blood has decreased after the clinic implemented a computerized patient record. Blood is one of the important resources used during surgery.
9. To keep your identity as an anesthetist means to continue to build on earlier knowledge. Anesthesia could stagnate as a specialist domain without scientific improvements. Implementing a computerized patient record improves the learning processes in the organization. Research, education and learning are possible with a computerized information system. In Austria they also use the computerized patient record as a way to explore data and investigate trends.

10. There are ergonomic consequences of implementing a computerized patient record, such as employees changing how they move around the patient. There are also tools, such as the mouse, which do not feel comfortable and should be changed. So, there is a need not only to develop good software but also hardware that suits circumstances that anesthesiologists work under.
11. Finally this research shows that implementing a computerized patient record improves security with things such as pin-codes and electronic trails. This is the case in Austria and will be the case at St Lukes hospital in the USA.

## 6.4 A chapter summary

In this chapter I have identified several problems that have to be solved when computerizing a patient record. The first one is how to transform and design what takes place in the anesthesia and intensive care unit in such a way that it can be represented in the software used in a computer. The differences between a paper document and software are many. One is that on a paper document it is possible to write on both sides. A paper document can also be folded in different ways. In this study I have also found that a computerized patient record not only influences the different mental schemas mentioned in the preceding chapter, it also influences how the anesthesiologist and the anesthesia nurse move around in the operation room. Logging on, safety and signing information are other problems that have to be solved in a computerized patient record. In a computerized patient record, it is also possible to include functions such as an automatic alarm, which are not possible in a patient record on paper. What the employees at the anesthesia and intensive care unit get out of a computerized patient record depends on what strategy they have for transforming it. Transforming it to a knowledge management system expands its influence in and outside the organization. In the next chapter I will present and discuss the theoretical contributions in this thesis.

# Chapter Seven

## Transformation, routinization and duality of structure

Earlier in this thesis I have tried to picture anesthesia as a specialist domain and verbalize how an anesthesiologist exercises his or her knowledge. In chapter four I made an effort to take the readers “*into the heart of that which is interpreted*”, (Geertz, 1973/2000) giving an account of the core in a profession. I gave evidence of how an anesthesia patient record on paper is constructed in chapter five and in chapter six how an anesthesia patient record is computerized. In each chapter I have presented the empirical data obtained during interviews and observations, analyzed it within the theoretical framework presented in chapter two, and then presented the empirical findings under the heading “conclusions”. This chapter discusses and interprets the theoretical findings in light of ideas about knowledge management, certain concepts from structuration theory and cognitive theories about representations, sensemaking and schema use. The ambition is to set forth a theoretical position grounded in empirical evidence. In the following section I will first discuss how anesthesia as an empirical setting is structured and enacted and how that structuring is influenced when a new patient record is constructed and designed either on paper or electronically. Second, I will summarize the results presented in chapter five and six. Then I will describe knowledge management as a multidimensional activity. The clinical eye is conceptualized as a cognitive style and the patient record as a knowledge management system. After that I propose two concepts, *knowledge structuring* and *knowledge domination*, as useful when analyzing and discussing the outcome of the practice of trying to manage knowledge in organizational settings, such as the anesthesia and intensive care unit of a hospital. At the end of this chapter I will summarize the theoretical position that I have developed during the research process.

## 7.1 Managing knowledge in a structured setting

First I want to state once again that in this thesis I have viewed implementing a computerized patient record into the anesthesia and intensive care unit of a hospital as an effort to manage knowledge in a structured setting. By denoting computerizing a patient record as a knowledge management activity I have also assumed that the employees at the clinic hope for improved work processes so that in the end they will exercise their knowledge better and create increased value in their every-day working life. In this section I will first describe the anesthesia and intensive care unit as a structured setting. Then I will relate this setting and the project of constructing and implementing a computerized patient record to three of Giddens very important concepts, routinization, transformation and the duality of structure.

### 7.1.1 The anesthesia and intensive care unit as a structured setting

Anesthetists and anesthesia nurses can be conceptualized as knowledge workers that belong to a thinking collective. A thinking collective has a common thought style that is based on a common amount of historically developed and shared knowledge. Its members use certain words and expressions known only among themselves when they meet and solve certain problems in a context that is specific for this group (Fleck, 1934). Anesthetists can also be pictured as knowledgeable agents that “know a great deal about the conditions and consequences of what they do in their day-to-day lives” (Giddens, 1984). I have already written that anesthesia is a “continuous flow of conduct” that influences and is influenced by structures such as mental schemas and sets of resources, that empower and constrain social action, and at the same time tend to be reproduced by that same action (Sewell, 1992, Giddens, 1984). In addition to this I have conceptualized performing anesthesia as a medium-range knowledge-intensive activity since the “producer” is well-educated and exercises knowledge based on scientific improvements, while the consumer, in this case the patient, requires no education at all to consume or receive what is produced.

In chapter four I point out that anesthesia is performed in two organizational settings, at the anesthesia reception desk and in the OR, operating room. In both settings a structuring takes place as actors draw on and make sense of the institutional patterns of signification, domination and legitimation that characterize this specialist domain in order to construct roles and interpret persons, objects and events in their environment (Giddens, 1984). During interviews and observations I have seen how the encounters at the anesthesia reception desk become an act that is constructed by the anesthetist and the patient together in a face-to-face situation. It soon becomes a struc-

tured activity. It also becomes a routinized activity. I have seen how the anesthesiologist sits in a chair behind a desk in a room and the patient at a chair in front of the desk. The anesthesiologist evaluates the patient, going through the human organs systematically. An interpretative schema for how to evaluate the patient is developed. It is a mental schema that becomes part of the structure and it also helps to structure what takes place in this organizational setting. A structuring takes place when anesthesia employees give what takes place around them a meaning, exercise power and live by a certain morality depending on what is seen as accepted in the context within which they perform. This implies that the anesthesiologist bases his or her evaluation of the patient on earlier experience and research about what is important to know about a patient in order to decide whether he or she can go through with surgery or not, whether the patient is allergic to certain substances and what kind of anesthesia to perform. Sensemaking takes place all the time at the anesthesia reception desk and in the OR. The purpose is to reduce ambiguity and develop a shared meaning so that the group that is involved in taking care of the patient may act collectively. At the same time an anesthesiologist constructs his identity, for example as "emergency-people", in interaction with others around the operating table. Sensemaking is retrospective, which means that the anesthesiologist judges what is happening with the patient, depending on what he or she as an anesthesiologist has experienced before. How he or she makes sense of what takes place also depends on how the other people around the operating table make sense of what happens.

I have seen how a younger anesthesiologist learns from an older one at the anesthesia reception desk and in the OR at Karolinska hospital through discussing cases. Discussing cases is also done during many of the meetings at the clinic. It is obvious that discussing, talking and debating cases embraces sensemaking in a medical setting. It makes a group of colleagues agree on how to address a certain problem. In addition to this, scientific and educational efforts are continuously integrated into the work since most of the physicians are involved in different types of research projects at the same time as they perform daily work. Being updated when it comes to the latest research within this specialist domain is advisable and part of being a knowledge worker. A knowledge worker strives for knowing the latest within his or her field. New knowledge is created, in this very specific organizational setting by managing conversations, mobilizing knowledge activities and globalizing local knowledge (von Krogh, Ichijo and Nonaka, 2000).

During social interaction, such as performing anesthesia, resources are effects of mental schemas and mental schemas are effects of resources. What resources are used depends on how a mental schema for performing work has developed, and how that mental schema looks like also depends on what resources are available. In the theoretical framework presented in chapter two, Sewell (1992) defines structures as "schemas with a purely virtual existence and resources are media and outcomes of the operation of structure". A structure is said to be dynamic, not static, and the continually evolving outcome of

a process of social interaction. For example, the mental schema for documenting a case changes when the physical document itself changes. If there are more blanks in the document to fill in, the anesthetists soon also get used to asking for this information during evaluations or surgery. A mental schema for how to perform anesthesia influences how the substance anesthetics is used. Schemas not empowered or regenerated by resources will eventually be abandoned and forgotten, just as resources without schemas to direct their use will eventually decay. Without the socially constructed profession of performing anesthesia probably nobody would use substances such as anesthetics, or they would at least have to find another use for them.

In both chapter five and chapter six I write that an artifact like a patient record is created by the anesthesia employees, but when used it also shapes the anesthetist and his or her actions. It both enables and constrains the anesthetist in situated practice. It is an artifact that contains high quality information. It is a diagnostic and therapeutic instrument. An anesthesia patient record originally showed only a curve and what happened with certain parameters such as blood pressure and pulse during surgery. Today the anesthesia patient record consists of three parts: the perioperative record, the anesthesia curve and the anesthesia report. How these are used soon becomes a routinized activity.

### 7.1.2 Routinization

One important concept in structuration theory is routinization, the habitual taken-for-granted character of many activities of day-to-day social life. During observations at Karolinska hospital and St Lukes I have seen how a special way of working is organized around the patient record on paper. An anesthetist gets used to documenting, "*using a pen*", diluting medications and giving anesthesia in a certain way. If this way of working is changed he or she might temporarily feel insecure until a new routine has established itself. I have seen that when a patient record is constructed and computerized, the life of a knowledge worker, such as an anesthetist, exercising his or her knowledge, is transformed then replaced by routine and after a certain time-period once again transformed. Today most of the things knowledge workers do, and the tools they use when doing what they do, are exposed to transformations. During this research project I have seen how knowledge workers are exposed to transformations, how they develop mental schemas and how they resist temporarily the transformation of these schemas. This is because it costs energy for a human being to transform a mental schema. But knowledge workers are forced to accept these changes, otherwise the practice a knowledge worker performs declines. It seems to me that a knowledge workers resistance to transformations can only be temporary since today the demands on people to be flexible are increasing all the time.

### 7.1.3 Transformation

In chapter two I report that according to Giddens there are three major sets of changes taking place in society today, and it is the task of sociology to analyse what they mean for our lives. One of them involves how new information technology is transforming the nature of many contemporary jobs. In chapter five I describe that one of the mental schemas that is transformed by constructing a new patient record is how to evaluate the patient at the anesthesia reception desk. These evaluations are mediated through resources such as time and eyes, but also the data and information that is included in the patient record. The requirements to fill in certain blanks in the patient record influence what questions are asked during the evaluation of the patient and how an evaluation takes place, but these blanks also exist because of the way anesthesia is performed. Here one can experience "the duality of structure" being acted out. Another mental schema that is transformed when computerizing the patient record is the actual administration of anesthesia. It is expressed through the use of resources such as eyes, hands, time, anesthetics and blood. How to dilute medication is also transformed and mediated through the use of drugs, hands and time. Finally ways of documenting cases are expressed through the use of resources such as eyes, hands, time as well as the appearance of the patient record and that mental schema is obviously transformed. An anesthesiologist is accustomed to using a pen when recording data. It becomes a routine. When the patient record becomes computerized anxiety increases in the beginning. The anesthesiologist is afraid of losing control over what happens to the patient. If recording vital signs becomes automatic, maybe the anesthesiologist will forget to intervene when necessary. But eventually he or she accepts and adjusts to a new situation. In chapter six I wrote that one example of a place-schema (Fiske & Taylor, 1991) is the way an anesthesiologist gets used to moving around the operating table close to the patient's head in the OR during surgery. How the staff move around among all the devices and among the other people working in the OR is also influenced and transformed by format of the patient record computerized or manual. In chapter six I therefore conclude that there are ergonomic consequences of computerizing a patient record.

All these things together make me realize that computerizing a patient record is a major transformation of a very important informational tool that ties together activities not only at the anesthesia reception desk and in the OR, but also outside the clinic. A computerized patient record is integrated into a routinized behavior that gets interrupted and then transformed. The relationship between the patient record and the "continuous conduct" of the anesthesia staff concerned is what Giddens calls recursive (1984). It means that employees have influenced how the new patient record looks but now the computerized patient record also influences how work is performed at the clinic. This is what is meant by Giddens's concept "the duality of structure".

### 7.1.4 The duality of structure

The duality of structure is probably Giddens's most wellknown concept, and in this research I have observed the way the duality of structure works. It is a dynamic phenomena that takes place during social interaction. It means that in our everyday lives we are all influenced by and influence what takes place around us. In this case I have seen how an artifact like the patient record is created by the employees and how they perceive that they perform work. But the patient record also transforms how work is performed. A patient record both enables and constrains the anesthetist in situated practice. It increases and decreases flexibility.

Patient evaluation becomes a structure at the anesthesia and intensive care unit. I have already written that this structure consists of a mental schema that is an effect of certain resources being used, and these resources are effects of a mental schema for how to evaluate. The structure structures what takes place in this organizational setting. In the next section I will once again summarize how and why a patient record is constructed as it is and implications of this for the anesthetist and the anesthesia nurse.

## 7.2 A summary of results presented in chapter five and six

Below I will once again summarize how and why a patient record is constructed as it is and implications of this for the anesthetist and the anesthesia nurse.

### 7.2.1 How is the content of a patient record constructed?

In the new anesthesia patient record on paper at Karolinska hospital is preop, intraop and postop included as well as trauma-information. A description of how the patient came into the care of an anesthetist has been expanded with emergency alarm, trauma alarm, the level of trauma as well as if the patient were transported with helicopter or ambulance. Another service that is included is whether the patient brought any personal items such as eyeglasses or hearing aids to the surgery. In chapter five I report that in a new patient record on paper I find four different trends. The first one is narrative, the second is including pictures, the third is integrating work at the clinic and the fourth is including different kind of services. In chapter six I write that a computerized anesthesia patient record at St Lukes in the USA consists of a three-page software design called Monitor, Fluids and Medication. The software both integrates work at the clinic and includes different services. It includes pre-anesthesia evaluation, intra-anesthesia record, remote monitoring of cases, anesthesia staff assignment, scheduling accessibility, personal daily schedule care overview, quality assurance and data analysis report and automated

charge services. At The Heart Clinic at Allgemeine Krankenhaus in Vienna they use two applications Chart Plus and Visual Care. Chart Plus registers data such as pulse and bloodpressure and Visual Care register therapies. In Visual Care a picture of the back and the front of the patient is included. They also use colors for different types of data in both applications.

### 7.2.2 Why is a patient record constructed as it is?

Both the new anesthesia patient record on paper and the computerized anesthesia patient record is constructed as they are to achieve coordination and enhancement both inside and outside the clinic. The project group also search for "the optimal" amount of information needed for improved performance at the anesthesia and intensive care unit. For example the efficiency and safety of what takes place might be improved using colors for different types of data. When more services are included in the patient record it is transformed into a knowledge management system. In section 7.5 I will write more about the implications of viewing the patient record as a knowledge management system.

### 7.2.3 What are the implications of constructing and computerizing a patient record for the physician and the nurse involved?

In both chapter five and six I conclude that "the clinical eye" is influenced by a transformed document. It is a resource and a cognitive style that characterizes the anesthetist. It influences how information is sought, work performed and knowledge exercised not only in anesthesia but also in other professions. In this case a transformed document might disrupt the harmony in how the patient is taken care of. A transformed patient record also influences following mental schemas: How to perform anesthesia, how to dilute medication and how to document. A computerized patient record also influences how the anesthetist and the anesthesia nurse move around in the operating room. A computerized anesthesia patient record makes it possible with many more standardtherapies which make it easier to work. Less modification of standard therapies decreases the workload for the physician. The work of an anesthetist demands fewer interventions when more standardtherapies are available in the software.

The use of blood also decreases when it is reported in both a patient record on paper and a computerized one. The possibility to explore data improves learning at the clinic. Safety is improved with log ons and electronic trails. Certain double and triple documentation disappears. Text is more easily read. I conclude that using pictures both in a document on paper and a computerized one eases communication and saves energy.

In the section that follows I will write about why I perceive knowledge management as a multidimensional activity.

### 7.3 Knowledge management as a multidimensional activity

One of the first things I realized, when reflecting over what I have explored during the research process, is that constructing and implementing a new anesthesia patient record involves learning, both for the anesthesiologists and the nurses. "I have had to learn a lot", says one of the nurses in Austria, and one of the anesthesiologists says: "I teach new physicians the software. If you do not know about computers, it is difficult at first. It takes about a month to learn" and "When a physician is alone, it can sometimes be a problem if she or he is supposed to search for trends in the data. New physicians make mistakes and we must change and correct what they do". At Sundebyn in Sweden the projectleader says that even though the project of implementing a computerized patient record failed they "got a perspective on what kind of work we perform and how a project like this should be conducted".

Another thing that happens when constructing a new anesthesia patient record is that the employees involved start reflecting over how and why they do what they do. Transforming a tool they use in every-day work creates an "awareness" among the employees concerned. The projectleader at Karolinska hospital also described the project of constructing a new patient record on paper as "finding out what we do". It can therefore be seen as a knowledge management project in the sense that it makes visible and elicits the core of a practice. It "turns an unreflective practice into a reflective one by elucidating the rules guiding the activities" (Tsoukas and Vladimirov, 2001). It is also a knowledge management project in the sense that it strengthens an identity and further develops a language for a unique group of people. A strong identity is believed to improve coordination, communication and learning in a professional group (Kogut and Zander, 1996). The projectleader at Karolinska hospital expresses this as "now we have a platform to continue working from".

I also think that this research shows that managing knowledge can be a multidimensional activity. When the project group mobilizes knowledge, they also build knowledge. And when they build knowledge they also mobilize knowledge. Mobilizing knowledge includes activities such as the sharing of information and conversion of tacit knowledge. When constructing a patient record on paper, employees share information. For example the project starts with an enquiry about what should be included in a patient record. Then they search for a level of information that they can agree on. They also search for a common language. The employees in the project group share experiences, they share a metaphor "the bible", they share the patient record. It is an arti-

fact but also a representation of the course of an anesthesia. They become aware of what they do and why they do it, and this strengthens their identity. Crucial activities such as coordination and cooperation are made easier by a strong identity.

In this project I have seen how both constructing a new patient record on paper and computerizing one nurtures activities such as experimenting, prototyping and implementing new processes and methods that are supposed to improve internal operations and how knowledge is exercised. These activities involve learning and create awareness. The importance of awareness cannot be overemphasized since awareness makes further learning possible.

The next section points out the importance of the clinical eye as a cognitive style for an anesthetist and as a resource and part of structure at the anesthesia and intensive care unit.

## 7.4 Conceptualizing "the clinical eye" as a cognitive style

Performing anesthesia is both a cognitive and physical activity, as I put forward in chapter four. An anesthetist analyzes and evaluates, but then he or she must also act. One of several theoretical contributions in this thesis is the concept "the clinical eye". This concept characterizes how an anesthetist exercises his or her work and can function as an example of a cognitive style (Dervin, 1992; Taylor, 1991; Wilson, 1997). A cognitive style is the same as information processing habits that represent how a knowledge worker perceives, thinks, remembers and solves problems. In this research the clinical eye emerges from the empirical data as a concept that influences the search for information, how knowledge is exercised and has implications for how a patient record should be designed. In chapter four I therefore conclude that the clinical eye is an important concept to understand how an anesthetist, as well as other physicians, exercises his or her knowledge, how the content of a patient record is constructed and staff react to changes in a patient record. I also think it is an interesting concept in relation to other professions, and one that can be taken further in future studies. The clinical eye is based on my observation that the anesthetist and the surgeon stand beside each other in the operating room close to the operating table, but it is the anesthetist that keeps his or her eyes on the patient while the surgeon operates. It is also the anesthetist that evaluates the patient and informs the surgeon about if the patient is ready for surgery or not. Anesthesia can therefore be described as a servicefunction to the surgeon. The clinical eye is used not only in Swedish medical terminology but also in French and German terminology. In German terminology it is called "medizinischer Blick". But it is not the same as the expression "clinical reasoning". It may be one aspect of clinical reasoning though in the sense that to be able to reason a physician must gather data and

information. I conclude that “the clinical eye” is both a mental construct and a concept that reflect external reality. According to Foucault (1963/2000) it is “the eye that knows and decides, the eye that governs”.

In chapter five I write about how a new patient record on paper influences the clinical eye and how the clinical eye influences the construction of a new patient record on paper. The clinical eye becomes part of a structure for performing a task. It supports certain mental schemas for how to do things, and these schemas are effects of the clinical eye as a resource. During this research process I have seen how the clinical eye structures how a patient record is socially constructed and designed.

Clinical concerns actual treatment, not experimentation or theory. It is a perceptual act in medicine and has to do with direct observation. Both the physician and the nurse are supposed to keep an eye on the patient during surgery. An anesthetist cannot explain exactly what he or she is looking for but knows when he/she sees it. In anesthesia as well as in other professional areas where experts have to keep an eye on a client or a product, this is a way of scanning for needed information. Baddeley has used the expression “scanning with the mind’s eye” (1997/1999).

During interviews I have found that “the clinical eye” is important both for the anesthetist and the nurse, and something they have trained themselves to develop. Therefore I conclude that if the paper document demands too much time it will disrupt the harmony in how the patient is taken care of. This recursive relationship between the patient record and the anesthetist is an important example of “the duality of structure” (Giddens, 1984). It is also an example of the dynamic relationship between mental schemas and resources – schemas depend on resources and the resources depend on schemas (Sewell, 1992). A mental schema for performing anesthesia is influenced by a resource such as “the clinical eye”. And “the clinical eye” influences mental schemas such as performing anesthesia and documenting. In my opinion the clinical eye as a resource also puts a focus on the importance of vision when taking in information, making sense of a situation and taking a decision about how to act.

Vision can be described as an intelligent process of active construction (Hoffman, 1998). It is a matter of perceiving sense data, synthesizing and then categorizing what people perceive. We “see” the time and remember with pictures (Schacter, 1996). This is because the ability of humans to think rests to a great extent on our ability to create a symbolic representation of the world, a picture of the world separate from the world itself. “What you see” has a phenomenal and a relational sense. In the phenomenal sense, what you see means “the way things look to you”, “the way they visually appear to you”, the way you visually experience them. But in the relational sense it mean “what you interact with when you look” (Hoffman, 1998). The visual system is believed to have two components, one concerned with pattern processing and detecting “what” while the other is concerned with location in space and conveys information about “where” (Baddeley, 1997/1999).

Visio-spatial planning and manipulation are thought to be important not only in medicine but also in professions like engineering, aeronautics, architecture and virtual design.

The section that follows deals with the phenomena of conceptualizing the patient record as a knowledge management system and what implications a strategy like this has for employees concerned.

## 7.5 Conceptualizing the patient record as a knowledge management system

In this section I start describing the patient record as a knowledge management system and an artifact that structures knowledge. Then I write about how technology shapes our behavior and how behavior shapes technology, an expression of Gidden's concept "the duality of structure". I continue with my view that the construction of documents is a knowledge management activity and conclude with the observation that the strategy behind constructing a knowledge management system can focus on coordination and/or enhancement and the use of verbal and/or visual data.

### 7.5.1 A knowledge management system helps to structure knowledge

To conceptualize a computerized patient record as a knowledge management system facilitates a new and different view of how to use it, as a tool to enhance and coordinate care processes in health care networks. It is a tool that is part of a structure as a resource supporting certain mental schemas such as the one used for evaluating the patient. It is a tool that helps to structure knowledge and how knowledge is exercised in this organizational setting. It is a tool that might influence what takes place at many different levels in both organization and society. In chapter five and six I write that a patient record on paper (and a computerized one) not only improves the documenting of data, but also enforces integrating mechanisms between different units of the clinic, including services outside the clinic such as ambulance care. In this thesis I conclude that a transformed patient record influences mental schemas enacted when performing anesthesia and the resources used when doing that, such as "*the clinical eye*". In addition to this, a patient record can help to monitor material resources such as blood and medication. With the help of a knowledge management system a clinic might improve learning, as in Austria. At St Lukes hospital, they plan to use the knowledge management system to monitor employees and their work schedules. It is a way to streamline a workprocess and contribute to both coordination and enhancement. In Austria they use the knowledge management system and add functions such as an alarm when a patient gets heart-problems. So a technology is not solely an al-

locative resource used to coordinate and control material objects, as Giddens first wrote in his book *The Constitution of Society*. (1984) It has a transformative effect on our lives. Before I discuss this in more detail I will review and discuss some of the conclusions I have drawn when conducting this research.

I have seen how the anesthesia patient record is formed and transformed in a defining process that takes place during social interaction between different parties. The importance of the anesthesia patient record is showed by it being called “*a bible*” by the projectleader at Karolinska hospital. Having a patient record is a way to escape the notion that anesthesia is a “*craftsmanship*” depending only on “*doctors temperament*”, as one of the anesthesists at Karolinska told me during an interview. It is a way to be professional. Upgrading and computerizing the patient record is a way to become even more professional. I view a computerized patient record as a socially constructed artifact used in collaborative work in situated medical practices. The character of the patient record influences the nature of the social relations that it helps to organize. The employees involved grow accustomed to how it looks and how to use it and than act accordingly. A particular way of using the patient record and of performing anesthesia become routine. That routine persists until it is time to transform the patient record once again. As long as routine persists the same mental schemas for how to interpret the world and act are enacted in daily work. During this period the anesthesia patient record is a representation of a medical work process, performing anesthesia. When written and signed it is a representation of one specific anesthesia performed on one specific patient by one specific anesthesist. The patient record can also include representations, such as a picture of the patient or a part of the patient.

During the years the motivation for writing anesthesia patient records has been presented in different ways, ranging from the medico-legal to the purely scientific. Two fundamentals are that “... one’s memory is a very poor vehicle on which to rely as a source of facts” (Waters, 1936 in Hallen, 1973) and that “... many physicians tend to see the past through rose-colored glasses ...” In Sweden T Gordh, 1946 (in Halle’n, 1973) declared: “Anesthesia records belong to an organized anesthetic service both for teaching and statistical purposes. Only by means of records of preoperative condition, effects of anesthesia and operation and a careful follow up of postoperative morbidity can the anesthetist determine whether his efforts are successful or not”. “Without well-kept records, we are deprived of a basis for discussions, comparison and conclusion and are left dependent upon memory and personal opinion as a foundation for instruction and progress” (Waters, 1942 in Halle’n, 1973).

The original idea behind the anesthesia patient record is to be a representation of the course of an anesthesia during surgery, to show the anesthesia curve. This is because the prime purpose of documenting in anesthesia is to show how the patient responds to anesthetica and surgical manipulations. “The first thing my eyes focus on in the journal is the pulse and bloodpressure”, says the head of the intensive care unit at Karolinska hospital when de-

scribing how he uses the anesthesia patient record. But today the idea behind what a patient record is and can be, is transformed every time it is upgraded. I have seen how its content is expanding in response to new legislation about what should be included in a patient record and to new ideas in society about how to perform health care, improve work processes and satisfy demands on quality assessments of care processes.

The findings in this thesis also indicate that the implications of constructing a new patient record on paper and then computerize it are both cognitive and social, both inside and outside the individual. In writing this I mean that not only the anesthetist, and his or her way of taking in information and exercising his or her knowledge, is influenced by a computerized patient record, but also the organizational setting surrounding the specialist, including the resources used and the mental schemas executed.

### 7.5.2 Technology is shaping our behavior and our behavior is shaping the technology

User involvement is essential in a project like computerizing a patient record. The future users of the tool will always have critical information that must be integrated during the construction process. This research also shows that successful implementation of a knowledge management system demands continuous investments in technical support, competence and education, as at Allgemeine Krankenhaus in Vienna. There are always increased demands for doing things "*the native way*", as the head technician in Austria expresses it. Therefore there exist a need to establish a "*fit*" between the needs of clinical work, the health care system and information technologies. Human factors such as how a knowledge worker exercises his or her knowledge must be studied before any development and implementation of a computerized patient record into a specialist domain takes place (Beuscart-Zephir, MC, et al, 2001). This is because technology is shaping our behavior and our behavior is shaping how the technology is constructed. Once again "the duality of structure" is acted out in every day life.

For example Patel (2000) found that exposure to the computerized patient record was associated with changes in physicians information gathering strategies. Differences were found in the content and organization of information, with paper records having a narrative structure, and the computerized patient record organized into discrete items of information. The differences in organization had an effect on data gathering strategies, where the nature of the doctor-patient dialogue was influenced by the structure of the computerized patient record. The conclusion in Patel's study was that technology has a profound influence in shaping cognitive behavior and the potential effects of cognition on the design of technological artifacts needs to be explored further.

In this research I have found that computerized patient records decrease double and triple documentation. It also makes it possible to read what has been written in the record, which is a change from when it is on paper. This is consistent with Wang, et al, 1995, who also found that a computerized anesthesia patient record was more legible and complete than a manual record. More vital sign data points and more notes and drug information per case is also recorded and this is in accordance with Edsall, et al 1993. With a computerized patient record information is always available and the text, if designed properly, is easier to read than in handwritten documents. It eliminates distractions, such as trying to make sense out of sloppy texts, and it makes some activities automatic, such as recording pulse and bloodpressure, what is going on, such as how people move around in the OR. At the same time computerized documentation makes it possible to go back and study the course of an anesthesia minute by minute, which is particularly important if there was a problem. This is consistent with Essin D.J., et al, 1998, who wrote that computerized patient records provided immediately available data for quality assurance activities. This is also consistent with Zander, Kogut, 1995, who see organizations as social communities that use their relational structure and shared coding schemes to enhance the transfer and communication of new skills and capabilities. In Austria the employees also look at the computerized patient record as a tool to "*explore data*". In this way an expansion of organizational capabilities is possible. A computerized patient record can, for example, be used when searching for trends in a patient's medical history.

To maintain your identity as an anesthesiologist means continuing to build on earlier knowledge. Anesthesia could stagnate as a specialist domain without scientific improvements. An organization learns by constructing, testing and restructuring its theories of action. And "situated learning" relies on participating in communities of practice (Kogut and Zander, 1996). Research, education and learning is possible with a computerized information system. In this way an expansion of organizational capabilities is also possible.

An anesthesiologist uses his or her hands a lot during operation. "All the senses goes through my hands". (Excerpt from interview with one of the anesthesiologists in Austria) Getting away from manual documentation frees the hands, says one of the anesthesiologists in Austria. Computerized documentation also makes it possible for the anesthesiologist to keep his or her eyes on the patient which is an important part of anesthesia work. "I get information from the patient by looking at her". (Excerpt from interview at Karolinska hospital) This confirms Edsall, et al 1993, who also found that an information system free eyes and hands and creates an opportunity for improvement and for more accurate information about the patient.

In addition to this, computerized documentation makes it possible to standardize many more therapies, which makes it easier to work. Less modification of standard therapies decreases the workload for a physician. Hopefully the results of the therapies also improve. Different situations can be handled in a more efficient way. "I want to have as few steps as possible when

I work. Standard therapies exist today but 70-80 percent of them must be modified". (Excerpt from interview with anesthesist in Austria) According to one anesthesist in Austria the work demands fewer interventions when more standard-therapies are available in the software.

There are also ergonomic consequences such as that employees have to change how they move around the patient in the bed in the room. This is what takes place at the clinic in Austria. Also some tools, such as the mouse, do not feel comfortable and should be changed. This confirms Yamaguchi, et al, 2000, that found that ergonomic problems remain to be solved before there is a wider acceptance of the computerized patient record in clinical practice.

### 7.5.3 Construction and design as a knowledge management activity

In this thesis I have viewed the construction of and computerizing of a document as a knowledge management activity. How a computerized patient record, as well as one on paper, is constructed influences the clinical eye and how work is performed. There is a balance between tacit and explicit knowledge that is disturbed if the patient record is poorly designed or difficult to use. One example of this is seen when the space available for the anesthesia curve is too small although it is the most important element in the patient record used by the anesthesist during surgery. Another example of a disrupted interpretive schema was observed when a trial record placed the fields for circulation and respiration too far apart. That influence how work was performed negatively.

I have already pointed out that vision works faster than other types of problem solving. Using pictures instead of words influences the speed with which information can be taken in and processed. This knowledge was utilized in the patient record on paper at Karolinska hospital. This knowledge is also used in the computerized patient record at Allgemeine Krankenhaus in Vienna. The picture or symbol is not the thing itself, it stands for or refers to the thing, in this case the patient: It represents the patient. Very simple figures that show the patient from the front and from the back are used in the documents. The ideal is to develop representations that capture the important, critical features of the represented world while ignoring the irrelevant, and that are appropriate for the task, enhancing the ability to make judgement, and to discover relevant regularities and structures (Norman, 1993, p. 52). Representations allow human beings to work with events and things absent in space and time, imaginary objects and concepts. For exemple an icon in the software might represent a phenomena such as heart-problems. And different colors might represent the urgency of doing something, such as giving the patient 300 ml of a substance. It is obvious that representations that match our perceptual capabilities are easier to use than those that require reflec-

tion. Under a heavy workload and stress are representations that require reflection not used as efficiently as those that can be used through simple perceptual comparisons.

The act of performing anesthesia on one patient can, in a knowledge management system, be represented by text (size, format), pictures (black-and-white, color, video), voice, signs and symbols, formulas (calculations), colors and data and information in a database. Today pictures and video might be included in a knowledge management system to enhance quality in learning that might take place during discussions at the clinic. How knowledge is structured and expressed is dependent on what kind of strategy has been worked out at the clinic for what they want to achieve with a knowledge management system. What kind of strategy is worked out at the clinic depends on political, economic and, I want to emphasize, emotional domination over a resource such as knowledge.

#### 7.5.4 Coordination and/or enhancement-Verbal and/or visual data

All human beings live in a world of objects. This world is socially constructed in that the meanings given to these objects are fabricated or made-up during a process of social interaction. Different groups develop different worlds and these worlds change as the objects that compose them change in meaning, according to symbolic interactionism. Blumer (1969/1998) writes that in a human group the life and actions of people involved change with the changes taking place in their world of objects.

The idea behind a technology like a computerized patient record is in general improved performance. A knowledge management system is developed to enhance the quality of a work process in a specific setting. It is supposed to facilitate codification, collection, integration and dissemination of organizational knowledge. It can also correct mental biases and avoid features such as fatigue among employees that limit decisionmaking. In my opinion a computerized patient record can be described as the subordination of cognitive abilities to “the best possible performance”. It is also an attempt to control generalized conditions of system reproduction over time and space.

A second idea behind a technological move like computerizing a patient record is efficiency. By efficiency I mean that documenting using the new information system is supposed to save energy compared to the way of working it replaced. A computerized patient record is also a subordination of “bodily freedom” to the “best possible performance”. By bodily freedom I mean the possibility to move around more freely in the limited space of an OR.

In addition to this a computerized patient record is an opportunity to elaborate on strategies for coordination and the more efficient use of information in networks. Integration mechanisms as on the level of face-to-face interaction take place. This means reciprocity between actors in contexts of co-pres-

ence, in this case in the OR or at the clinic. But integration also refers to connections with those who are physically absent in time or space. This is the same as reciprocity between actors of collectivities across extended time-space. Here computerized information systems facilitate extended network integration, such as between the clinic and units outside the hospital.

In this case a computerized patient record is implemented into a specific organizational setting where certain mental schemas, such as giving anesthesia, diluting medication and documenting information are executed. When performing anesthesia, certain resources such as anesthetics, medication, blood and time, as well as eyes and hands of employees are used.

This research shows that changing the content of the patient record both influences and is influenced by mental schemas and resource use in this setting. Transforming the patient record into a knowledge management system alters social relations, such as those between different units of the clinic, and manipulates certain cognitive abilities, such as "*the clinical eye*". All physicians are individualists and care in general only for their own part of the care process. A different design and transformed use of the patient record hopefully makes the anesthetist realize how his or her work fits into the whole care-process of the patient.

When constructing a new patient record knowledge structuring takes place and somebody also dominates over a resource such as knowledge. In the next two sections I will discuss why I perceive knowledge structuring and knowledge domination as two interrelated and important concepts in connection with knowledge management activities.

## 7.6 Conceptualizing knowledge structuring

I want to emphasize that exercising knowledge is a structured activity. In our heads we make plans for what to do, how to do it and what to do next. There is even a specific place in the frontal lobe of the brain that is vital for planning. When an organizational setting is structured, the knowledge that is exercised in this setting also becomes structured. When conducting this research I have seen how an anesthetist exercises the practice of anesthesia in a structured order at a certain space. When upgrading and computerizing the anesthesia patient record, an additional structuring of how knowledge is exercised takes place. Then the question is how this structuring influences the practice of performing anesthesia.

In the knowledge society the aim of many is to get access to the knowledge of a specialist, not making it person-dependent. Codifying knowledge, trying to make it explicit and store it on a medium to make it available to others, is considered a core activity. This is based on a view of certain knowledge as something accessible for many more than today. "Now we can study and discuss what happened if there was a problem during surgery, even if the person who did it isn't here", says one anesthetist in Austria. "Computerized docu-

mentation makes it possible to go back and study the course of an anesthesia minute by minute". But to me it is obvious that codifying knowledge also implies a structuring of knowledge. To codify knowledge means to make visible how a knowledge worker does what he or she does. The different elements of an act of knowledge are made visible and organized in a certain order. For example employees are forced to define work routines for one element of performing anesthesia, such as dilution of medication. In anesthesia there are many problems that might appear as one works. One of them has to do with giving the wrong medication. To produce routines for how to dilute medication is therefore seen as something good. This is consistent with Merry, et al, 2001, that found that a well-functioning system improves patient safety by facilitating correct drug administration. But this is at the same time a way to structure how dilution of medication takes place.

Another element of performing anesthesia, such as how actually to administer anesthesia, also becomes more structured. The projectleader at St Lukes says that computerizing the patient record decreases flexibility in how anesthesia is administered but increases flexibility in what takes place around the operating table. The same is true of documentation. With increased demands on how and what to document, documenting becomes a more and more structured activity. One can say that a technology like a computerized patient record removes from a profession one of the symbols or "signature skills" that distinguishes it, in this case manually recording pulse and blood pressure. To me that means that it introduces a different structure in what takes place. There are many advantages with this structuring. But not writing with a pen might also make the physician loose concentration, and forget to check the pulse or the blood-pressure and intervene when necessary. A computerized patient record frees hands and eyes of an anesthetist but at the same time he or she has to follow a structure in a patient record when taking care of the patient. This also influences how an evaluation of a patient takes place. The patient record's appearance influences how work is performed, and how work is performed influences how the patient record is designed. A patient record makes explicit knowledge available to others. Explicit knowledge is knowledge that can be formalized and written in a document.

But there is also a tacit dimension to all knowledge, according to Polanyi. We know more than we can tell (Polanyi, 1966). Lyotard also writes that true knowledge is always indirect knowledge (1979/1984). Tacit knowledge is learned through experience and doing a task, during which the individual develops a feel for and capacity for making intuitive judgments about the successful execution of the activity. You have to get "*it*" into your hands, as one of the employees at Karolinska hospital describes the existence of tacit knowledge within anesthesia.

Diagnosing a patient's condition is characterized by a significant tacit dimension. Polanyi (1966) writes about the merits of tacit knowledge when it comes to diagnosing: "This is particularly clear in the art of diagnosing, which intimately combines skillful testing with expert observation". Expert observa-

tion is what I call face-reading. Face-reading is an activity that I think is based mainly on tacit knowledge achieved through experience and a personal gift for understanding people. The existence of tacit knowledge can in some cases be made more explicit through modes of discourse that include the use of analogies, metaphors or models, and through story telling. In this case "*the clinical eye*" is a metaphor for how an anesthetist takes in information and exercises his or her knowledge. It is a concept that can be used to get insight into how an anesthetist exercises his or her work. But what it is an anesthetist sees or feel can never be made explicit and recorded on a medium.

"Our body is the ultimate instrument of all our external knowledge, whether intellectual or practical. In all our waking moments we are relying on our awareness of contacts of our body with things outside for attending to these things (Polanyi, 1966).

It is important to realize that what is expressed and recorded when codifying knowledge is not complete knowledge since knowledge is in "the body" of the knowledge worker. What is recorded is more of a learning program that helps to stabilize and reproduce knowledge (David and Foray, 2002). Polanyi thinks it is counterproductive even to try to believe that it is possible to formalize knowledge.

"I think I can show that the process of formalizing all knowledge to the exclusion of any tacit knowing is self-defeating (Polanyi, 1966).

It is also evident that in most cases the codified knowledge provides only partial assistance. Knowledge reproduction will then occur through training, practice and simulation techniques. Another example of this is a recipe in a cookbook. All the ingredients are listed with instructions for how to prepare the dish. But to be a successful chef demands something more, it demands a "feeling" for how to make a meal delicious. A third example is reading notes and performing music. Most people can learn how to read notes and play a waltz by Chopin on piano. But to do it beautifully requires something more that is not so easily expressed in words. It is the same with performing surgery or anesthesia. You have to have a "feeling" for what you do and get "it" into your hands, according to the employees. Some people have this gift others don't. As a response to the somewhat naïve aim today to formalize and make knowledge explicit one can read Polanyi:

"But suppose that tacit thought forms an indispensable part of all knowledge, then the ideal of eliminating all personal elements of knowledge would, in effect, aim at the destruction of all knowledge". (1966)

I apply the concept knowledge structuring to a phenomena that needs to be explored further. When trying to achieve different goals the knowledge worker is moving in between control and creativity. Here time and technology combined with personality are resources that influence what can be achieved. Personality includes a capacity to judge anew what is needed in every situa-

tion. It is an ability to transform how you exercise your knowledge to reach a certain goal. The procedure for how to do something might be transformed. There might be a problem if you can't unlearn and transform how you do something when transformation is needed. An ability to unlearn is the personal expression of exercising knowledge. It is closely related to the character of the person that exercises knowledge. A person's personality influences how tacit knowledge is established and exercised. It seems to me that a structuring of knowledge might limit the possibility to unlearn. A person gets locked in a structure that makes it difficult to transform how a task is performed if needed.

In this thesis I have not tried to investigate how an anesthetist performs work after a computerized patient record is implemented. I don't know if the anesthetists at the clinic at Allgemeine Krankenhaus perform more brilliantly now compared to earlier. And I have not investigated whether diagnoses of patients' conditions have improved or deteriorate with a knowledge management system. I have already mentioned that there are many advantages in implementing a knowledge management system. But at the same time it seems to me that there is a risk for conformism when a knowledge worker is forced to act and communicate by means of "correct rules". For me one important question is if more structured also means more rigid. Another question to investigate further is how to find a balance between control and creativity when working with knowledge management activities.

## 7.7 Conceptualizing knowledge domination

Giddens writes that in an administered society centralized control of "knowledge" or "information" is a medium of domination (1979, p. 162). In this section I want to emphasize that it is not self-evident that the outcome of knowledge management activities depend on management or some kind of central force, but rather on who dominates knowledge, the most important resource when creating values in professional organizations and society. Giddens (1979, 1984) treats resources as the vehicles of power. He writes that political and economic domination of resources underlye the structuring of a setting. I want to add domination related to different kinds of affections as important when it comes to an idiosyncratic resource such as knowledge.

Power can be conceptualized as "the capacity to achieve outcomes ... to make a difference" (Giddens, 1984). But at the same time Giddens thinks that it is a mistake to treat power itself as a resource, as many theorists of power do. Instead resources, in this case knowledge, are the media through which power is exercised and structures of domination reproduced (Giddens, 1979, p. 91). Today the individual often experiences feelings of powerlessness in relation to a diverse and large-scale social universe. Time-space distanciation and the deskilling effects of abstract systems seem to be the two most important influences (Giddens, 1991). Then the individual's sense of ontological

security can be achieved through a fantasy of dominance. The next step is that this fantasy is acted out.

So, the way a knowledge worker exercises his or her knowledge is influenced by feelings and thoughts. Management might try to target the minds of the knowledge worker by influencing values and norms. But authority can be problematic. The essential characteristic of authority is the general approval and acceptance of those over whom it is exercised. If they don't accept the authority of management they might negatively influence what takes place in this organizational setting. Since knowledge is embedded in practice, it is the person who exercises knowledge that dominates how the knowledge is exercised. Moreover making tacit knowledge explicit takes place during collective reflection, but during reflection someone dominates the course of the negotiations that take place. I therefore propose the concept knowledge domination as a perspective to think about and further investigate and analyze the outcome of efforts of trying to manage knowledge.

The concept "knowledge management" is based on the view of knowledge as an economic resource (Swan, Scarbrough, 2001). If knowledge is a critical resource and a source of competitive advantage it must be managed more efficiently. One underlying assumption of knowledge management is that knowledge is a resource that can be managed. But some also point out the contradiction between the words *knowledge* and *management*. If knowledge is "an ambiguous phenomena, intrinsically related to meaning, understanding and process", then it cannot be managed (Alvesson and Kärreman, 2001). Others also think that the value of knowledge management is limited since it implies control of processes that may be uncontrollable or stifled by heavy-handed direction (von Krogh, et al, 2000). At the very least, there are both individual and organizational barriers to managing knowledge. Typical obstacles are "knowledge as power" and that there are few rewards for sharing knowledge. Sometimes individuals feel threatened and do not want to share their experiences and knowledge. Trust is an important element when trying to communicate and share knowledge within organizations. As I write in chapter two, von Krogh (2000) and Södergren (2001) among others also argue that care is one of the key enabling conditions for knowledge-creation processes.

One assumption underlying my concept "knowledge domination" is that knowledge is localized and embedded in practice. Someone governs over knowledge, the mental schemas that are enacted and the resources used, when exercising knowledge. "*Who governs*", is also what the project-leader at Sundebyn in the north of Sweden asks herself. The person that dominates knowledge influences what transformations take place and how they do so. In Austria it was the two heads of the clinic that decided on implementing a new information system. They governed over what happened. If someone didn't want to use the system they had to leave the clinic. In Sweden it was a political decision to implement a computerized information systems, but when it was time to do something nobody took responsibility. Both the head of the clinic

and the politicians had changed and new people occupied these posts. Different stakeholder groups negatively influenced the outcome of the project and caused it to fail.

Domination occurs when the structured asymmetries of resources are drawn upon and reconstituted in power relations. When it comes to a resource such as knowledge this is an extra sensitive issue. An employee might know more about something than management but keep it to himself if he doesn't gain something from contributing his knowledge. Giddens writes that information storage is a fundamental phenomena permitting time-space distanciation, and it function as a thread that ties together various sorts of allocative and authoritative resources in reproduced structures of domination (1984, p. 262). To me it seems that how information is stored in a setting depends on how this setting is structured; how a setting is structured might be decided by someone who controls a resource such as information that in the end influences how knowledge is exercised in this environment.

Transforming knowledge refers to a process of altering current knowledge, creating new knowledge, validating it within each function and collectively across functions. Changing his or her knowledge means that an individual will have to face the cost of altering what he or she does to develop new ways of dealing with the problems he or she faces. I have already concluded that it costs energy to transform a mental schema for performing an act of knowledge. It means that if they are to spend this energy, people have to perceive some gain to make this effort worthwhile.

Today knowledge management systems have expanded the distribution of specialist knowledge and made it more transparent. It means that professional groups have become more exposed to market forces and control by a management hierarchy than they were earlier. Also the influence of professional institutions has been weakened by deregulation and globalization, and by IT systems that "threaten professional autonomy with surveillance and remote control" (Scarbrough, 1999). Some professionals' do not like that and resist, for example, implementing a computerized patient record. They don't want most of the things they do to be visible in detail to others. Similarly some knowledge workers don't like to be forced to formalize and structure how they perform in a way that it can be stored on a medium like a computer. It might even be considered degrading. Some might feel that the art of the performance is at risk. If a knowledge worker doesn't like what is happening at his work place, or feels uncomfortable with a new tool, he might exercise his knowledge less well. An example of this is that if a mental schema for how to perform anesthesia is disturbed by a poorly designed anesthesia curve in the patient record, the balance in how to perform anesthesia is also disturbed. To exercise knowledge costs energy, and a knowledge worker stops producing or produce less if he sees that it doesn't pay to make an effort. In a knowledge organization the one that exercises the knowledge and the one that has the ideas must be rewarded, otherwise he or she stops trying. Therefore it is im-

portant to involve the users in how transformations take place. It is characterized as "*doing things the native way*", according to the technician in Austria.

I think that the other side of domination might be resistance. Relatively powerless people might accommodate to power while at the same time protecting their interests and identities with acts of resistance. Resisting power, authority and norms might be a way to exercise domination in a sensitive situation. In Sweden the anesthetists used "patient safety" as an excuse to protest against implementing a new information system. In Austria the two professors in anesthesia used "patient safety" as a reason for implementing a computerized patient record. This is an example of how a norm might be used differently in the same type of situation depending upon personal interest of the group it may concern. The same norm sanctions different behaviors at different places.

I have already written that effectiveness of integration mechanisms in an organizational setting such as the anesthesia and intensive care unit depends on the existence of a common language. In this case the clinic at Karolinska hospital adjusts the language they use according to a nationally accepted database of search words. Nurses and physicians also find a common base on how to express themselves when performing anesthesia. Then there is a local discourse that influences the outcome of what takes place. The attitude to the project is expressed through language and signification such as in Austria they wanted "the best" but in Sweden they wanted the "cheapest possible" solution. I cannot keep myself from asking how this way of thinking influenced the outcome of each project? And in what kind of local discourse were these comments grounded? If signification, or the meaning people give phenomena, is structured in and through language, language at the same time expresses important aspects of domination, and then the codes that are involved in signification have normative force. I view what is said as an attempt by people who dominate the local discourse to direct the efforts of members in their community, by controlling or exercising domination over some of the underlying thoughts and feelings that guide their actions. It seems to me that investigating who really dominates the outcome of knowledge management activities such as the one I study in this thesis is an underestimated phenomena but must be reckoned with.

In the next and last section of this chapter I will summarize and report on the theoretical position I take after having conducted this thesis project.

## 7.8 A summary of a theoretical position

In this thesis I conceptualize the knowledge society as a place in which we invest in people using modern information and communication technology. In this society a knowledge worker, such as an anesthetist, exercises his or her knowledge in an organizational setting. In this setting a structuring takes place, depending on how meaning, power and morality is articulated through

interpretative schemas, domination and norms. The everyday work life and the tools a knowledge worker such as an anesthetist uses pass between transformation and routine. Today it sometimes seems that transformations have become the ordinary and routine has become extraordinary. And knowledge workers are supposed to be flexible. To be flexible means to transform the mental schemas a person uses when performing certain practices. But it costs energy to be flexible. Sometimes people resist transforming the way they interpret something or perform work if it costs too much energy or there are no rewards for being flexible. A patient record is used in the anesthesia and intensive care unit. When a patient record is transformed into a knowledge management system certain schemas are enacted and resources used. I have found the clinical eye to be a cognitive style for an anesthetist. But it is also a resource used when enacting mental schemas for giving anesthesia and documenting. The clinical eye influences how a patient record is designed and a patient record influences the clinical eye. What kind of transformations that take place depends on who dominates a resource like knowledge and a tool like the patient record. According to Giddens, domination depends on political or economic institutions. I want to add that domination over a resource such as knowledge also depends on feelings among the people that are supposed to use the patient record. In this context the other side of domination might also be resistance to transformations and authority. When mental schemas are transformed, a structuring of knowledge takes place, and it implies a transformation of how knowledge is exercised. Exercising knowledge is a structured activity that becomes more structured through the constructing and computerizing of a patient record. Then a question to pose is what happens to the tacit part of exercising knowledge when it becomes more structured. Does a knowledge worker feel locked into a structure and exercise his or her knowledge less well? Is less space given to a person to unlearn and transform how a task is performed? How a structuring of knowledge takes place depends on who dominates the knowledge exercised. Domination also influences what kind of language is used and how the people involved discuss the software. I apply the concepts knowledge structuring and knowledge domination to two phenomena that I think is important to investigate further. During this research I have seen how a knowledge management system influences what takes place in an organization on many different levels. I have also seen that conceptualizing a computerized patient record as a knowledge management system initiates a new thinking and an awareness of the possibilities embedded in a KMS. Implementing a KMS might support a horizontal influence, coordination, and a vertical one, enhancement of medical services in a health care setting. I perceive this as a movement connected to improved performance and efficiency.

# Chapter Eight

## Concluding remarks

Now it is time to make a few concluding remarks and recapitulate what this thesis is about. It is also time to reflect briefly over the research process and how I have addressed the purpose presented in chapter one. Then I give a summary of the theoretical contributions and some of what I see as important implications for practitioners generated during this project. In the last section I introduce a few of the many ideas I have about possible future research.

### 8.1 What was all this about?

This thesis took its point of departure in the knowledge society. It is a concept used differently by different people. But it is a concept that has interested me since the beginning of the 1990s. In the first chapter of this document I conceptualized the knowledge society as a place in which we invest in people using modern information and communication technology. Then the project I have researched is what I consider a typical knowledge management project in the knowledge society. I assume that the ambition behind the activity of implementing a knowledge management system is to make it possible for a knowledge worker to perform more brilliantly. This assumption is based on a view of knowledge that I also adhere to as a very important resource that creates value both in society and in organizations.

The overall purpose in this research has been to investigate what happens when somebody or something intervenes into a knowledge worker's every day life. Empirically I have chosen to explore how an anesthesia patient record is constructed to be what it becomes and then computerized, and then the implications of this for the anesthetist and the anesthesia nurse. I find the purpose and the approach to the research project relevant since many transformations today are initiated by implementing new information and communication technology in many different types of organizational settings. And I have both seen and heard how this influences people's lives in many different ways. I also want to repeat that today, according to Giddens and others, imple-

menting new information and communication technology is actually one of the major social forces that transform our lives, and it is the duty of sociologists to research this force. So in short, what I have tried to do in this thesis is to take a look into one of these settings in which major transformations are initiated by computerizing work processes or work tools.

The title of this thesis is “The clinical eye. Constructing and implementing a computerized patient record”. The following research questions have been specified: How is the content of a patient record constructed? Why is it constructed as it is? What are the implications of constructing and computerizing a patient record?

This study takes place among a group of employees that call themselves emergency people and some of them think that the art of the performance is at risk if the anesthesia patient record is computerized. With the expression exercising knowledge I mean using certain mental schemas supported by certain resources to perform a task, in this case performing anesthesia. When using the word construction I mean socially constructing and designing a new patient record.

I have used a theoretical framework integrating ideas about knowledge management with concepts from structuration theory and theories about sensemaking, representations and schema use. Integrating knowledge management with structuration theory makes it possible to capture the complexity of what takes place when a knowledge worker shuttles between transformation and routine in an organizational setting in the knowledge society. This framework has also made it possible to emphasize the cognitive dimension of what takes place in day-to-day life at work in connection with one very important transformation of a way to exercise knowledge. In chapter two I write that a social setting is structured when actors draw on and make sense of institutional patterns of signification, domination and legitimation to construct roles and interpret persons, objects and events in their environment. (Giddens, 1984) Modalities are interpretative schemes, resources and norms. This theoretical framework has made it possible to first understand how a setting is structured and then what happens when somebody or something interferes with this setting. I think it has given me the possibility to investigate the complexity of exercising knowledge, something not investigated enough according to Giddens. It has also made it possible for me to emphasize the importance of knowledge as a structuring phenomena and what happens when something interferes with established structures.

I have tried to fulfill the purpose of this thesis and answer the research questions presented above using interviews, observations and reading, following the construction of a new anesthesia patient record on paper at Karolinska hospital in Sweden, how a computerized anesthesia patient record was developed at St Lukes hospital in the USA and a computerized patient record implemented at Sundebyn in Sweden and the Heart Clinic of Allgemeine Krankenhaus in Vienna. I have described, analyzed and interpreted what takes place. I have alternated between interviewing and observing at the em-

pirical sites and reading and reflecting over what I have found. I have searched for patterns in the empirical data that relate to the purpose of this thesis. Then I have discussed the findings and searched for concepts using the theoretical framework I presented above. When doing that I have used what I call systematic reflection. Systematic reflection means to go back and reflect over every statement from the interviewees and every interpretation I have made and the conclusion I have drawn over and over again. Then a picture of what took place emerged. And this picture is what I have tried to verbalize and visualize in this thesis.

There are probably many different ways that I could have performed this study, but the way it was done and the methods I used is what I felt most comfortable with. When I have tried to recapture what has happened since I started this project I realize that this research is based on a substantial amount of observation. Actually observation as a method has played a crucial role when understanding and interpreting what takes place. I have used my own clinical eye when trying to carry out the purpose and answer the research questions I presented in chapter one. I also think that interviewing and discussing this with the employees at the different research sites have generated interesting insights that I would not have achieved with a more quantitative approach such as using questionnaires. I also wanted to avoid questionnaires since a lot of research within health care is done this way and employees are tired of answering them. I have spent a lot of time at different hospitals, especially Karolinska hospital. First I even thought of making an ethnographic study, having a desk at Karolinska hospital, spending all days and even some nights at the clinic. But I soon realised that this was not necessary. The insight I had already gained was enough to make me understand and be able to interpret the implications of constructing, designing and implementing a computerized patient record.

This thesis was more case than theory driven from the beginning. I very much liked the empirical part of the research process which consisted of being at the research sites, meeting people and trying to understand how they managed their every-day work life. I even nurtured some hope of contributing to enhancing a work-situation. But the more I understood of what took place the more interested I also became of theory. When I saw theory acted out in "real" life, such as "the duality of structure" it was fascinating. Therefore the end of this thesis project has been more theory driven than case driven. As Corbin and Strauss suggest I have tried to discover the ways that concepts relate to each other and tried to integrate them in a conceptual framework. Building theory from a case study has resulted in theory that I believe is consistent with empirical observation and hopefully it closely mirror reality (Eisenhardt, 1989).

## 8.2 Empirical contributions

One of the many conclusions I have drawn during the research process is that the very fragmented structure within health care, both when it comes to hardware and how documents and software are constructed, has slowed down efficient information use. Anesthesia as a specialist domain is technical and deals with many different devices, machines and equipment. Earlier every OR used to buy a different blood pressure or anesthesia machine. It used to be a constantly changing market. Therefore few companies were interested in developing software for this specialist domain since it would have been too expensive. Now some agreements as to standards, equipment and what to display has been achieved. Then it is also possible to develop a computerized anesthesia patient record for a more substantial market. Therefore I conclude that developing standards when it comes to machines and devices used within health care influences in many different ways employees, patients and the working environment.

I have found that anesthesia work is performed before, during and after surgery, at the anesthesia reception desk and in the operating room. I picture anesthesia as a kind of service function, both to the surgeon and the patient. Work includes assessing the patient before surgery, making a plan for giving anesthesia during surgery, following this plan and then managing pain after the surgery. Both observations and interviews have made it clear to me that an anesthesiologist uses his or her eyes and hands a lot during surgery. Therefore getting away from manual documentation frees the eyes and the hands of the anesthesiologist and that is something good. So, computerized documentation makes it possible for the anesthesiologist to keep his or her eyes on the patient more than before, which is considered an important improvement in anesthesia work.

Observing anesthesia work has made me realize that the OR is a unique environment, with many people involved in work, using complex equipment in a limited space. Tasks are in high intensity, acquiring data is mission-critical and loss of data unacceptable. The anesthesiologist uses information to assess the status of the patient, if the patient is alive or if some sort of action besides surgery has to be taken. Management of the OR includes managing resources such as employees, information, drugs, blood, eyes and hands, equipment, supplies and time. I conclude that all the people working in the OR want to make sure that the patient is safe and that the outcome of the surgery is good, but everybody has their own separate jobs to do. Working in the OR includes giving anesthesia, diluting medications and documenting. These activities are all performed differently by different anesthesiologists. Every anesthesiologist develops his or her own way of exercising his or her knowledge. When performing anesthesia important resources, besides eyes and hands, are blood, anesthesia substances, medication and time. I have seen how a physician formulates a diagnosis of what problem the patient might have that is based on data in the patient record, visual perceptions, earlier experience and verbal information

from the patient. I conclude that the anesthesiologist documents because of legal requirements but also to provide other health care workers with the knowledge of what was used to keep the patient asleep. Patient records might also be used for teaching and statistical purposes, and for discussions and comparisons.

After observing anesthesia work at Karolinska hospital, Allgemeine Krankenhaus and St Lukes hospital I conclude that patient care in this specialist domain is intense and requires an awareness of what is happening not only with the patient but also in the operating room. It is a stressful working environment. An anesthesiologist must have generated a patient record at the end of the procedure. Therefore constructing and implementing a computerized patient record is considered as a difficult transition period and a "high-risk" situation, according to the project leader at St Lukes hospital in Jacksonville, Florida.

Constructing and computerizing a patient record is a formative process in which many different parties are involved. The idea behind an anesthesia patient record is socially constructed. How it looks shows what the core of the profession is and how it is performed. Anesthesia employees belong to a "thinking collective", but they are also individuals with different ideas about how work should be performed. The patient record is a tool when evaluating the patient. Writing and using a patient record is part of being a professional. But some of these technological devices confuse employees and alter social relations when implemented. As is shown by this research, tools like computerized patient records manipulate cognitive abilities when they interact with the human mind and with situated action in a specific organizational setting.

The cognitive dimension of what takes place shows itself in that several mental schemas for how to perform anesthesia are transformed. In this thesis I have identified five schemas and they are: how to evaluate the patient, how to give anesthesia, how to dilute medication, how to document and how to move around in the OR. These are the most obvious mental schemes that are transformed, but there may be other mental schemes that the interviewees just didn't talk about during the research process. Resources such as "the clinical eye" are also influenced by and influence the knowledge management system. The inclusion of several services in the knowledge management system influences how work is performed at the rest of the clinic and the rest of the hospital. I have found that depending on the strategy behind it, a knowledge management system might influence networks and units both inside and outside the hospital. I identify the transformations that take place in this research project as a collected movement of coordination and enhancement in a context or network that extends through the clinic. How far the influence of these transformations extends depends on the level of ambition and the strategy for the knowledge management system constructed, designed, implemented and used.

### 8.3 Theoretical contributions

“The clinical eye” emerges as a concept that influences how an anesthetist searches for information, how knowledge is exercised in anesthesia and how a patient record should be designed. I conclude that the clinical eye is a central concept for understanding how an anesthetist exercises his or her knowledge, how the content of a patient record is constructed and designed and how reactions to a changed patient record evolve. The clinical eye is related to the tacit dimension of performing anesthesia. It is achieved after a lot of training and many years of experience. I also think it is an interesting concept in relation to other professions and can be taken further in other types of studies. In addition I theorize that if the computerized anesthesia patient record is conceptualized as a knowledge management system how it is used changes. Many more services are included, and it is not “just” a patient record anymore. The knowledge management system is used in networks at many different levels in an organizational setting, in the specific organization and in society. How it looks and how it is used depends on what strategy the employees have for what they want to achieve. Therefore a knowledge management system might be used in connection with trying to improve the quality of many different work processes within health care.

Then I introduce two concepts, “knowledge structuring” and “knowledge domination”, that are important and interrelated. I point out that exercising knowledge is a structured activity. In our heads we make plans for what to do, how to do it and what to do next. When an organizational setting is structured the knowledge that is exercised at this setting also becomes structured. An anesthetist exercises the practice of anesthesia in a structured order at a certain space during a certain time-period. When upgrading and computerizing the anesthesia patient record, a transformation and an additional structuring of how knowledge is exercised takes place. Then the question becomes how this new structuring influences the practice of performing anesthesia.

In chapter one I write that the aim in the knowledge society is to get access to the knowledge of a specialist, thus making it less person dependent. Codifying knowledge, trying to make it explicit and store it on a medium to make it available to others is considered a core activity. This is based on a view of knowledge as something accessible to everybody. But to me it is obvious that codifying knowledge also implies a structuring of knowledge. To codify knowledge means to make visible how a knowledge worker does what he or she does. The different elements of an act of knowledge are made visible and organized in a certain order. One example of this is that employees are forced to define work routines for one element of performing anesthesia, such as dilution of medication. To produce routines for how to dilute medication is seen as something good. But this is, at the same time, a way to structure how anesthesia is performed. Another element of performing anesthesia, such as how to administer anesthesia, also becomes more structured. The project leader at St Lukes hospital says that computerizing the patient record reduces

flexibility in how to administer anesthesia but increases flexibility in what takes place around the operating table. The same is true for how they document. With increased demands on how and what to document, documenting becomes an increasingly structured activity. In this case I conclude that a technology like a computerized patient record introduces a different structure in what takes place at the anesthesia and intensive care unit. There are many advantages with this structuring. But not writing with a pen might also make the physician lose concentration, and forget to check the pulse or the blood pressure and intervene when necessary. A computerized patient record frees the hands and eyes of an anesthetist, but at the same time he or she has to follow a structure in a patient record when taking care of the patient. This also influences how an evaluation of a patient takes place. How the patient record looks influences how work is performed, and how work is performed influences how the patient record is designed.

In general it is not self-evident that the outcome of knowledge management activities depends on management or some kind of central force, but rather on who dominates knowledge, the most important resource when creating value in professional organizations and society. Giddens (1984) treats resources as the vehicles of power. He writes that political and economic domination of resources underlies the structuring of a setting. Power is conceptualized as "the capacity to achieve outcomes ... to make a difference" (Giddens, 1984). But Giddens thinks that it is a mistake to treat power itself as a resource, as many theorists of power do. Instead resources, in this case knowledge, are the media through which power is exercised and structures of domination reproduced (Giddens, 1979, p. 91). I conclude that how a knowledge worker exercises his or her knowledge is influenced by feelings and thoughts. Management might try to target the minds of the knowledge worker by influencing values and norms. But authority can be problematic. The essential characteristic of authority is the general approval and acceptance of those over whom it is exercised. If they don't accept the authority of management, they might negatively influence what takes place in this organizational setting. Since knowledge is embedded in practice it is the person who exercises knowledge who dominates how that knowledge is exercised.

In this thesis I have concluded that the concept "knowledge management" is based on a view of knowledge as an economic resource (Swan, Scarbrough, 2001). If knowledge is a critical resource and a source of competitive advantage, it must be managed more efficiently. One assumption underlying the concept "knowledge domination" is that knowledge is localized and embedded in practice. Someone governs knowledge, the mental schemas that are enacted and the resources used, when exercising knowledge. To me it seems that the way information is stored in a setting depends on how this setting is structured, and how a setting is structured is decided by someone who dominates a resource such as information and in the end that influences how knowledge is exercised in this environment. I think that the other side of domination might be resistance. Relatively powerless people might accom-

moderate to power while at the same time protecting their interests and identities with acts of resistance. Resisting power, authority and norms might be a way to exercise domination in a difficult or sensitive situation. Today the individual often experiences feelings of powerlessness in relation to a diverse and large-scale social universe. In this universe time-space distancing and the deskilling effects of abstract systems seem to be the two most important influences (Giddens, 1991). In a situation like this the individual's sense of ontological security can be achieved through a fantasy of dominance.

## 8.4 Implications for practitioners

In this section I will summarize several contributions that have implications for practitioners. Although the important thing for me has been to contribute theoretically, I also want to share the implications I have uncovered during the research process with people working with these problems within health care.

One of these implications is that design of a document like a computerized anesthesia patient record should utilize the insight that vision is a quick way to process information. Very complex situations such as a patient with several problems can be communicated much more quickly with a picture than with many words. One body with many wounds and many different therapies can be difficult to describe in words. Then it is easier to use a picture. A picture can function as a simplified representation of a complex situation. In a computerized patient record a picture makes it possible for the anesthetist to mark a place on the body for a therapy with a computerized pointer instead of describing the place with several words/or sentences. Today video also makes it possible to use moving pictures if a document is on the computer. This is part of an area or field called e-health and can be developed further in many different directions, such as for teaching purposes and when cooperating with colleagues in other parts of the world. Innovative thinking within this area might change how health care workers perform their duties and transform ideas about what is achievable.

When it comes to text in a document like a patient record, there is also always a conscious choice about what and how much text to use. The project involves an active search for the "optimal" level of information. In this case employees prefer to get everything about the patient on one page in the software, or two pages that are easy to change between. The size of the numbers on the screen as well as the color of text are crucial and can be used for different purposes such as reminding employees about duties to perform.

Several "functions" can also be added to the patient record to improve its usefulness. At Karolinska hospital a description of how the patient enters the care of an anesthetist has been extended with emergency-alarm, trauma-alarm, helicopter/ambulance and information about the degree of trauma. The following options were already in place: primary care, secondary care

and elective care. What kind of post-operative care will take place after surgery is also included. Another service that is included is information about the patient's personal items such as eye-glasses or hearing aids. In this way they do not get lost when the patient leaves surgery and the OR. This research also shows that implementing a computerized patient journal improves security with things such as pin-codes and electronic trails. This is the case in Austria and will be the case at St Lukes hospital.

In order to maintain an identity as an anesthetist one must continue to build on prior knowledge. Anesthesia would stagnate as a specialist domain without scientific improvements. Implementing a computerized patient record improves the learning processes in the organization. Research, education and learning are possible with a computerized information system. In Austria they also use the computerized patient record as a way to explore data and investigate trends.

Computerized patient records decrease double and triple documentation, as is clear in Austria. It also makes it easier to read what has been written in the record, which is a change from when it is on paper. More vital-sign data points and more notes and drug information per case are also recorded. With a computerized patient record information is always available and the text, if designed properly, is easy to read compared to in handwritten documents. It eliminates distractions, such as trying to make sense out of sloppy texts, and it makes some activities automatic, such as recording pulse and blood pressure. It also redesigns what is going on in the OR, such as how people move around there. Computerized documentation makes many more standard therapies possible which makes it easier to work. Less modification of standard therapies decreases the workload for a physician and the results of the therapies improve. Different situations can be handled in a more efficient way. The work of an anesthetist demands fewer interventions when more standard therapies are available in the software.

With both a new patient record on paper and a computerized patient record, it is possible to control the use of a resource such as blood during an operation. In Austria the use of blood decreased after the clinic implemented a computerized patient record. There are also ergonomic consequences of implementing a computerized patient record, including changes in the ways employees move around the patient in the bed. In addition some of the tools such as the mouse do not feel comfortable to the staff and should be changed.

## 8.5 Ideas for future research

In a future study I hope somebody will research and develop theory about the connections between the culture of the knowledge society, the activity of computerizing work processes and work tools, our health and phenomena such as "burn-out". I have already mentioned that I would like someone to investigate the importance of the clinical eye in other professions, especially in rela-

tion to transforming work processes and tools. Another question worth exploring further is how employees or management might manipulate and transform what takes place in an organizational setting depending on what strategy they have for constructing and implementing a knowledge management system. In this thesis I apply the concept knowledge structuring to a phenomena that I also think needs to be explored further. I have already mentioned that there are many advantages in implementing a knowledge management system. But at the same time it seems to me that there is a risk for conformism when a knowledge worker is forced to act and communicate by means of "correct rules". One important question is whether more structure also means more rigidity. Another question is how to find a balance between control and creativity when implementing and using tools like knowledge management systems. If transformations are ordinary and routine the unusual state, then we all have to research and reflect over questions such as: How do transformations influence sensemaking? What happens with the tacit part of knowledge when routines are transformed so often? Does the professional lose perspective and time to reflect when forced to work in real-time. Moreover people react differently to transformations. Finally, I believe that it will become possible to research more fully the influence on people's working lives of transformations such as implementing a knowledge management system now when we have a new and richer view of such transformations.

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# Appendix

1. Swedish requirements for anesthesia patient documentation
2. The old patient record on paper at Karolinska hospital
3. SurgiNet Anesthesiology System. A Prototype Overview



## Appendix 1: Swedish requirements for anesthesia patient documentation

### Riktlinjer för dokumentation av perioperativt anestesiarbete.

Föreliggande rekommendationer har framtagits genom ett gemensamt arbete av representanter för Riksföreningen för Anestesi och intensivvård och Svensk Förening för Anestesi och intensivvård. Riktlinjerna godkändes 1996 av respektive förening.

#### A.Preoperativ journal.

Förekomst, respektive frånvaro av sjukdomstillstånd i vitala organsystem samt andra faktorer av relevans för anestesigivande såsom resultat av preoperativa undersökningar anges av läkare. Omvårdnad dokumenteras enligt klinikens anvisningar.

Planerad anestesiform, premedicinering samt andra, avseende anestesi relevanta behandlingar eller erforderlig utrustning anges av anesthesiolog.

Att patienten är informerad om och samtycker till föreslagen anestesiform och relaterade åtgärder förutsätts vara normalfall. Om sådan information ej kunnat komma till stånd bör detta förhållande anges.

Anvisningar för dokumentation av inför operation ordinerade läkemedel som inte har direkt betydelse för anestesi bör fastställas lokalt, så att dessa uppgifter enkelt kan kontrolleras inför anestesistart. Vilka sådana ordinationer som skall anges i preoperativ journal respektive annan journalhandling får överenskommas lokalt.

#### B.Anestesijournal.

Kontroll av patientidentitet dokumenteras enligt lokal anvisning.

Utförd funktionskontroll av medicinteknisk utrustning dokumenteras. Medicinteknisk utrustning, där korrekt funktion är av vital betydelse, skall kunna identifieras.

Läkemedel, vätskor och blodprodukter som administreras under anestesi, samt förluster av blod etc. skall anges så att ett tidsmässigt förlopp relaterat till fysiologiska parametrar kan följas.

Fysiologiska parametrar under anestesi dokumenteras i enlighet SFAIs (se ovan) publikation “Riktlinjer för basal övervakning vid narkos, bedövning och intravenös sedering” och lokala anvisningar.

Patientens läge dokumenteras.

“Blodtomt fält” dokumenteras vad avser duration och trycknivå.

Åtgärder såsom anbringande av intravenös infart, CVK etc. dokumenteras även med angivande av lokalisation. Vilka åtgärder som ska anges i anestesijournal respektive annan journalhantering regleras lokalt.

Vid generell anestesi anges metod och material för att upprätthålla luftvägen.

Vid regional anestesi anges material, lokalisation och utbredning.

Svårigheter vad avser kärlaccess, upprätthållande av luftväg, anläggande av regional anestesi etc. dokumenteras.

Komplikationer eller avvikelser under och i omedelbar anslutning till anestesi dokumenteras.

Övrig omvårdnad dokumenteras enligt klinikens anvisningar.

Ordinationer inför den postoperativa vården dokumenteras i anestesijournal eller annan journalhandling enligt klinikens anvisningar.

Sammanfattning av förloppet under anestesi utöver vad som framgår av övrig dokumentation sker enligt klinikens anvisningar.

Kontakt av särskild vikt med icke närvarande befattningshavare i händelse av komplikation, avvikelse eller av liknande skäl, dokumenteras.

Det skall även i avlösningssituationer framgå vilken anestesisjuksköterska och vilken anesthesiolog som vid varje tidpunkt har ansvarat för anestesi/sedering. Tidpunkt för överlämnande för postoperativ vård anges, liksom vilken sjuksköterska som övertar ansvaret för vården av patienten. Signering av de moment som dokumenterats enligt ovan sker enligt klinikens anvisningar.

### **C.Postoperativ journal.**

Ordnation och administration av läkemedel, vätskor och blodprodukter under den postoperativa fasen anges så att ett tidmässigt förlopp relaterat till fysiologiska parametrar och eventuella subjektiva skattningar av tex smärta och illamående kan följas.

Fysiologiska parametrar under återhämtning efter anestesi eller sedering dokumenteras i enlighet med SFAI's publikation och lokala anvisningar.

Komplikationer eller avvikelser under den postoperativa fasen dokumenteras.

Övrig omvårdnad dokumenteras enligt klinikens anvisningar.

Ordnationer som skall gälla på annan avdelning och särskild utrustning i form av CVK, epi-duralkateter, dränage etc som medföljer patienten, dokumenteras inför utskrivning.

Rutiner för vem som ordinerar vad i denna situation fastställs lokalt. Utskrivning från postoperativ avdelning sker enligt SFAIs publikation "riktlinjer för vård under återhämtning efter anestesi/sedering" och lokala anvisningar.

Sammanfattning av det postoperativa förloppet utöver vad som framgår av övrig dokumentation sker enligt klinikens anvisningar.

Kontakt av särskild vikt med icke närvarande befattningshavare i händelse av komplikation, avvikelse eller av likande skäl dokumenteras.

Det skall även i avlösningssituationer framgå vilken sjuksköterska och vilken anesthesiolog som vid varje tidpunkt har ansvarat för den postoperativa vården.

Tidpunkt för överlämnande efter den initiala postoperativa vården anges, liksom vilken sjuksköterska som övertar ansvaret för vården av patienten.

Signering av de moment som dokumenterats enligt ovan sker enligt klinikens anvisningar.

### **Förteckning över föreskrifter och lagar av betydelse för dokumentation på anestesi/IVA.**

SFAI:s riktlinjer

Lag om åligganden för personal inom hälso-och sjukvården SFS 1994:953

Patientjournalagen SFS 1993:20

Lag om ändring i lagen 1994:953 om åligganden...SFS 1996:79

Lag om ändring i hälso-och sjukvårdslagen 1982:763,SFS 1996:787

Soc.styr. anvisningar rörande journalföring vid vissa ingrepp och undersökningar, SFS 1979:72

Soc.styr.allmänna råd:Omvårdnad inom hälso och sjukvården, SFS 1993:17.

Soc.styr. föreskrifter om åtgärder för att förhindra förväxlingar inom hälso-och sjukvården och för att öka säkerheten vid läkemedelshandling inom den slutna vården, SFS 1989:1

Läkemedelshandlingen inom landstingens m.fl.hälso-och sjukvården inklusive tandvård,SFS 1995:19

Soc.styr föreskrifter om ansvarsfördelning och läkemedelshandling i samband med anestesi, SFS 1987:27  
 Lag om tillsyn över hälso-och sjukvården, SFS 1996:786  
 Soc.styr.föreskrifter om markering i journal av intolerans och allvarlig överkänslighet mot läkemedel mm, SFS 1982:8  
 Meddelandeblad 15/97 IT-användning vid journalföring.  
 Soc.styr föreskrifter om Idkontroll, SFS1992:2  
 Soc.styr föreskrifter om delegering, SFS 1997:14  
 Soc.styr kompetenskrav för tjänstgöring som sjuksköterska/barnmorska, SFS 1995:15.  
 Södersjukhusets lokala föreskrifter och ID-kontroll  
 Soc.styr föreskrifter om anmälningsskyldighet i sjukvården, SFS 1996:23  
 Soc.styr. föreskrifter om kvalitetssystem i sjukvården, SFS 1996:24,  
 Soc.styr föreskrifter om målbeskrivning för läkare under AT, SFS 1998:6,  
 Soc.styr föreskrifter om specialistutbildning för läkare, SFS 1996:7  
 Lag om transplantation, SFS 1995:831,  
 Lag om obduktion, SFS 1995:832,  
 Soc.styr föreskrifter om kriterier för bestämmande av en människas död, SFS 1987:269. SFS 1987:32.  
 Soc.styr.föreskrifter om blodgivning och blodtransfusion, SFS 1989:38

Sjukhusledningens beslut 1996-04-29 att införa ett elektroniskt patientjournalssystem på Karolinska sjukhuset grundar sig på behovet av ett säkert journalsystem. Sedan en tid och under de kommande två åren införs journalsystemet BMS på de flesta av sjukhusets kliniker. BMS är inte avsett att tillgodose de mycket speciella förhållanden med extremt teknikintensiv behandling inom anestesi-och intensivvård.

Det finns olika system på marknaden utvecklade speciellt för intensivvården. Till skillnad från BMS erbjuder dessa intensivvårds-journalsystem online datainsamling från patientens övervakningsutrustning för automatisk dokumentation och arkivering av övervakningsdata, avancerad omvårdnadsplanering med uppföljning och ändamålsenliga grafiska resurser för presentation av samtliga data.

För att sammanföra de olika kraven som ställs på ett intensivvårdsjournalssystem från samtliga anestesi-och intensivvårdsenheter över hela KS startades i februari 1998 det sk AIDA-projektet. I konsensus har man kommit fram till en enhetlig användar-kravspecifikation för ett intensivvårds-journalsystem.

Enligt en preliminär konsekvensanalys genomförd av styrgruppen för AIDA kan vid jämförelse med manuell journalhantering följande förväntas av ett elektroniskt intensivvårdsjournalssystem.

Förväntade vinster:

- gemensamt system och sammanhållen journal vid flyttning av patient inom sjukhuset, tex från CIVA till Thorax IVA.
- snabba svar på remisser om elektronisk post kan användas i stället för vanlig postgång,
- enhetligt, disciplinerat journalskrivningssätt,
- “online” insamling och pedagogisk presentation av patientövervakningsdata utgör bättre beslutsunderlag och behandlingsuppföljning med ökad patientsäkerhet,
- förbättring av journalsystemets åtkomsttider, arkivering, journalsäkerhet,
- mera rationell åtkomst av information för forskningsändamål:outcome studier,

- mera rationell åtkomst av information för verksamhetsanalys och administrativa ändamål för enheten,
- mera ändamålsenlig användning av personalresurserna genom förenklade och säkrare arkiveringsrutiner för patientjournal, besparing av personal för arkivarbete, besparing av papper och arkivutrymme,
- mera ändamålsenlig användning av personalresurser genom förbättrade möjligheter att i tid upptäcka väntetider och borttappade provsvar,
- optimering av läkemedelshantering genom säker tillgång till aktuell ordination, särskilt vid långvarig behandling.

### Kravspecifikation:

#### 1.Allmänt

Systemet skall vara anpassat till kraven från socialstyrelsen avseende signering av patientjournal samt arkiveringskrav (10år), Menyer, text (inkl hjälptext) och dokumentation skall vara på svenska.

#### 2.Omfattning

15 spridda enheter med 3-30 intensivvårds-sängplatser med upp till 20 apparater per sängplats anslutna.

Antal patienter ca 180 (250 inkl DS)

#### 3.Funktioner

##### 3.1.Systemfunktioner (lägsta krav)

3.1.1.Automatiserad online datainsamling från patientansluten övervaknings-eller mätutrustning. Insamlingsfrekvens av mätdata fast (anpassningsbar för grupper av mätdata), presentation i lika eller valfritt större intervall.

3.1.2.Registrering/inmatning av data i efterhand för anestesi på "satellitstationer" som angiolab,radiumhemmet,akuten med spårbarhet (tidpunkt och referens).Dessutom spårbar (tidpunkt och referens) inmatning av mätresultat för hand för sådan apparatur där online datainsamling inte är tillgänglig,

3.1.3.Graf presentation av mätdata/variabler i valfria tidsintervall, trender med zoomfunktion, kurvdiagram med sammanställning av flera valfria variabler på samma skärm.

3.1.4.Journalförings-och daganteckningsfunktion med söktermer anpassningsbara till varje enhet och harmonierande med befintligt journalsystem, BMS,

3.1.5. Läkemedelsordination –och administration speciellt anpassad till anestesi-och intensivvården med höga krav på spårbarhet, användarvänlighet och funktionalitet (förutom automatisk registrering från infusionspump även spårbar inmatning av givna läkemedel/doser för hand inkl antedatering av administrationstidpunkt). Beräkningar och grafisk presentation av infusioner, vätske-och jonbalans skall vara anpassningsbara till de olika intensivvårdsenheterna.

3.1.6.Möjlighet till automatisk remiss-och svarshantering mot förutbestämda leverantörer via KS intranät.tex lab, röntgen, externa konsulter och blodcentralen.

3.1.7.Diagnoskoder enligt ICD 10.

3.1.8.Möjlighet till vårdtyngdsdokumentation inkl verksamhetsstatistik och redovisning för kliniken, anpassningsbar till varje enhets speciella behov enl VLT och TISS. Redovisning skall ske mot sjukhusets Ikaros-system.

##### 3.2.Tilläggsfunktioner

- 3.2.1. Möjlighet att hantera sjuksköterskornas omvårdnadsplanering och dokumentation.
- 3.2.2. Möjlighet att upprätta speciella register (definierade som kopior av delmängder av data i CCIS) med öppen struktur, tex ett infektionsregister, för export till riksregister etc.
- 3.2.3. Möjlighet att definiera representationsprofiler för olika patient-och behandlingsgrupper,
- 3.2.4. Rapportgenerator för sammanställning av valfri statistik från patient-databasen (forskning).

#### **4. Åtkomst**

Åtkomst till varje intensivvårdsenhets journaler krävs från valfri dataterminal inom KS intranät.

#### **5. Tillgänglighet**

100% tillgänglighet under hela dygnet för minst 50 st IVA-platser.

#### **6. Användarvänlighet**

Existerande journalblad och övriga blanketter motsvarigheter på dataskärmen skall vara grafiskt utformade som respektive original.

Sammanställning av förekommande dokument och blanketter finns I bilaga 9.????

#### **7. Gränssnitt mot BMS-journal**

7.1. Termer (sökord) skall avstämmas med BMS.

7.2. Kopiering av data/dubbelregistrering

7.2.1. Allmänt

Användarvänliga funktioner skall kunna utvecklas inom särskilt projekt för ergonomisk koppling av de två systemen. Dubbelregistrering skall undvikas i möjligaste mån.

7.2.2. Vid inskrivning på intensivvårdsenhet

Persondata kopieras från BMS i intensivvårds-journalsystemet. Anteckning genereras i BMS med information om patientens fortsatta behandling på viss intensivvårdsenhet inklusive hänvisning till enhetens journaldatabas.

7.2.3 Vid utskrivning från intensivvårdsenhet

Anteckning om utskrivning av patient från IVA läggs automatiskt i

BMS. Slutanteckning skall kopieras från intensivvårdssystemet via EDI-fakt protokoll.

#### **8. Gränssnitt mot övriga IT-system på KS.**

Intensivvårdssystemet bör vara konstruerat som öppet system som ger möjlighet för dataåtkomst från övriga system på KS.

Avancerad bildbehandling, tex röntgenbilder, ingår ej i intensivvårdssystemet.

#### **9. Krav på leverantören betr utbildning, underhåll och utveckling.**

Dessutom skall ingå:

Utbildning av personal anställd vid KS för

-klinikanpassning av systemet,

-framtagning av nya inmatningsrutiner,

-grafisk presentationer,

-kontinuerlig användarutbildning,

-supportgaranti avseende systemets grundfunktioner,

-garanti avseende implementering av drivrutiner för datainsamling, beträffande apparatur som KS kommer att installera framöver.  
Leverantören skall beskriva sitt kvalitetssäkringssystem med speciell hänsyn till intensivvårdsjournalen och ange status för certifiering.

Appendix 2: The old patient record on paper at Karolinska hospital



Anestesijournal

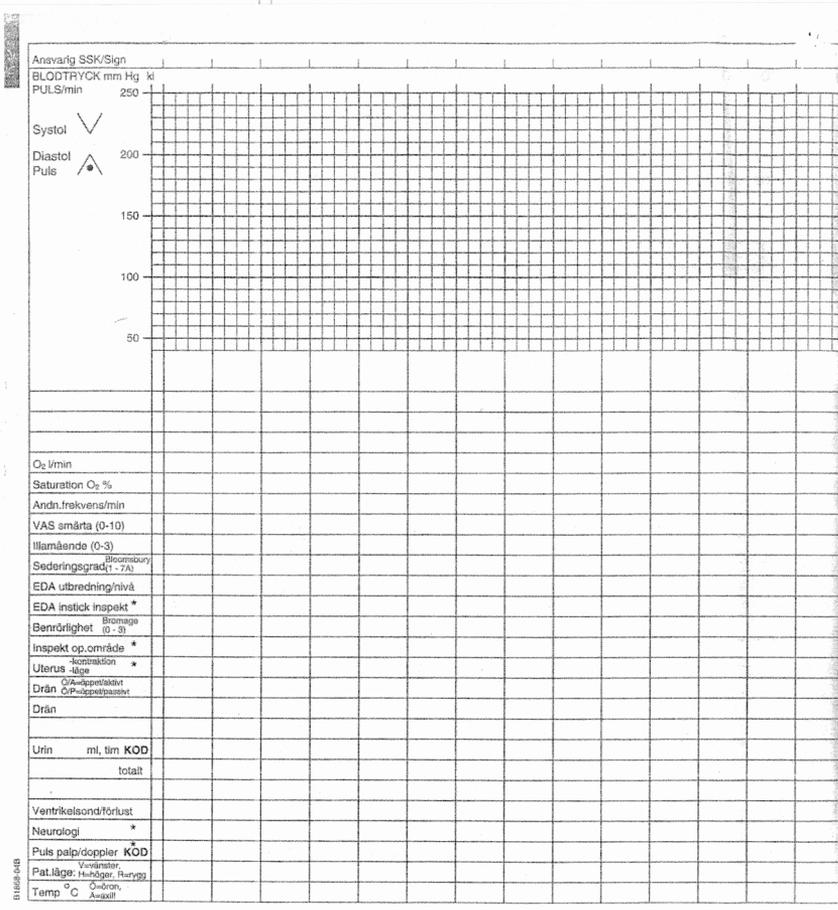
*Janita Arashijanni*

Datum (år, mån, dag)		Klinikkod	Avd	<input type="checkbox"/> Öppen v. <input type="checkbox"/> Akut	Pat.Data
Preop ordinationer				<input type="checkbox"/> Sluten v. <input type="checkbox"/> Elektiv	
				Langd	
				Vikt	
				ASA	
Premedicering (prep, dos, adm.-sätt)					<input type="checkbox"/> Id-kontroll, sign:
Ord. av:			Givet kl	Sign	OBS!
Bastesu/blgr			Givet kl	Sign	CAVE
<input type="checkbox"/> Ja <input type="checkbox"/> Nej	<input type="checkbox"/> Fragmin	<input type="checkbox"/> Heparin			
Op. klin.	Op-avd	Sal	Ankomst(K)	Upplagd(AN)	An-start(AP)
				Op-klart(OK)	Op-start(OP)
				Op-slut(OS)	Avlämn.(AS)
Operation			Op-kod	Op-kod	Op-kod
Trachealtub			<input type="checkbox"/> Nasal	<input type="checkbox"/> Packning	<input type="checkbox"/> Fiberskop
Nr:			<input type="checkbox"/> Oral	<input type="checkbox"/> Cm:	<input type="checkbox"/> Kuff
An-kod 80-89			Insticksnivå	Utredning	Påfyllning
<input type="checkbox"/> Sit.	<input type="checkbox"/> Ligg.				ml/...e min
KI.					
VENTILATION	O <sub>2</sub> /N <sub>2</sub> O				
	V <sub>i</sub> x f				
	Tryck cm H <sub>2</sub> O				
	E <sub>t</sub> CO <sub>2</sub> %				
	S <sub>p</sub> O <sub>2</sub> %				
	mg				
CVP mmHg					
Temp °C					
Diures ml					
ART/KAP BLODGAS	200				
KI					
pH	150				
Pco <sub>2</sub>					
BE	100				
PO <sub>2</sub>					
SO <sub>2</sub>	50				
Operatör/Assistent			VÄTSKEBALANS		
Anestesiolog(er)		P-sök	An-sektion	Kristalloid	ml
An-sköt		Op-sköt		Blödning	ml
Anestesi		Kompl/svårighetsgrad (1-4)	Post op vårdform	Dextran	ml
<input type="checkbox"/> u.a.	<input type="checkbox"/> LUVA	<input type="checkbox"/> CUVA	<input type="checkbox"/> CIVA	<input type="checkbox"/> Avd	<input type="checkbox"/> Hem
Kommentar			Plasma/alb	ml	Perspir.
			E-konc	ml	Övrigt
			Sign	S:a In	ml
				S:a Ut	ml

MSM 170, Anestesi, Injektions, OS 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28







B1108-0418

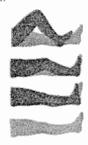
- \* = Se sökord status/åtgärd.
- = Som tidigare status.
- % = Avslutat.

**Smärtbedömning**  
 Be patienten att markera hur hon uppfattar sin smärta med hjälp av VAS-stickan (0-10). (VAS = Visuellt Analog Skala).  
 V = Våra.  
 R = Rörelse.  
 Vid siffrorna för VAS ange V o R.

**Illamående**  
 0 = Inget illamående.  
 1 = Illamående. O<sub>2</sub> ökn.  
 2 = Illamående. Antiemetika givet.  
 3 = Kräkning.

**Benrörlighet (Bromage)**

- Kontroll av muskelkraft i benen - intermitterat av motorblockad
- Ingen blockad. Bromage 0.
  - Partiell blockad. Bromage 1.
  - Nästan komplett blockad. Bromage 2.
  - Komplett blockad. Bromage 3.



- Full rörlighet i knä och fot.
- Kan röra knä lite grand.
- Kan röra endast fot.
- Omöjligt att röra knä och fot.

**Sederingskala (Bloomsbury)**

- 1 = Agiterad och orolig.
- 2 = Vaken men påverkad.
- 3 = Vaken och lugn.
- 4 = Väckbar av röst stimuli.
- 5 = Väckbar genom tracheal-sugning.
- 6 = Väckbar genom smärtstimulering.
- 7 = Öväckbar.
- A = Naturlig sömn.

**Blåsfunktion**

- K = KAD.
- T = Tappad.
- S = Spontan.
- BS = BladderScan.

**Perifer cirkulation**

- K = Kall.
- V = Varm.
- S = Sval.
- PP = Palpabla pulsar
- DP = Doppler pulsar



### UVA ÖVERVAKNINGSDIARI

Patientdata

Till UVA	Namn/Sign	Från UVA	Namn/Sign
Pat mottag av SSK		Pat lämnad av SSK	
Datum		Till SSK avd	
Tid		Datum	
Avd		Tid	
Avd.kod		CIVA	Vårdavd
		Hem	Mottagning
		Annat:	

Utskrivning	Tid	Postoperativa observationer/komplikationer	
Anestesiolog, namn		Inga	Aspiration (5)
Tel kontakt med anestesiolg, namn		Illamående/kräkning (1)	Andn.depr (6)
SSK, namn		Arytmi (2)	Allergireaktion (7)
		Bltr.fall (3)	Cirk.stillestånd (8)
		Blödning (4)	Övrigt (9)
			Kommentar

POSTOPERATIVA ORDINATIONER	<b>Överkänslighet:</b>	Antal/Volym	Läk ord Sign	VÄTSKEBALANS				
	Tillfällig ordination:			Vätska	Volym			
	Beredn form, läkemedel, styrka, dos, adm sätt			Kristalloid				
	Övriga ord/Vårdåtgärder:			Dextran				
				Albumin				
				Plasma				
				Blod				
				<b>SUMMA:</b>				
				Perspiratio				
				Urin				
INFUSIONER	Prover/rtg:			V-sond/Kräkning				
				Dränage				
	Patienten vårdad enligt PM postop omvårdnadsrutin			Blödning				
	Diagnos:			<b>SUMMA:</b>				
	<input type="checkbox"/> Nattpatient	Läk sign	<input type="checkbox"/> Postop smärtenh kontaktad	I Sign	<b>BALANS +/-</b>			
	Läk sign		Infusionsvätska, styrka	Volym	Ki	mmol	mmol	Övrigt
			Perop:		SSK sign	Volym slut	Ki	SSK sign
			Postop:					
TRANSFUSIONER	<b>Transfusioner:</b>	Antal enhet	Tillförda enheter, Volym/ml					
	E-kono/Perop							
	E-kono/Postop							
	Plasma/Perop							
	Plasma/Postop							

\*SSK sign, se transfusionsjournal.

811859-040



Operationsanmälan

Centraloperation	Op datum	Opererande klinik (om ej ovanstående)	Optyp	Prioritet	Åt/druck	ASA-klass	
	Anmälan utfärdad av	Ber. optid	<input type="checkbox"/> Elektiv <input type="checkbox"/> Akut		Kl.		
	Operatör/assistent	min	Vårdtyp		Blodsmitta		
			<input type="checkbox"/> Sluten <input type="checkbox"/> Öppen		<input type="checkbox"/> Nej <input type="checkbox"/> Ja		
	Diagnos	Kod	P-sökare		Primärt infekterad		
			<input type="checkbox"/> Nej <input type="checkbox"/> Ja				
			Operation			Kod	
			Infektionsprofylax		Operationsläge		
			<input type="checkbox"/> Nej <input type="checkbox"/> Ja		<input type="checkbox"/> Rygg <input type="checkbox"/> Buk <input type="checkbox"/> Extension <input type="checkbox"/> Benstöd <input type="checkbox"/> Sidoläge		
		Trombosprofylax		Operationssnitt			
		<input type="checkbox"/> Nej <input type="checkbox"/> Fragmin <input type="checkbox"/> Dextran <input type="checkbox"/> Annat		<input type="checkbox"/> Vänster <input type="checkbox"/> Höger			
		Önskas under operation		Särskilda upplysningar/önskemål			
		<input type="checkbox"/> Rtg <input type="checkbox"/> Prep.rtg <input type="checkbox"/> Genomlysning <input type="checkbox"/> Fotograf					
		<input type="checkbox"/> Odling <input type="checkbox"/> Cytologi <input type="checkbox"/> PAD <input type="checkbox"/> Fryssnitt					
		<input type="checkbox"/> Rtgbilder <input type="checkbox"/> Blodtomt					
		<input type="checkbox"/> KaD <input type="checkbox"/> Suprapubiskateter <input type="checkbox"/> GI-sond		Implantar			
		Planerad anestesi		Post op till			
		<input type="checkbox"/> La <input type="checkbox"/> La +övernakt./sed. <input type="checkbox"/> Annan		<input type="checkbox"/> UVA <input type="checkbox"/> CIVA <input type="checkbox"/> Vårdavdelning <input type="checkbox"/> Hem			

Preanestesibedömning

*orig. i journalen / kopierat på peritona s. d. resp. op. avd.*

	Nej	Ja	Anmärkning	Behandling
CNS-sjukdom	<input type="checkbox"/>	<input type="checkbox"/>		
Lung/luftvägssjukdom	<input type="checkbox"/>	<input type="checkbox"/>		
Hjärt/coronarsjukdom	<input type="checkbox"/>	<input type="checkbox"/>		
Kärlsjd/hypertoni	<input type="checkbox"/>	<input type="checkbox"/>		
Njursjd/Vätskebal.rubbn.	<input type="checkbox"/>	<input type="checkbox"/>		
Leversjukdom	<input type="checkbox"/>	<input type="checkbox"/>		
Koagulationsrubbnig	<input type="checkbox"/>	<input type="checkbox"/>		
Endokrin sjukdom	<input type="checkbox"/>	<input type="checkbox"/>		
Annan sjd av betydelse	<input type="checkbox"/>	<input type="checkbox"/>		
Allergi	<input type="checkbox"/>	<input type="checkbox"/>		
Rökare	<input type="checkbox"/>	<input type="checkbox"/>		Övriga mediciner
Tid. anestesi	<input type="checkbox"/> U.a. <input type="checkbox"/> Ej tid. ane. <input type="checkbox"/> Kompl.			Lab.
EKG	<input type="checkbox"/> U.a. <input type="checkbox"/> Ej taget <input type="checkbox"/> Best. <input type="checkbox"/> Patol.			Hb: _____ EVF: _____ Alb: _____
Kommentar				Na: _____ K: _____ Krea: _____
				Datum _____ Planerad anestesi _____
				Namn _____

KES33FD - Datum: (Bioscience®) Göteborg Post AB 20/04/2004

## MINIMIKRAV FÖR PREANESTESIUTREDNING

	Hb, EVF*	EKG	Rtg c-p	Ei-status	B-glukos
<b>ASA-klass 1</b>					
<70 år					
≥70 år	+	+			
<b>ASA-klass 2-3</b>					
Hypertoni	+	+			
Ischem. hjärtsjd	+	+			
Övrig hjärtsjd	+	+	+		
Kron. lungsjd	+	+	+		
Njursjukdom	+	+	+	+	
Saluretikaterapi	+			+	
Malnutrition, kron. cortisonbeh., diabetes	+			+	+
<b>ASA-klass 4</b>	Utreds primärt i samråd med anestesilog				

\* Tages *alltid* vid en beräknad perop blödning >10% av blodvolymen.

Pat med grav angina pectoris (dagligt behov av sublingualt nitro) skall ha genomgått arbetsprov inom 1 mån.

Hos pat. med kron. lungsjd i ASA-klass 3 skall spirometri övervägas.

Pat. med grav njurinsufficiens (S-Krea >400 mmol) skall utredas med S-Urea samt koagulationsprover (PK, APT-tid, TPK).

Blodgruppering, BAS-test enl. ssk lista, beroende på ingrepp.

**Med-konsult** beställs endast i de fall där pat:s funktionsinskränkande sjukdom ej bedöms vara optimalt behandlad.

## ASA-KLASSIFIKATION

ASA-Klassificering innebär en funktionsbedömning av patienten, baserad på dennes **aktuella** hälsotillstånd **utan** hänsyn till typ av ingrepp, som patienten skall genomgå. En ev. funktionell begränsning kan betingas antingen av den sjukdom som utgör operationsindikation, eller annan patologisk process.

ASA-klass 1 **Frisk patient**

ASA-klass 2 **Patient med måttligt uttalad sjukdomstillstånd som ej orsakar funktionell begränsning.** Ex.: Diabetes utan kompl., välkontrollerad hypertoni, lindrig VOC. Barn <3 mån. Förekomst av ASD el. öppetstående ductus arteriosus.

ASA-klass 3 **Patient med allvarligt sjukdomstillstånd som orsakar funktionell begränsning.** Ex.: Diabetes med komplikation, angina pectoris, genomgången hjärtinfarkt (>6 mån), adipositas, måttligt uttalad lungsjukdom. Esofagusatresi hos barn, VOC som op med öppen hjärtkirurgi, intrakraniell tryckstegring.

ASA-klass 4 **Patient med svår systemsjukdom som är potentiellt livshotande.** Ex.: VOC med uttalad hjärtsufficiens, angina pectoris i vila, hjärtinfarkt <6 mån. Avancerad lung-, njur- el. leverinsufficiens. Akut neonatal hjärtkirurgi.

ASA-klass 5 **Moribund patient** som ej förväntas överleva 24 tim. Ex.: Pat med rupturerat aorta-aneurysm i chock, comatos patient med stor intrakraniell blödning.

MP II  
+M > 70a

**Appendix 3: SurgiNet Anesthesiology System. A Prototype Overview**



***SurgiNet Anesthesiology  
System***

***Product Requirements and  
Prototype Overview***

## Product Overview



- **Anesthesia Staff Assignment View**
- **Schedule Accessibility**
- **Daily Case Overview**
- **Documentation of Records**
- **Remote Monitoring of Supervised Cases**
- **Quality Assurance and Data Analysis**
- **Automated Charge Services**

## Daily Routine



### Monday afternoon

Anesthesia Care Provider assigns anesthesia staff to the schedule

### Monday night

Anesthesia staff reviews their schedule for the next day

### Tuesday morning

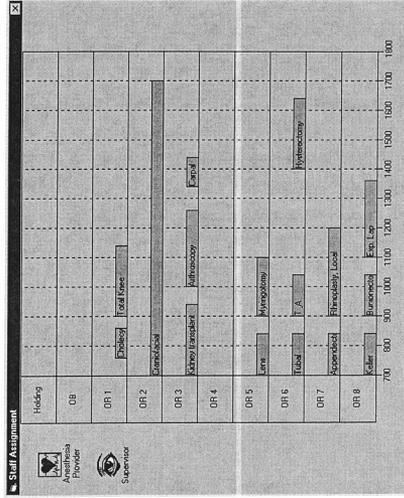
- Anesthesia care provider receives list of patient information
- Meets the first patient of the day in the holding area
- Administers anesthesia in the operating room

# Anesthesia Care Provider and Supervisor Assigning



- Assign Anesthesia Care Provider to cases
- Assign Supervisor to CRNA, case or location(s)

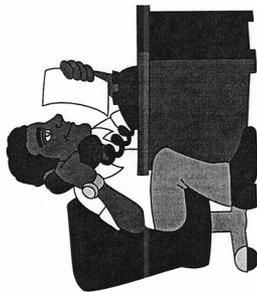
**User alerts**  
**-Supervisor/CRNA ratio levels**  
**-Supervisor assigned double roles**



## Schedule Accessibility



**The Anesthesia Care Provider's schedule is automatically generated each night.**



- ☞ Phone mail message
- ☞ E-mail message
- ☞ Alpha pager

# Pre-anesthesia Documentation



## Record patient information

- NPO recommendation
- Previous Surgery/Anesthesia history
- Known Allergies
- Anesthesia plan

## Care design

- assessment and physical exam
- impression
- record additional orders
- part of patient's chart

**Vital Signs**

**Blood Pressure**  
 Systolic: 300  
 Diastolic: 150  
 Site:  Right Arm,  Left Arm,  Right Upper Leg,  Left Upper Leg,  Right Lower Leg,  Left Lower Leg  
 Method:  manual,  auscult,  Doppler  
 Position:  Standing,  Sitting,  Supine

**Pulse**  
 BPM: 30  
 Character:  Regular,  Irregular  
 Site:  Radial,  Brachial,  Apical  
 Temperature: 30  
 Temp:  Oral,  Rectal,  Tympanic

**Respirations**  
 Breaths per min: 100  
 At Rest:  With Activity:

**Anthropometrics**  
 Height: 220  
 Weight: 0  
 Age: 199  
 Head Circum: 80  
 Chest Circum: 20

Cancel OK

# Daily Case Overview



- Available on-line or in hard copy.
- Shows up-to-date information about the patient and the case schedule.

Anesthesiology Case Preview: Anst, David		7:00 am	OR6	Tubal Ligation
	<b>Christenson, Sandra</b> Surp / Anes Hk C-Section	ASA Dist: 1 NPO: 7 hrs	Medications: none Allergies: Penicillin	HGB: negative
	<b>Den, Lawrence</b> Surp / Anes Hk Colonoscopy	ASA Dist: 1 NPO: 10 hrs	Medications: none Allergies: Chocolate, Seafood	Bronchoscopy
	<b>Jones, Claudia</b> Surp / Anes Hk Hilation & Curettage	ASA Dist: 2 NPO: 13 hrs	Medications: none Allergies: none	Hysterectomy HGB: UA: K: Na: negative normal 4.0 mg/dl 140 mg/dl Cl: Ca: Hemoglobin: 3.0 mg/dl 29% 8.8 g/100ml

- ◆ Picture
- ◆ Name
- ◆ Procedure
- ◆ Room/Time
- ◆ Assessment
- ◆ History

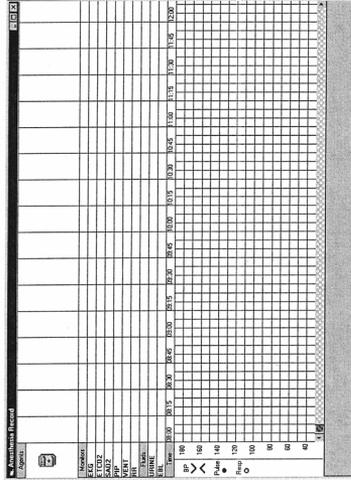


# Intra-anesthesia Record

- voice commands and touch screen user interface
- manual or automatic charting
- documentation of real time data
- macros for one-step documentation

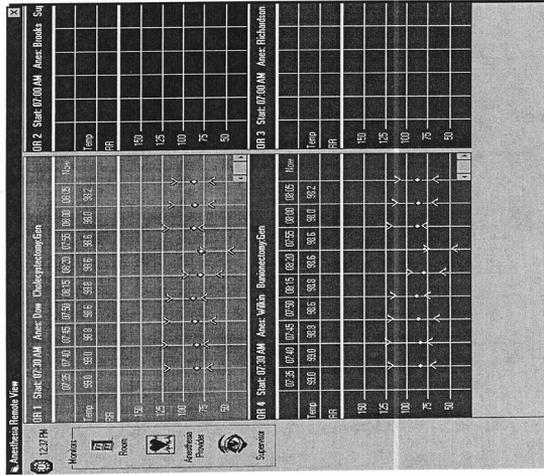
Automatically Displays average over interval

Cost meter as medications are administered



Graphical view is updated automatically as case progresses

# Remote Monitoring of Supervised Cases



- Monitor multiple cases from remote locations
- Color coded display
- Displays
  - current values
  - historical view
  - patient overview
- CRNA comment field

## Post-Anesthesia Evaluation



### Documentation of...

- One last set of vitals
- Patient information
  - \* self breathing
  - \* consciousness
- Assessment section configurable by facility

# Quality Assurance



-Configurable set of yes/no questions

-Default answers

-Facility set of questions

-Specific physician questions

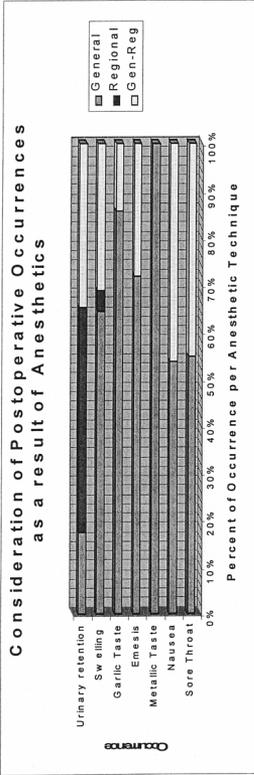
-Outcome indicators may be used to create reports

General Anesthesia Information		Yes	No
<b>Consciousness</b>			
Was the patient asleep more than one hour?		<input type="radio"/>	<input type="radio"/>
Was the patient confused?		<input type="radio"/>	<input type="radio"/>
Was the patient unresponsive?		<input type="radio"/>	<input type="radio"/>
<b>Color</b>			
Was the patient pink or pale?		<input type="radio"/>	<input type="radio"/>
Was the patient mottled?		<input type="radio"/>	<input type="radio"/>
Was the patient cyanotic?		<input type="radio"/>	<input type="radio"/>
<b>Perfusion</b>			
Was blood pressure beyond 20mm of pre-op range?		<input type="radio"/>	<input type="radio"/>
Was the heart rate beyond the range of pre-op value?		<input type="radio"/>	<input type="radio"/>
<b>Activity</b>			
Was the patient unable to move all limbs?		<input type="radio"/>	<input type="radio"/>
<b>Specific Information</b>			
Did an occurrence of anaphylaxis/shock happen?		<input type="radio"/>	<input type="radio"/>
Did an occurrence of emesis happen?		<input type="radio"/>	<input type="radio"/>
Did the patient complain of gastric taste?		<input type="radio"/>	<input type="radio"/>
Did the patient complain of metallic taste?		<input type="radio"/>	<input type="radio"/>
Did an occurrence of pruritis occur?		<input type="radio"/>	<input type="radio"/>
Did a rash occur?		<input type="radio"/>	<input type="radio"/>
Did any seizures actively occur?		<input type="radio"/>	<input type="radio"/>
Did the patient experience a sore throat?		<input type="radio"/>	<input type="radio"/>
Did swelling occur?		<input type="radio"/>	<input type="radio"/>
Did urinary retention occur?		<input type="radio"/>	<input type="radio"/>
Did dental injury occur?		<input type="radio"/>	<input type="radio"/>
Did peripheral neuro damage occur?		<input type="radio"/>	<input type="radio"/>
Did aspiration occur?		<input type="radio"/>	<input type="radio"/>
Did an occurrence of cardiac dysrhythmias occur?		<input type="radio"/>	<input type="radio"/>

# Data Analysis



## Configurable quality assurance questionnaires to create analysis reports



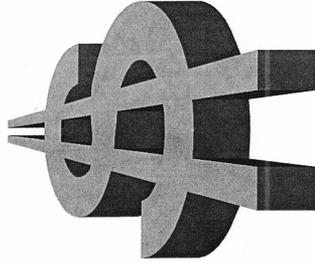
## Automated Charge Services



### Automatically Dropped Charges on...

- Total anesthesia time
- Procedure
- Body position
- Medications
- Anesthesia type
- Age
- Care Team Ratio
- ASA classification

\* Charge for Medications





## **SurgiNet Anesthesiology System**

**Questions?  
Comments?  
Thoughts?**

**A sincere thank you to those who contributed to this system which includes but is not limited to: the MDI Team, Advance Tech. Team, SurgiNet Team, and the SCD Content Team.**

**Email ID: [DCROOKS@Cerner.com](mailto:DCROOKS@Cerner.com)  
[CGNACINSKI@Cerner.com](mailto:CGNACINSKI@Cerner.com)**

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