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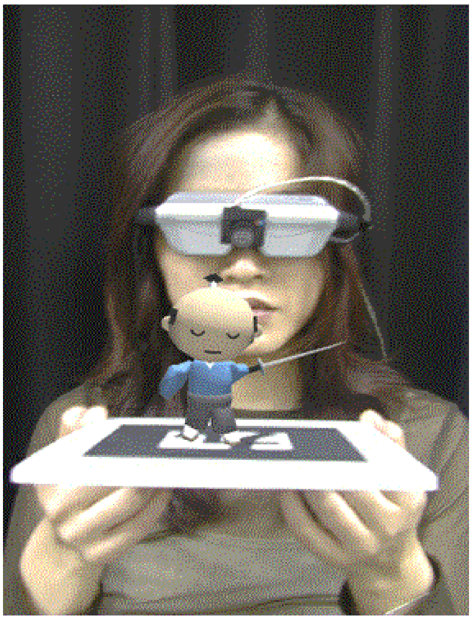
MEDICUS IN VIRTUS



Telemedicine, a Network and a Cyber Nurse – Notions on New Developments in Medical Science and Practice

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“Imagine if some of the thinkers of the old days, Buddha, Socrates, Christ, came back to us and we wanted to show them all our wonderful inventions and scientific discoveries, that signify the great development since their time. Wouldn’t they give us an indulgent smile, like we smile when our children show us their favourite toy?
I imagine the following conversation could have taken place between Socrates and Marconi.
Socrates, after having seen all the inventions, says: “This is all very interesting, but what has it taught You about yourself?”
Marconi: “But don’t You see, what enormous meaning this has for human life, for business, for economic relations and for the development. To be able to spread news fast?”
Socrates: “But how has this helped You? Have You become a better person? And if it helps some, maybe others suffer.”
Marconi: “But what about broadcasting, which brings beautiful music and lectures to thousands, yes, millions of people?”
Socrates: “How then, do these people get time to what is in eternity more important, - to think by themselves?”

From explorer and Nobel peace prize-winner, Fritjof Nansen’s speech at St. Andrews University. November 3rd 1926 (My translation)

Synopsis

Telemedicine is widely defined as medicine performed at a distance by the means of telecommunication. It often proofs to fulfil both medical and technical acquirements, but often fails to reach large-scale use. The focus in evaluation of telemedicine projects generally concerns efficiency and economic issues. In this thesis I try to explore the links between telemedicine projects and medical science and practice. I ask, “What are the implied theories of medical science and practice engendered by telemedicine?” Social studies of medicine shows that the leading rationality in modern medicine is “evidence based”, I show how practices, tools and decision techniques are influential in logics and science of medicine. Further I describe two case studies: The plans for a regional teleradiology network in Northern Norway and technological mediated health workers represented in the concept called CyberNINA . I show how new concepts of organising and performing medical work are inscribed in the telemedicine projects and I discuss some of the implications it might cause. Different technology projects in different fields of medicine construct and re-construct health care work by interaction in socio-technical networks. By discussing the medical aspects of telemedicine I show that it is important to create boundary objects and rationalise new concepts of medicine within existing cultures.

Keywords: Telemedicine, Medical Science and Practice, Cyber Nina, Teleradiology, Future health work.

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Acknowledgements

In the film “Matrix” (1999) by Andy and Larry Wachowski, the main character gets the choice of taking a blue or a red pill. The blue pill will open his eyes and make him understand that we are part of a technological dominated world, it will show him what the “Matrix” is. If he takes the red pill everything will be as it was and he will remain an ordinary citizen in his platonic cave.

I wouldn’t say that participating in the ESST program is like taking the blue pill, but it has opened my eyes to a new way of seeing and understanding the field of science, society and technology. Entering ESST has given me many new perspectives, many new friends and an unforgettable experience together with the hard work of writing this thesis. The ESST philosophy and spirit has been a fantastic challenge and source for excitement. My stubbornness and a priori distinctions have slowly been adjusted and watching me now compared to when I started would probably look like the two faces of Janus (see Latours *Science in Action* 1987).

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But at the end of the day, the brain is all alone, so thanks to the “unbearable lightness of being”.

Introduction

"It's a fax from your dog, Mr. Dansworth. It looks like your cat."

Gary Larson, author and drawer of the cartoon series called "The Far Side", often makes us laugh of his twisted and bizarre interpretation of nature, or rather his denaturing of the world. In this case, "It's a fax from your dog, Mr. Dansworth. It looks like your cat." Mr. Dansworth's cat has been subjected to information processing mechanisms, translated into a stream of binary electrical codes, transmitted out in cyber space and been reconstructed pixel by pixel as a piece of information coming out of Mr. Danswort's fax machine. An animal body transformed into a cyber cat by the use of IT[1][2].

[1] I will use the term IT (information technology) when I refer to technologies that transmit text or pictures. When telephones, emails and other interactive communication features are included I will use ICT (information and communication technology).
[2] The Larson interpretation is inspired by Callahan's WWW presentation "Cyborgs on Campus", http://www.2street.com/cyborg/top.html18-03-2000

Since different projects in *telemedicine* deal with medical workers performing virtualities, technological mediated nurses, mobile telecommunication devices and transmissions of digitalised human materials, it might make you realise that Gary Larson, in this case, wasn't that "far sided" after all. I will illustrate it with a fictitious story about how the health system might work in the future. It can give the reader an idea of what role ICT can play in medical work.

Tore Jensen, a 69 year old man from the small municipality of Lavangen, far above the polar circle in Northern Norway, is out cross country skiing on a wonderful Sunday morning. Suddenly he feels a severe chest pain and he sinks down in the cold snow. His clothes detect that his body temperature is falling and there doesn't seem to be any muscle movements. Through a GPS (Global Positioning System), an electronic compass, a S.O.S. signal is sent through GSM to the University Hospital in Tromsø (UHT). A few minutes later Tore Jensen is rescued by a helicopter ambulance and is connected to a portable ECG, which is monitored by a specialist at the hospital while Tore Jensen is still under transportation.

Some hours later our friend Tore is to be found in a surgery room. The surgeon is well trained. She has spent hours literary "inside" bodies like Tore's, mediated by VR (Virtual Reality) technology. She is wearing AR (Augmented Reality) glasses so she can see everything in the surgery room, but additionally there will pop up different information in the corners of her eyes which is not to be found in the room. This might be heart rhythm signals, x-ray pictures, blood sample test results etc. She even sees the top surgeon in the field, giving her live interactive advice from a hospital in the USA. Actually, all the information she gets come from different institutions and hospitals from *different parts of the country as well as from abroad. They are all connected via information networks, which allows for the delegation of tasks between professionals.*

Nina Hanson arrives at the UHT; she works as a nurse at the heart, lung and cardiac department and is about to do her daily rounds. She presses her fingers to the door and the Hospital Computer recognises her digital signature (fingerprints) and proceeds register her as "in". She puts on her coat, which has a wearable computer and an ID tag. As she rushes down the corridor she puts on her AR glasses enabling her to see where she is to report next. When she enters the room of Tore Jensen the Hospital Computer will register where she is by censoring her electronic ID tag, all phone calls are automatically directed to her answering machine. She scans the stripe code wrapped around Tore Jensens's arm wrist and her wearable computer downloads the patient file. Nina is free to move around and has her hands free to do her work as she can give commands through a microphone to view the information she needs. Tore wakes up and begins asking what has happened to him. Nina can then project illustrations, x-ray pictures and maybe a short film clip of the surgery procedure on the wall with the help of a small pen projector.

By the time Tore is well and at home, he is for a period under remote supervision by the hospital, his blood pressure results and heart sounds can be sent by e-mail to the hospital. He can, among other things, check waiting lists for his next control and renew his prescriptions of drugs over the Internet as he has his personal code to access the health information system. The doctors, patients and all other personnel in the health system are all connected in an information network by the means of ICT. (Brøndmo 2000, Pedersen & Hasvold P. 2000)

This might all seem a bit over exaggerated and even somewhat like science fiction. At this point it is easy to argue that this is not a realistic portrayal of the future health service. But technologically speaking this scenario is possible now or within the very near future.

At the Expo 2000 exhibition in Hanover the Finnish company Reima presented clothes for extreme winter conditions, which has an in-built emergency system. Through GPS and GSM systems the wearer can send S.O.S. messages him or her self, but if an accident occurs the suit can autonomously make a decision of calling for help when it detects an abnormal health status[3]. And at HITlab at the University of Washington, engineers and medical advisors from a wide range of specialities and hospitals are gathered weekly in LIMIT (Laboratory for Integrated Medical Interface Technology), a clinical simulation room. LIMIT is a testbed for making use of VR technology in surgeries. The surgeon can see different pictures and objects, such as x-rays, ECG monitors and even live interactive communication with others by the use of video conferencing technology. All popping up in the wearers sight when using VR or AR glasses[4].

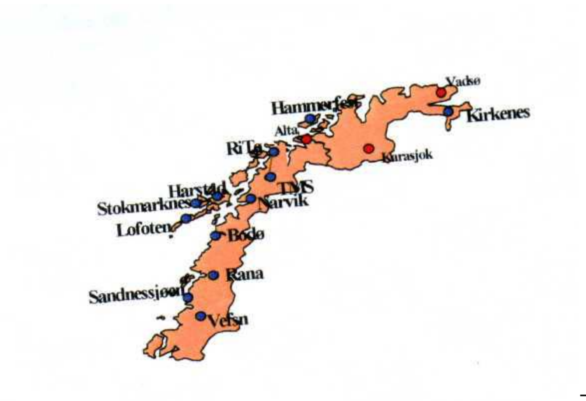
(HITlab)


(Virtual surgery at HITlab)

[3] See http://www.reima.fi 06-04-2000
[4] See http://www.hitl.washington.edu/research/limit/ 06-04-2000

As one, by now will understand, the development and use of ICT in health care is the topic of this thesis. I have studied telemedicine and its relation to medical science and practice. I focus on two projects, which are under development in the Northern Norwegian health region. In Norway it is a prioritised goal to create joint information networks between all health care institutions. For the last four years the UHT and the National Centre of Telemedicine (NCT) in Tromsø have made efforts to establish a regional *teleradiology* network. The main goal is to connect all hospitals and health care centres in Northern Norway to an electronic network to distribute and delegate x-ray pictures and other services among the connected institutions (Regionalt helseutvalg 1996).

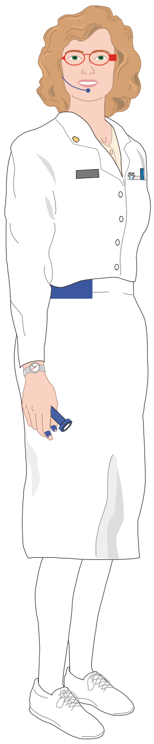
Illustration 1



⇒The map shows Northern Norway and the main hospitals and primary health care centres. UHT is marked as RiTø and TMS is a military hospital in Bardu.

Also at NCT, more specifically at the *Future Lab*, there is a pilot project on technologically mediated health workers. The aim is to make use of wearable and mobile ICT equipment to ease the work of people who need to be on the move and, at the same time, be able to send and receive medical information. It has the prototype name of CyberNINA.

"*CyberNINA is the name of a concept that serves the purpose of illustrating how a future healthcare worker might be equipped:*



- *She [sic] has a set of glasses that provide a virtual screen. From this she can see a computer screen or video screen approx. 1m ahead.*
- *The glasses also include a small camera. This allows her to let other see the same things she is seeing or it may be detached and used for video conferencing.*
- *A microphone and headset allows her to talk and listen to phone calls, as well as controlling the computer or hearing the computer read text.*
- *The wearable communicator is worn in the belt. Later it might be integrated into the shoes or other part of clothing.*
- *The communicator is wirelessly connected to the computer (IP) network. This allows the user to work with email, WWW, participate in a videoconference or use other CSCW tools and applications.*
- *A special ID tag identifies and provides the user the correct authorisation level for the user in a computer network.*

A laser pen acts like a projector and allows the user to share information with others; a colleague, a patient, etc." (NCT, Research draft, 1999)

Medicus in Virtus

Making use of telecommunication technology to assist the delivery of health care has become increasingly popular. With the IT "explosion" in society in general it is important to examine the development and what it is lead and influenced by, as well as the consequences or non-consequences. Medicus in virtus, is Latin for *the medic in virtual*, my thesis title is also a play on words with the medical term *in vitro,* which means to study life or specimens in glass. I have set out to study medical science and practice in its dealing and interaction with telemedicine projects. Not to let the title mislead you, the thesis is a description of three main subjects. First, it is about science and technology, or more specifically; medical science and telemedicine. Second, it is a description of how medical science is closely related to its practice. How telemedicine relates to rationalities of medical work. How telemedicine is seen as a valuable asset to the medical practice as well as how it is evaluated in regard to clinical aspects. Third, it is an empirical study of two limited case studies. How two different projects of telemedicine are shaped and how they shape the medical system and medical practices in their relation to them.

I desire to study the structures and social frames in which telemedicine develop in. Why is telecommunication and ICT viewed as an important asset in medicine? What are the logics and rationalities of medicine? How are these rationalities represented in medical practice? What role can telemedicine play in medical work? How do social actors and social groups affect telemedicine projects, medical work practices and the medical system? Does telemedicine imply changes in the medical system or is it just a tool to make existing routines more effective?

My main research question is **- *What are the implied theories of medical science and practice engendered by telemedicine?***

To study medical science and practice is a large task in itself, one therefore would need to limit the subject. I make use of a perspective referred to as *science and technology studies*[5] (STS). The STS approach is inspired by "post-Kuhnian" and "post Bloorian" theories. It contests notions such as science being a linear and cumulating development of set "facts". When science fails, it is often explained by social factors, such as; - lack of funding, disagreements or communication problems between researchers or research institutions etc. Funnily, these factors are seldom visible when science succeeds, then it is often explained as the work of a genius or a result of logic, or a cumulating and evolutionary process that leads to increased knowledge. By applying a *symmetry* or *equivalence* approach, and treating "true" and "false" statements equal, the *sociology of scientific knowledge* (SSK) opened for a methodology that is, by some, viewed as "rebellious" in sociological terms, because of its relativistic approach to scientific work. But it embraces the virtue that Peter Berger has called the *alternated* researcher, the idea of being neutral to any cultures, also those who claim to have knowledge of the "facts" (Barnes & Bloor 1982, Collins 1985, Collins & Yearly 1992, de Vries 1995). A broader approach develops when some of the ideas and concepts are being used related to work and technology. The *social shaping* approach is one label used on that account. Another is *Social Construction of Technology* (SCOT) used by Bijker et al (1987). Relatedly people like Bruno Latour and Michel Callon use a more radical symmetry approach. Their *Actor Network Theory* proposes that construction and maintenance is regulated by

[5] There are different definitions of the STS term. For instance, John Law (1991), uses "science, technology and society". My use of the term is similar to what, among others, Jasanoff et al (1995) uses.

heterogeneous networks, which include both human and non-human actors, or "heterogeneous entities that constitute a network" (Bijker et al 1987 p 11). These entities, or *actants* (to emphasise the semiotic point of including both human and non-human actors), are analysed by a "generalised symmetry", which maintains the same terms and methods for the different entities (Latour 1987, Callon 1986, Grint & Woolgar 1997). It rejects every a priori distinction between the "social" and the "natural" world (Callon 1986).

It will be clear to you in this thesis that it is sometimes difficult to distinguish where the human action ends and the non-human begins. The STS approach is a method and a vocabulary that does not make a priori distinctions between these entities. Making use of very deterministic or very voluntaristic explanations often results in a treatment of science and technology as a "black box". This can be prevented by focusing on the relevant actors and on the processes from which science and technology is constructed (Bijker & Law 1992, Latour 1987, Callon 1986).

I will apply constructivist theories and the principles of symmetry in my methods. And I hope it can provide a deeper understanding of telemedicine, medical science and practice. I have followed the actors and seen how they interrelate with each other on the medical "scene". My focus has been the role and influence of the "props", represented by telemedicine, and how they can affect the rationalities and practices of medicine.

First I will describe telemedicine and look at how it is viewed by its promoters and critical evaluators. I will show how increased use of IT and ICT networks is a prioritised political goal for leading health authorities. There will be given an review of evaluations of telemedicine regarding clinical aspects, I will contest some common notions on telemedicine, such as; it being a neutral tool that does not affect work practices. In the next chapter (2), I will show how medical science and practice are interwoven and how they mutually shape each other. Many believe that medical science is a provider of the "facts" and of singular answers regarding problems related to our bodies, our biochemical structure, to diseases and treatment. I will show that medical science is constantly changed, constructed and re-constructed in a diversity of fields and practices. The case is that there are many uncertainties in finding the "right" answers in a system that is facing increasing demands from society. Medical action and procedures of problem solving can vary within different rationalities of work. A link between what is regarded as the dominant science and practice of medicine and its relation to information tools will also be given in the second chapter. I base my empirical work on two case studies done at NCT. After a short presentation of my methods I will, in the following chapter (3), present the case of a teleradiology network and of the concept called CyberNINA. The two projects will be described and I will give a presentation and an analysis of the processes and developments I have observed during my fieldwork. The fourth chapter will present my analytical remarks to the two cases. I will explore some of the implied theories of medicine engendered by the projects with a focus on institution, co-ordination, work, roles and identities. I will also discuss how telemedicine must be understood as a process, which has to be interwoven into the rationalities of medicine. A summery of the thesis will be given in my concluding chapter (5). I will restate my main points of argument and try to provide some answers to my research questions. I have added a post-script (Chapter 6) which will include some thoughts on the wider implications of the subject I have chosen to study. It will also include some end remarks, which I hope can provide the reader with ideas for further discussions.

Chapter 1

1.1 What is telemedicine?

Telemedicine[6] is widely defined as medicine performed at a distance by the means of telecommunication. It covers the whole range of medical activities including treatment and education (Wootton 1996). To date, there is no united telemedicine "community" or organisation and different definitions have been used. In 1975 Bird stated this definition; "Telemedicine is the practice of medicine without the usual physician-patient physical confrontation via an interactive audio-video communication system". In the eighties it was given a more general definition by Corath et al: "Telemedicine is the use of telecommunication technology to assist in the delivery of health care." More often used today is EU and Advanced Informatics in Medicine's (AIM) definition: "The investigation, monitoring and management of patients and the education of patients and staff using systems which allow ready access to expert advice and patient information no matter where the patient or relevant information is located." And the latest edition might be World Health Organisation's; "Telemedicine is a practice of medical care using interactive audio, visual and data communication; this includes medical care delivery, consultation, diagnosis and treatment, as well as education and the transfer of medical data." It is easy to assume that telemedicine is a tele-service, the case, however, is that it is largely a part of the health service's infrastructure, a hierarchical system that implies a large degree of co-operation between institutions and health workers (AIM 1990, Bird 1975, Corath et al 1983; In Nymo 1993 p. 4, WHO 1997)

[6] Telemedicine is not defined as any use of ICT in relation to health. It only covers activity performed within the medical system. Internet services with non-clinical information or health "chat" between different people are often referred to as "cybermedicine".

There are various telemedicine activities, projects and centres in large parts of the western world activated from the late 1980's and 90's with different levels of development, use and success (Lehoux et al, submitted b). There are many successful examples of distance education in medicine, among them the medical education program run by the Mayo clinic in USA and delivered by satellite. Britain also has a long running programme teaching undergraduates of surgery. Moreover there are few major successful projects in the field of distance treatment. Areas where there are registered well known and long living activities, whereby the professional is remote from the patient is in; Teleradiology (radiographic images are transmitted to a radiologist to examine), Telepathology (transmitting images of specimens or remote controlling or use of microscope) and Teleconsultation (medical videoconferencing, doctor and patient are located in different places and are subsequently joined by a telecommunication link) (Wootton 1996). In Norway telemedical solutions are used routinely in radiology, ear-nose and throat diseases, paediatrics, pathology, psychology, geriatrics, cardiology, and lung diseases (HSA 1996). Telemedicine is by many viewed as having a valuable role in the case of emergencies in remote environments such as the Antarctic, on ships, in aeroplanes, in high security prisons, and on the battlefield. But there are also drawbacks. Some of the disadvantages include legal implications, depersonalisation, bureaucracy and overdependence on technology, clinical risk, and non-sufficient trust - between institutions, in the technology and in health personnel (Wootton 1996). I will in the following sections present some of the arguments for – and problems with the implementation and use of telemedicine. I will concentrate on the situation in Norway in describing the leading ideals and arguments for implementation, although, it seems to be a very unison international view on these matters.

1.2 The reasons for use of telemedicine

The Norwegian public health services are decentralised and based on the principle of treatment on the lowest, efficient level of care (The Norwegian Storting 1987-88). According to Norwegian law the municipalities are responsible for the primary health service, while the counties are responsible for the hospitals. Each county has a central hospital and a varying amount of local hospitals. The expansion of telemedicine is expected to contribute to a better co-operation and a more rational delegation of tasks and functions between hospitals, specialists and the primary healthcare.

> *"The starting point is a steadily increased gap between the expectations of the population to the health services and what the community can make accessible for health purposes". (Nymo 1993 p. 6)*

The Norwegian Ministry for Health and Social Affairs (HSA) states that telemedicine will give increased access to parts of the health service, especially in places with a scattered population and long distances to specialised competence (HSA 1996). The former health minister, Gudmund Hernes, stated 5 main goals for the use of IT in the health service (June 1996):

1. Increase the competence among health personnel → Better diagnoses and treatment
2. Ease routines for updating and storing information → More time for the patient
3. Better communication between different sections → Better co-ordination and teamwork
4. Encourage good information to the patient → More power to the patient
5. Conduct a sufficient information security → Attend both a secure and effective patient treatment and a strong protection of people.

(HSA 1996 p. 7)

Telemedicine has proved to help patients avoid strenuous journeys and made some services more efficient and thereby reduced waiting lists. Whether it has a decentralising effect is still not sufficiently documented but it is largely viewed to have one. As a part of a larger goal to provide equal access to health care, the Northern Norwegian Health Region has become a prioritised area for the telemedicine development in Norway (HSA 1999).

The integration of health services is seen as important in a time where the population in the age group over 80 is increasing together with the costs of running hospitals, nursing homes, etc. Telecommunication is not expected to take over the role of physicians, but contribute to a more direct contact between the health care provider and the patient. Creating information networks is regarded as an important part of the future health service.

> "The health service will be improved and the quality increased by joint introduction of information technology in all parts of the health service. Local, regional and national health networks shall strengthen co-operation and resource utilisation in the health sector"
> (HSA 1996 p. 7)

1.3 The problems with telemedicine

Telemedicine is often regarded as a neutral tool to ease the flow of medical information. Efficiency and organisational benefits are the leading goals behind many telemedicine projects. It is seldom regarded to have very much impact on the traditional science and practice of medicine.

> "As a respondent put it: "What's medical about telemedicine?" The technology is unquestionably seen as a communication tool, an add on to existing means that will not change their role as physicians." (Lehoux et al, submitted b, p. 17-18)

The problem is that many telemedicine projects never pass the initial pilot phase (Heathfield et al 1998 and Lehoux et al submitted a and b). If the technology is only a tool to make the old work practices more efficient and rational, without making any big impact on traditional routines, then why is it so difficult to get it out in large-scale use? This is an increasingly more important question in the field of evaluation of telemedicine. There is a large focus on the above mentioned drawbacks. Expensive technology, infrastructure adaptation, legal issues and organisational difficulties are repeatedly stated as important reasons for the stranding of projects. Tanriverdi and Iacono (1999) focus on the knowledge gap between implementers and users. Health workers have different levels of experience and knowledge about ICT and this can create a knowledge barrier. The problem with such evaluations is that they often imply an attitude one could describe as "if-only-they-knew-more-or-had-more-money-things-would-work". Often, the challenges are too complicated to be solved by the most obvious adjustments.

Heathfield et al (1998) stated that the lack of clinical input and leadership in ICT projects in health care is a major factor in the failure of the projects. To evaluate ICT projects clinical systems must be understood as embedded social systems and it is therefor important to search for causal mechanisms that lead to clinical outcome. They also criticise the current policy where evaluation is based on economic gains more than health outcome and quality of life. It is important to understand that telemedicine is a process, not just a technology, and that it effects work practices as well as being adapted to them (Wootton 1996).

Lehoux et al (submitted a) argue that *trust* should be an important keyword in telemedicine projects, the new technologies demand a new way of dealing with each other and thereby creates challenges to traditional communication within the clinical community. The critical recognition that efficiency and economy serves more important meanings than what is often blearily referred to as *quality*[7] is also followed by another argument, that telemedicine projects are driven by a *technology pull* rather than a *clinical push* (Wyatt 1996). However, some telemedicine projects do seem to focus on the very importance of changing practices and the way medical work is performed. As will be illustrated by my case studies later on.

> "The use of telemedical methods will to some extent mean that the traditional roles of health personnel will change" (HSA 1999, p.15)

The impact of telemedicine on medical science and practice is what will be further investigated in this thesis. To more thoroughly explore what the clinical / medical aspects of the development of telemedicine is and consists of, I will dedicate the following chapter to a closer view on medical science and practice as seen through the glasses of theories of sociology-, philosophy-, and anthropology of medicine.

[7] What is regarded as quality in the health system can vary depending on whom you ask. What is a good health service? It is a mammoth study in itself.

Chapter 2

2.1 The history of medical science

In all times and cultures there has been healers, witch doctors and medicine men. There is quite a common notion that medicine is an old tradition with traits back to Hippocrates and the Antic ages. But what we regard as modern medicine (Western medicine or after a global spread - “cosmopolitan medicine or “allopathic medicine”) is of a relatively new date (Mol & Berg M 1998). It was as late as in 1913 that a newly educated American doctor could be expected to give more precise diagnostics and treatments than any other alternative practitioner (Illich 1976). In other words, before the breakthrough of antiseptics and anaesthesia in the late 19th century, medicine didn’t differ much from the arts of healing in medieval ages. Modern medicine is based on natural sciences. Following Semmelweis’ deductive methods, pathology (Virchow) and bacteriology (Koch), medicine established itself within a positivistic field (Føllesdal et al 1977).

The medical profession has often been regarded as one unit. The traditional view is that there was *one* profession and *one* science – medicine had a *holistic* approach (Berg O 1987, Mol & Berg M 1998). The patient and his/her disease were the centre of attention. Increased knowledge, the development of more refined tools and the discovery of more complex biochemical connections, made it possible to fight many life threatening diseases. Ole Berg argues that modern medicine develops within a *reductionistic* logic, which is also represented in the way it is organised. It searches deeper and deeper “inwards” and “downwards” to seek increased knowledge about the body and its biochemical structure. The demands for continuously more detailed knowledge moves the medical system from a traditionally flat and collegial organisation to a complex and specialised one with large degrees of division both vertically and horizontal. Medicine also moves from being (mostly) person oriented to a more molecular centred practice. The introduction of new service functions and the technological development under-supports a medical system which we are now familiar with. It consists of specialists, sub-specialists, generalists, nurses, service personnel, technical personnel etc. (Berg 1987)

2.1.1 The fall of essentialism

The Danish philosopher Uffe Juul Jensen describes many of the same observations as Ole Berg, but is more interested in how disease and treatment is understood in the medical practice. He describes a medicine that has an embedded essence. The essentialistic principle, he says, has traits back to Antic ages. It claims that there is a clear distinction between sick and well and thereby what should be treated as a disease and what should not. The principle states that even though there exist different diseases, each disease can be recognised by the same characteristics. The belief is that every disease (D) has a treatment (T). Bacteriology and vaccination were important in giving medicine an optimism around the notions of the existence of specific treatments for every disease. Later on it is argued increasingly that rather than diseases being triggered by one cause (monocausality), that there are several reasons for the outburst of a disease (multi- or complex causality) (Jensen 1983).

Many still put their faith in the hypothesis that our diseases are due to biochemical abnormalities only. It can be argued that many diagnoses have never reached the precision that essentialist principles incline. And only in few cases is there a certainty that the *right* treatment is found. One of the arguments for upholding the hypothesis is that the alternative implies that decisions to a large extent would be based on coincidental and subjective choices. Jensen says that medicine of today is confronted with a *methodological crisis*[8], because the principle of specific treatment does not cover the wide field of medical activity. The clinical collective is dealing with much larger issues than the ones we find at the critical hospital bedside or by the deathbed. It deals increasingly with the whole range of social life and activity, including risk factors for disease, diets, conduct of life, labour environments etc. This is also one of the important reasons why medicine has been criticised by some sociologists of medicine for invading personal life by a *medicalisation*[9] of society. Not only does medicine increasingly widen its field of activities, it is also made aware that nature, often, is quite unpredictable. As Sven G. Johnsen, a self proclaimed essentialist, (or in his words, a biochemical fundamentalist) puts it:

> "Medical science of today is a sore and imprecise science. The patient always surprises. He [sic] dies against all expectations, recovers against all expectations, or proves perhaps to suffer from something completely different than what we first thought. The patient is unpredictable. We simply don't know where we are." (Johnsen 1981 p. 1665 My and Dutch translation)

Medicine being a fragile science can, for example, be illustrated by how infarct is diagnosed. It is a biochemical measurement of secretion of cell liquid in the heart, where a certain degree is defined as infarct and another is not. But the patient can feel and have all the symptoms of an infarct even though the tests show differently (Sackett et al 1985). It illustrates a science where there are no natural distinctions between sick

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[8] Relates to Thomas Kuhn's idea of scientific change due to change in systems of "paradigms", because of the confrontation of increasingly larger problems of upholding methods that supports existing hypothesis. See Thomas Kuhn: *The Structure of Scientific Revolutions;* Chicago University Press, 1970.
[9] See Illich 1976 or Andersen 1998 for more detailed discussions on the medicalisation of society.

and well. It is a question of definition, -of where to limit analysis and these might not always fit with individual variations in biology and psychology. It is, as some would say, *socially constructed*.

2.1.2 Evidence based medicine

If the medical science is fragile and imprecise, how then can the medical community make rational decisions? This question has been important among constructivist scholars within the STS field. Lately we have witnessed that social studies of medicine has moved from discussing the medical field in terms of power and control in relation to society, towards how medical science rationalises its decision. It has become an important topic for sociologists of science to study the evolving ties between medical practice and the shaping of its science. (Berg 1995, Casper & Berg 1995, Berg & Mol 1998).

The leading methodology within today's medicine is based on a wide range of research data, calculations, frequency of results, epidemiology and then on its logical outcome. This methodological direction is often referred to as *Evidence Based Medicine*[10] (EBM). In EBM decisions are not based on secure diagnosis and procedures of treatment, but on associations between varying factors of explanation (risk and effect, condition and disease) (Wullf and Gøtzche 1997). The logic is that nature shows traits, and by

[10] Evidence based medicine is not the only direction in medicine. Many argues in favour of a "narrative based medicine", a hermeneutic approach, where the patient-doctor situation is important to understand the disease. The story of the patient and the doctor's way of placing himself/herself in the patients social setting makes communication and interaction an important factor in decision making. Because of necessary limitation of my thesis this is not included in my discussion. See Nerheim 1996, Mabeck 1999 or Jensen 1983 for additional information.

knowing these traits and registering in what numbers they appear one can give an estimate of the outcome.

Medicine often operates with percentages and risk calculations, expressions like; “the chances are…”, “it is likely…” and “we believe that…” is common in today’s medicine. Medicine performed on the basis of secure and essentialistic principles is rejected as a myth. The confrontation of risk and uncertainties in the matters of life and death and medical treatment is something society has to live with and accept (Beck 1992). But it also puts the medic and the medical system in a very difficult position. The basis is what you *believe as-* and not *knowledge of* the outcome, clinical decisions are therefor crucially dependent on taking into account as many variables of risk as possible. EBM implies a medical system with a large degree of knowledge exchange, of information and service systems, of communication in and between institutions and personnel. A system where the doctor makes his/her decisions on basis of many available resources, information from different medical fields and from literature etc. It puts the *tools* of decision making in an influential position. EBM implies a use of a wide range of decision support techniques, which all serves different functions in a wide range of practices and rationalities.

Marc Berg shows how using different tools can give different outcomes in how medical practitioners rationalise their decisions. But he also gives a good description on how different logics and rationalities work in different contexts and how difficult they are to unite. The wide variation of medical practices also represents varying ways of thinking and varying ways of rationalising clinical choice. To a large extent medicines practical problems are related to the above mentioned methodological problems. If there are no singular answers in medical work, how can medicine "uniformise" its practice? How does it bring different rationalities together and how does it make the right choices of evidence? (Berg 1995)

2.2 The messy practices of medicine?

> "Medical action is a moulding process in which the client and his [sic] situation are reconstructed to render them manageable within existing agency routines" (Smith 1973 as quoted in Casper & Berg 1995 p. 399)

Medical work is a collective process. Different sets of people with different sets of skills do things together in different institutional settings. It creates power- or "turf" battles and "ego" battles, but it also nurtures a high degree of co-operation and teamwork. Drawing on a wide range of general and specialised knowledge, together with complex technology, medicine is *heterogeneous* and varies within different cultural contexts (Casper 1998). In Marc Berg and Annemarie Mol's (Eds) *Differences in Medicine* we can see how different contexts project different ways of defining medical science. Monica Casper shows how different procedures of fetal surgery imply different notions of patients, status of fetuses, of "moms", objects and subjects. Isabelle Baszanger shows how different approaches of practices of pain creates different ways of defining health, and Annemarie Mol shows how different the views and definitions of atherosclerosis can be (Berg & Mol 1998). Focusing on how the very different ways of practising medicine creates different ways of articulating the science shows how our conceptions of bodies, health, illness and treatments are continuously constructed and reconstructed. And how the practice is interwoven and mutually shapes and is transformed in its assimilation to the science (Casper & Berg 1995, Haraway 1991). Science studies point out that scientific practices require a stabilisation of "facts" (Latour 1987, Latour & Woolgar 1986). To make medical work manageable it is essential to bridge the different communities by articulating and negotiating metaphors and common grounds for understanding and formalising work. This is often referred to as a *boundary object*. A boundary object as introduced by Star and Griesemer (1989) is a way of illustrating how to articulate activity in the intersection of different social groups, or "worlds", and understanding how heterogeneous interaction can be effective (Star 1991, Baszanger 1998, Fujimura 1992). Boundary objects serve the purpose of co-ordinating and managing work across worlds, or bringing social worlds together. Fujimura uses another term, similar to boundary objects; *standardised packages*. The slight difference is that the package allows a greater degree of fact stabilisation in multiple social worlds. It is a way to construct and solve problems by making them "doable". It serves as an *interface* between different worlds, which means that it can facilitate the flow of resources among multiple lines of work. Thus, a standardised package is used as a reorganiser of work while it still maintains stability, integrity and continuity in diverse social worlds (Fujimura 1992).

I have tried to study how heterogeneous groups with different viewpoints and goals can co-ordinate work by the means of telemedicine. How does the "technological" and the "medical" world collaborate and find consensus and stabilise differences? What are the boundary objects or standardised packages of telemedicine? First I will show how information and communication technologies serve an important function in today's medicine.

2.2.1 ICT and EBM

As mentioned above, EBM requires a large degree of co-operation, decision techniques and tools. But how does the practitioner find the best evidence at the point of care? The most important information is of course the clinical results based on the examination of the patient - such as x-rays, blood samples, the symptoms of the patient, the patient's history etc. These types of information need to be structured, sorted and assured that it will get to the right receivers. It requires standardisation of forms, of measurements and of patient files. Procedures need to be formalised to ensure a safe handling as well as being understandable for everyone involved (Berg 1995).

The first priority of EBM is to minimise the risk of making the wrong decisions. Making systems that provide effective co-ordination and co-operation is important. Systematising evidence by quantifiable data, as well as getting access to the latest research and knowledge is believed to contribute to a reel reduction of risk. Therefore EBM also relies on systems that can provide access to accepted and updated knowledge. Often international databases are used to provide access to the latest research. Databases such as MEDLINE (National Library of Medicine, USA), EMBASE (Elsevier Science Publishers, Netherlands) or COCHRANE LIBRARY (BMJ Publishing) and different citation indexes serve as important providers of scientific information (Ridsdale 1998).

As I have stated, the function of these technologies is to minimise the risk of making wrong decisions. Practitioners are, however, aware that it will always be far from perfect. But taking into account as many variables as possible is believed to be *closest* to the right answers. So it also serves another function. To reduce the possibility of being held responsible if the decision still should be wrong. Embedded in the technologies is the universal *trust* of the science, as well as its uncertainties. It provides the legal, moral and scientific safety needed in an unpredictable practice.

2.2.2 Differences in telemedicine

As we can see, information processing is an important part of modern medicine. One-third of the cost of health care in the United States - some $350 billion - consists of the cost of capturing, storing, processing, and retrieving information: patient records, cost accounting, and insurance claims. By that measure, health care is a larger information industry than the "information industry" itself. (Evans & Wurster 2000). The demands and increased delegation of work that are not directly patient oriented are enormous. The need for good and efficient ICT solutions is pressing. IT is expected to ease the administration and other work practices that have to do with information processing, telemedicine can serve an important purpose and the expectations are high. The global telemedicine industry will grow 40% annually over the next 10 years, according to Waterford Advisors chairman Peter Leitner[11]. There is a technology pull in general in today's society, but medicine seems to attract large parts of the ICT industry. It might be related to EBM's implied dependency to information exchange. But to more thoroughly explore the processes that lead to the development and use of telemedicine I believe it is important to follow the steps of the involved actors.

So far I have discussed telemedicine in wide terms, but different tools of telecommunication serve different functions within the health service. Some systems store information, some distribute information, some provide communication links, while others sort information. It is a difficult task to choose the best solutions and the ones that are compatible with each other at any given time. Different medical institutions negotiate with each other and different companies and technical experts to find the best solutions. The need for standardised technology and routines are just as important in telemedicine as in other medical activities.

The different functions of different ICT solutions might also influence how medical work is performed, how the medic rationalises his/her decisions and thereby imply new theories of medical science. The tools might be seen as a "re-representation" of the repetitive character of traditional routines. But by focusing merely on how this new "map" fits the "terrain ", one can easily forget how the world is transformed to fit the map (Berg 1997, Latour 1987).

To limit the scope of my studies I will, in the following chapter, describe two specific cases in telemedicine. How does telemedicine become realised? Who are the relevant actors in telemedicine projects? How does the medical system interact with project centres, innovators and telemedicine promoters? What happens in the negotiations? And by which purposes is telemedicine implemented?

[11] www.waterfordadvisors.com 23-02-2000.

2.3 Choice of method

To study the processes and the development in telemedicine, I chose to follow two projects at NCT. The plans for a regional teleradiology network and CyberNINA. I base part of my studies on field studies I completed at the department of radiology at UHT and on reviews of earlier research and evaluation reports. All these materials are from the period 1995-1999. But mostly my empirical work consists of participatory observations at NCT, or more specifically, at the Future Lab in the period between April-May of this year.

I chose a teleradiology network because teleradiology has been regarded as a relatively successful telemedical service with a long history and with a large scale - and routine use. I could see how the project had developed from creating an IT infrastructure in a radiology ward to evolve into ideas of connecting all radiology institutions in a regional network. The CyberNINA concept was interesting because it featured notions on future medical work and was based on many new and creative technological solutions. Comparatively, the two cases represent aspects of medicine ranging from a macro level of co-operation between institutions and medical systems to the micro level of the single health care worker.

I endeavoured to meet the engineers, project managers, designers and evaluators of telemedicine projects and to obtain their views and experiences. By attending meetings, workshops and other activities on the two projects, I was able to follow the involved actors and see how the projects developed over the period I was there. With regard to my research questions, I was able to obtain an impression on both the obstacles and the inspirations behind these projects, as well as the actors notions on medicine in working on the projects. My method could be called an “actant-network-method”[12], as I have followed both human and non-human[13] actors in their interaction with each other and in the meeting with the medical system. I could see how they created heterogeneous networks around the projects and how the projects developed through social interaction, negotiation, resistance and compromise.

2.4 Method discussion

Apart from document studies and what I could find of evaluation and earlier field studies in clinical settings, I did not have many health workers among my informants, their views are presented by my earlier research. This was partially because the projects were in a phase of development and partially due to what I could afford to take on regarding workload in respect to the time limit. One could ask how I can say anything about medical science and practice when my studies are mainly based on pilot projects and telemedicine not yet initiated? But to emphasise what I mentioned earlier, many projects in telemedicine do not pass the initial pilot phase. Another problem is that once technology is in use and has become part of the practice, it often gets “black boxed”. One tend to forget what changes or processes one had to go through to make it work. Once the technology and what follows with it is there, it is much more difficult to see what it actually meant, caused and what processes were necessary to bring it to a *closure*, meaning when conflicting groups reach or conclude an outcome (Bijker et al 1987, Bijker & Law 1992, Latour 1987, Grint & Woolgar 1997).

[12] Latour and Callon’s Actor Network Theory is not a theory in the full sense of the term. It is a method to study science, society and technology. You can not talk about “Latourism” in the same terms as, for example, “Luhmannism”. See, Callon & Latour 1992.

It is therefore important to study technology in the making, and to follow the processes that lead to telemedicine activity. The negotiations, the barriers and the problems are often the things that characterise and show what the technology represents and implies. It has been argued that technologists or engineers define the characteristics of their objects. That they make a hypothesis about the entities that make up the world into which the object is to be inserted. A large part of the work of innovators is to visualise or predict the world in which the object is to work. It is an attempt to make a scenario of the object and how it acts with its surroundings. This *inscribed* vision can also be viewed as an attempt to predetermine, or *pre-scribe*, the roles and actions of the object, its users and the setting (Akrich 1992, Akrich & Latour 1992).

In many ways I have tried to be an "archaeologist of the future[14]". Like the archaeologist, I am interested in artefacts and what role they serve in a culture. But I am more interested in what the artefacts tell me about future cultures than those of the past. I can do this by following the steps and processes the projects have gone through and try to see where they are heading. One can only know what the situation is today, but by learning of earlier processes one can see some logical traits. I will let Gary Larson illustrate how one learns by the processes, this time in a cartoon called "Early experiments in transportation". It illustrates how it is important to stop and think, and evaluate developments, rather than to "sit on the wheel and let it roll".

[13] The non-humans are here represented by the technology and the projects, research drafts etc.
[14] See Bo Dahlbom's description of archaeology of the future in "Talk Society" at http://www.informatik.gu.se/~dahlbom

Early experiments in transportation

My aim is to seek out the inscribed and pre-scribed notions on medical work and how they are represented in the two cases I have studied. I will discuss this in my analysis (Chapter 4). But I will first give a more detailed description of the telemedicine centre and the two projects.

Chapter 3

3.1 The National Centre of Telemedicine

The "Telemedicine in Northern Norway" project was started by the Research Department of The Norwegian Telecommunication Administration in 1988. Research activities were initiated in collaboration with several health institutions in Northern Norway. The research proved to be quite successful and central health authorities decided to establish a national centre for telemedicine in Tromsø. In February 1993 former Minister of Health, Werner Christie, officially opened the centre. NCT has gained widespread attention national and international and the institution has grown to house about 70 people with backgrounds in diverse fields, like engineering, social sciences, medicine, economy, law, psychology and more. Their function is to be a consulting agency and to develop good telemedicine solutions as well as the forefront in the investigation of new and future developments in ICT and health services.

NCT is mainly financed by public budgets, but they also have co-operation with big industries like the Telenor, The Norwegian Tele-company, Compaq (the world’s second largest IT company) and Pentagon, the American Military Industry (probably the largest industry in the world).[15] In a few years they hope to have built a new and modern centre situated near the UHT and the number of employees is expected to grow substantially over the next three years (NCT, 2000).

[15] See http://www.telemed.rito.no and http://www.vg.no/pub/vgart.hbs?artid=1987999 10-07-2000

Since January 2000 NCT has been through an organisational change, they have divided their activities into different sections within the centre. Some of the activities I took a special interest to were those at the Future Lab.

The Future Lab aims to be visionary and have an eye for the “impossible” and the “incredible”. They endeavour to be a R&D laboratory where they can study technologies, services and organisational possibilities that are 2-5 years into the future. The idea is to be a think tank for the future as well as a source for creativity and innovation. Some of the projects they are currently working on are: CyberNINA, patient PC’s, the future patient role, organisational models in the health system, scenarios, simulations and new netbased co-operations (ibid.).

I was given an office at the Future Lab and could participate in all activities, meetings and workshops on the two projects I was interested in.

3.2 A Teleradiology Network in Northern Norway?

3.2.1 The Technology

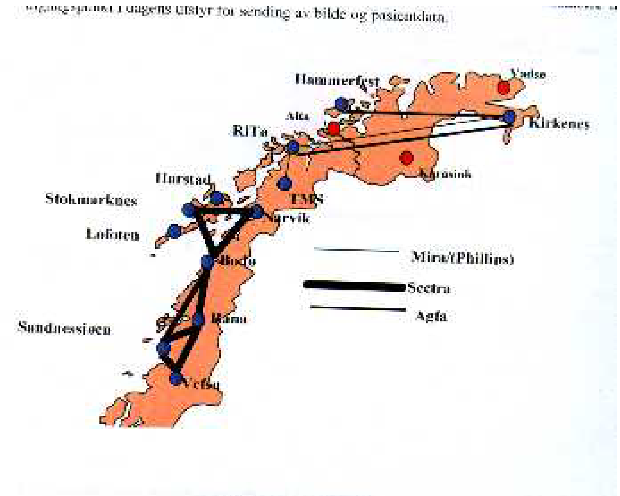
Medical radiology includes diagnostics and treatment of disease. For diagnostics a wide range of image creating methods are used. The technological development has influenced changes in methods of making x-ray photographs. Analogue pictures are based on traditional photographic principles; they are documented on film consisting of silver chloride. Analogue apparatus are still in use, but is on their way out of modern hospitals. The reason being that they take up too much space and that they use up a lot of resources. Moreover, it is also argued that it is environmentally unfriendly, as it requires large amounts of polluting chemicals (NIS Sintef 1982). According to Norwegian law, x-ray images have to be stored for at least ten years, which consequently requires a lot of archiving space (Regionalt helseutvalg, 1996). Many types of equipment and methods are therefore replaced by digital solutions. IT systems makes it possible to create, view and store x-ray pictures in computers and databases. Digital pictures are a necessity to be able to send pictures over a computer network. It is also possible to digitalise analogue pictures by making a computer "read" the picture and give every shade of grey a number (scanning), or some systems can produce digital pictures from an analogue laboratory with the help of a "digitizer" (Ekeland & Hasvold 1997)

To make a radiology system work in large scale, it is essential to have computer technology that can handle administrative tasks. A RIS (Radiology Information System) is developed, which can store and sort text data, laboratory data, date and time of examinations etc. It also provides an overview of where the pictures are to be found in the archives. In other words, it serve as a file and archive function. The RIS is based on *modules* that might be specially designed for different hospital departments. Subsequently, it means that some modules might not communicate with others. Another system needed is PACS (Picture Archive and Communication System). PACS stores x-ray pictures in a database. Finally PAS (Patient Administrative System) handles transcript data and insurance functions. In theory PAS, RIS and PACS can supplement each other, but it requires some adaptation work (ibid.).

To make a teleradiology network operational it is necessary to exchange patient information together with the pictures. This information might include clinical data, laboratory orders, payment, refunding etc. It implies that the administrative systems must communicate with each other. Good transmission lines for pictures and text are also needed.

There are technical problems with creating a teleradiology network. It has to do with different hospitals in different counties having bought different equipment and systems that doesn't communicate. For example a Mira workstation in Troms (Central N-Norway) county will not communicate with a Sectra in Nordland (Southern N-Norway) and vice versa (ibid.).

Illustration 2



⇒ *The map illustrates how the different hospitals have made use of different systems and how they can communicate, although, only in theory. We can see that the region is separated into information "islands", rather than in an united network, and that only a few institutions have the* *compatible connection with the Regional Hospital (UHT / RiTø)* (Ekeland & Hasvold 1997 p. 14).

3.2.2 The Use of Information Systems in Radiology

One of the leading institutions in making use of information systems in Northern Norway's health service is the radiology department at UHT. In the late 1980's the radiology ward at UHT was in a difficult situation. They had problems recruiting enough radiologists and since the ward was criticised for being badly organised and had problems with providing the wanted service, few where interested in staying there for longer periods, so they found themselves in a vicious circle.

One of the radiologists decided that if he was going to stay there for a longer period, things would have to change. He got support to develop a system to measure production numbers, and through statistics they could get a better overview of what had to be done and they could gain more control over the wards production. After some time they saw that they gained organisational benefits from the work they had done and the wheels started to turn to build up an IT infrastructure (Field notes 1997). This is also quite common in other ICT and health projects, it is important to have "enthusiasts" or "innovators" within the system that can initiate a technological development (Tanriverdi & Iacono 1999, Lehoux et al submitted b). Although no single persons or "creators" can change the system alone, it must be based on support and teamwork, negotiations and compromise (Bijker 1995, Bijker & Law 1992, Latour 1987).

Today the Radiology ward at UHT has a highly complex IT infrastructure including RIS, PACS and PAS. But there were different opinions on the strategy chosen to achieve this. In the initial phase, the IT development at the department was to a large extent based on a few peoples interest and initiative to create an infrastructure. The innovators where among those who developed the systems, they looked at technological development as a goal in it self and viewed any use of the technology as a sign of success. *"It is like a car, for some it is just a mean for transportation, for others it's a passion" (IT consultant)*. The strategy was to act instead of discussing, or as a radiologist put it: *"If this was to be done trough a large project group, we would only get fragments done"*. They believed in a quality change for the better and as they saw the organisational gains, they got more optimistic and could live with the lack of recourses when the use of the technology resulted in faster diagnosis. Some did not hide the fact that they became dominant in the department: *"I think you will have A-B-C levels after how interested and how much knowledge you have in technology. Take me for instance, I have one year extra education in informatics in addition to nursing school and have the position and salary on the level of the leaders of this ward" (IT Consultant)* (Field notes 1997).

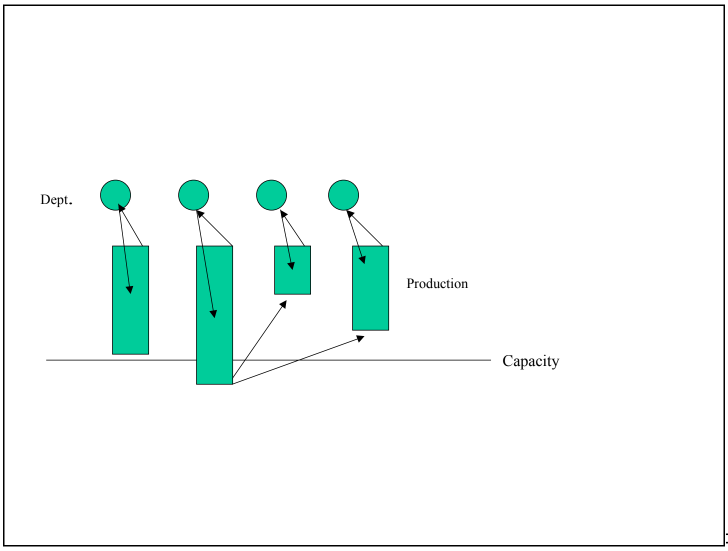
However, not everyone shared the innovator's enthusiasm. Some argued that it was a problem that the systems were "home made", and that the "manual was to be found in a few persons heads". These scepticists were not technological negative, but sceptical to the development in general and to the way the new IT systems had been introduced at the ward. The view was that medicine is getting too dependent on technology. *"Things can't be done manually any more. Human judgements loses its meaning when you can punch a button and get the answer (Nurse)*." It was also said that IT had changed the way they work and co-operate between wards and institutions. Especially the introduction of a network co-operation between the UHT and a Military Hospital in Bardu. Before the teleradiology network came up between the hospitals, a radiologist would travel the 160 km and stay for a week and work trough a pile of pictures and patient records. These are now sent electronically. *"It was a way to get away from the routines here at UHT, and a possibility to get more in contact with the primary health care. I liked that better than staring at a screen. We are judging pictures much faster now after the teleradiology co-operation started with the Military Hospital. But as a human it hasn't been a good development (Radiologist)"* (Field notes 1997).

The teleradiology connection between the military hospital and UHT is one of few telemedicine projects that has a long history and is in routine use. Even though many other hospitals have the technical possibility of establishing a teleradiology service, the use has been limited. Still, it has been a wish to connect all the institutions in a network, and since 1996 NCT and UHT has been some of the leading actors to make the network become a reality (Regionalt helseutvalg 1996).

3.2.3 The Network

A network can be described as a virtual radiology department. It consists of a workstation and a database. Radiologists or the radiology departments in the network create a virtual department by putting pictures in a queue system in a joint database. The pictures can be physically located at the hospitals, but mediated by web-technology it will "look as" they are all placed at the same base. Pictures are examined by the radiologists who, at any given time, are on their shift, no matter which hospital he/she works in. If someone has too much work he/she can send some of it to the database and those who have a "slack" can collect more pictures from the database. The activity can be an integrated part of the delegation of work. It can also be used spontaneously when the production passes the level of capacity of a department. The situation for some of the smaller hospitals is that they sometimes are overloaded with work, while at other times it is less stressful. Some hospitals only have two radiologists who work in shifts. Sometimes it is difficult to give weekends of or to allow them to travel somewhere (NCT Research draft 2000).

Illustration 3



⇒*Queue model suggestion*

(NCT Research draft 2000 p 6).

A joint network within the region can serve as a triage system, where the delegation of tasks can be distributed over the region as a whole. Local hospitals can obtain greater access to sub-specialists in some cases. It can contribute to a more flexible production, resource utilisation and shift list. A collegial network is believed to result in a better workflow and the possibility to have a more structured allocation of spare time.

Analysis of economy, resource flow (queue-theory), co-operation and quality, different models of delegation of resources and teamwork is to be studied through a pilot at NCT and the Future Lab. The project leaders want to try out a socio-technical network which can *"combine a flexible network organisation + [sic] a formalised shift solution, an economic model that does not hinder competition and technology that makes all to all communication possible"* (NCT Research draft 2000 p 2 My translation).

3.2.4 Connecting people

So far, the attempts to create a network have not succeeded. The technical problems are expected to be solvable. One could decide that only one standard should be used and that all hospitals should buy the same equipment. This, however, is very expensive. Another approach is to make the different programs communicate by developing compatible software. But technology alone doesn't solve the problems. It must be a regional consensus on what solutions should be chosen and how the network should be organised. Conflicting interests between institutions on these matters exists and need to be solved. But a new optimism has grown with the introduction of a new actor.

Northern Norwegian Healthnet (NNH) is to serve a co-ordinating role in creating a network within all fields of the health service and connect all Northern Norwegian health institutions and health care services to an information network through inter- and intranet technology. But there are uncertainties and discussions on what role NNH is going to have, how the network is to be administrated? Who should control it? Where should the servers and the archiving computers be placed?

"The battle has moved from within the institutions to between the institutions(…)The UHT wants NNH to be closely linked to UHT, the smaller hospitals wants it to play an independent and neutral role" (Project Manager).

A small hospital in Finnmark (Northern N-Norway) feels overrun by the dominant regional hospital and refuses to buy the technology the UHT wants them to buy. While other hospitals in Nordland county feel the need for a development, being dissatisfied with the co-operation with their central hospital (Bodø) and wanting to do what ever the UHT is doing, regardless if it is the opposite of what the county's central hospital does. But the will for coming to agreements is still strong. One of the smaller Nordland hospitals put it like this to one of the project managers: *"We have lots of beautiful nature to offer. And we would want our radiologist to be able to maybe go fishing once in a while, but we can't afford not having him here. With the network we can distribute some of the workload to other colleagues and thereby give our radiologist some time of and that's important if we want to be able to hold on to the few recourses we've got"* (Field notes 2000).

The Norwegian health system is organised so that money follows production. It makes the issue of where to place the virtual department and in which way production numbers should be registered an important question. In theory the virtual department can be placed anywhere, also outside Norway, but nevertheless, the centralising versus decentralising issue is a problem needed to be solved. To come to agreements and to make the system work, a collegial trust is essential as well as trust in the technology and the involved actors. Trust in the virtual will be further discussed, but I will first present the findings in my other case. In the CyberNINA project, the technology is to be worn by its users. What happens in the processes of creating technologically mediated health workers?

3.3 CyberNINA

3.3.1 The Concept

The telephone becomes a computer and the computer becomes a telephone, it is not a question if, but when? We are witnessing that more and more IT applications and technology systems are being merged and integrated with each other. Machines are getting smaller and the capacity more powerful. It is also expected that the technology will be more integrated in our daily life surroundings. As we are facing more digital systems, the idea of adding more telemedicine features to functioning technologies is emerging. Different technologies can work asynchronous in networks and the systems can be integrated in small wearable components.

At the Future Lab some of the researchers were inspired by the work done on VR/AR applications at HITlab in Washington and of research on wearable technologies and interfaces done at MIT[16]. The idea was that wireless networks and mobile computing can be useful and make a dramatic impact on how health work is organised. They came up with the idea of making a concept, image and a name that could illustrate how health workers might be equipped in the future.

[16] See http://www.media.mit.edu/wearables/mitres.html 18-06-2000

The CyberNINA concept illustrates a practice where every health worker have their own small computer, which also works as a telephone, answering machine, “beeper” etc. The computer might be sewed into the “white coat”. This *communicator* can recharge the batteries by muscle movements. Authorisation and autentisation might happen through DNA recognition. The communicators will be wirelessly connected to information networks and to receive information, the wearer has glasses with a small screen. He or she can also have a microphone, a projector and a small camera. The health worker can access the net wherever the user is and moves. Around the user is his/her personal “bubble”. In this area can medical equipment, printers, screens etc. become part of the users personal network. One no longer has to bother with tripping on wires or looking for an office with a computer, one is effectively accessible and operational everywhere at any time (NCT Research draft 1999, Pedersen & Hasvold P 2000)

3.3.2 Unplugging health workers

Who needs wearable computers? To begin with, it was thought that emergency rescue personnel, medical laboratory technologists, doctors or nurses doing rounds or general practitioners could be interested in the concept. These health workers always seem like they are supposed to be somewhere else, preferably an hour ago. The strategy of the Future Lab was to introduce the concept to different types of health personnel and see if anyone were interested in making use of some of the ideas. An anaesthesiologist liked the concept but was worried that the equipment would be too heavy and he also warned: *“Doctors are conservative, they are not the ones who like flashy and fancy* *technologies. They are not the ones you see running around with cell phones and the state of the art PDA (Personal Digital Assistant, authors note). They prefer to be traditional and write with pen and paper"* (Field notes 1999).

With the organisational changes at NCT this winter, the CyberNINA concept was put on ice for a period, but was often used in presentations of NCT in general and of future scenarios for the health care service. Many had taken a liking to the name and the concept.

The presentations would, however, cause debate and emotions. One of the things I would register was that the name caused instant reactions. Utopian thought is often followed by its shadow, dystopia (Manuel 1966, Wammer 1999). CyberNINA got her name inspired by an evil cyborg called "Cyanina" in the comic series called Sprint (Spirou, Belgian origin). We often imagine cyborgs to be evil creatures, nature having been messed with when humans and machines are made into a hybrid. A common thought is that cyborgs will eventually turn against their creators and cause murder and destruction. We have seen these portrayals in literature and by Hollywood, where they have made images of cyborgs to represent fear and horror. We relate it to stories like; Mary Shelly's "Frankenstein", "Robocop", Arnold Scwarzeneger as the "Terminator", or the viscous computer Hal 9000 in "2001: A Space Odyssey" by Stanley Kubrick. A nurse as a cyborg might seem a bit odd. *"At first, people laugh, they think its a computer game or something, but they all get quiet when we tell them that all the equipment could be bought in local shops in Tromsø more than a year ago" (Project manager).*

The name is important in drawing attention, and as the medical workers got used to the idea of a cyber nurse, the people at the Future Lab could present the benefits, possibilities, and how wearable solutions could be a good assisting aid in medical work. But if the technology is there and is presented as beneficial, then why isn't it used? Why do we not have CyberNINAs? Lets take a look at what it would look like with the state of the art technology of today. In the illustration (4) under we can see how CyberNINA was presented in Norway's biggest newspaper in February this year.

Illustration 4

CyberNINA as presented in VG 9th of February, this year.

She looks a bit different from the nice and "clean" illustration in my introduction. The nurse's face is almost covered by the glasses, she has lots of wires and artefacts that disturbs our view of her. One wants to ask - Who is she? Would you like to be met by "this" at your hospital bed? Or more importantly for the developers - Would health workers like to wear this? An important part of communication is eye contact, if the patient is unable to see the eyes of the health worker, it becomes difficult to establish the trust and safety, which is so important in health care. The visual and subconscious fears one might have of cyborgs can be minimised by design and by developing "softer" technology. But as we will see, there were other reactions to the presentation.

3.3.3 Demon box?

Often one gets the impression that there are demons in our computers. We get these irrational thoughts whenever the computer acts strange, or when sudden and unexpected changes occur and things get messed up. Well, it might not be far from the truth. When I write this thesis the word program "knows" that I use three types of headlines, that I use footnotes and hyperlinks. When I open a new document the same features automatically comes up because the computer "remembers" how I prefer to write and what interfaces I prefer in my documents. This is caused by *electronic remembrance agents*. Remembrance agents make autonomous decisions by experience, the computer learns how the user work. Part of the CyberNINA project was to actively make use of electronic remembrance agents. They could be used as control agents to provide the accurate authorisation for the users, or in a network, the agents can move between the machines and serve as a virtual secretary. For instance, they may automatically avoid booking meetings on Fridays if this is a day the user is very busy. The agents will learn by the routines of the user and autonomously create catalogue indexes, be mobile and "travel" in the system. In an evidence-based practise the agents could be used for filtering relevant information, match making etc. Or in the teleradiology network we could imagine the queue administration being done by electronic remembrance agents. At MIT remembrance agents (RA) have been tested out with different applications and in different settings.

> *"The system has been in daily use for over two years now, and many applications have been found. For example, when a researcher writes a technical paper, the RA suggests up email from reviewers, calls for papers for appropriate conferences, relevant class notes, papers written on the same topic, and abstracts from a database of IEEE journal articles that might be good references. With the touch of a key the entirety of the suggested document can be retrieved" (Rhodes 1997 p 220).*

One of the ideas in the CyberNINA project was that the remembrance agent could distribute relevant patient records to the health workers. By making a match between, for instance, diagnosis, the agent could provide similar files on how other patients with the same condition were treated and the results of the treatment. But this was not a popular idea; *"People didn't like it. They thought of remembrance agents as digital spies. They view the medical records as their own property. It is like peeking in their cards" (Engineer).* (Field notes 2000)

Marc Berg says that the patient record[17] has developed from traditionally being the doctors work paper and "memory" of patients, to also become information for other health personnel as well as third parties (research, government agencies). The patient record then serve as a description of the activity in health care processes (Berg 2000). But there seem to be a resistance in making traditional work papers more public.

[17] It is important to mention that patient's right to confidentiality and privacy is a basic human right protected under the European Convention on Human Rights. But legal issues will not be further discussed. Security is, however, important for developers and users of telemedicine and the laws are followed.

3.3.4 CyberNINA@work

Even though there was some resistance and difficulties with getting the CyberNINA concept out in use, things changed during this winter. The picture from the newspaper is of a nurse working at the heart, lung and cardiac department at UHT. The nurses of the department took an interest to the ideas and initiated a co-operation with the Future Lab. *"The nurses are much more open minded and creative, than the doctors" (Project manager).* This is no big surprise, the heart, lung and cardiac department's policy is to be innovative and creative and it is a highly technical ward. The IT infrastructure, however, isn't that impressive. Most of the patient files and records are still paper based. The strategy of the Future Lab for the first stages was therefore that they do not have to solve everything at once, they wanted to make it a long term and "slow moving" project with a close interaction with the users. To begin with, there would not be tested out technology with high risk of failing. No AR glasses and no fancy wearable computers would be tested in the initial phase.

They made visits to the ward and videotaped the activities and the nurses' routines when dealing with information, and tried to find out what could be improved. The nurses at UHT work in teams, and one of the ideas was to equip the team leader with a laptop to make use of mobile technology which people are still familiar with and know how to operate. Another thing that caught the Future Labs attention was the wards white board.

In the meeting room of the department was a white board, which provided information like: the whereabouts of patients (name and room number), date and time of operation, type of operation, nurses responsibility (name and tasks), and the name of the team leader. If it was to be replaced with a computer screen and the same information features were inserted, the white board would be digitalised. Part of the wearable principle is that these types of information should be accessible regardless of time and place. So if the white boards information was to be digitalised it could be sent to mobile computers to where the nurses are. This idea lead to some discussions at the Future Lab. It might sound strange, but to remove or change the white board could represent a big step and a big change, thus the idea needed to be discussed and agreed with the nurses.

What is the social function of a white board? The board can be viewed as only a tool to provide information, but it can also serve as a meeting place. People can gather around it with a cup of coffee and discuss work or other things. The social function of a white board is tacit and might easily be forgotten. If the information is mobile, it can reduce all the time used by nurses to get from A to B. Nurses walking in corridors from a lab to the white board or a patient, is often viewed as inefficient time spent. But maybe the hallway walk is important in health care work? Maybe it is a way to get a break from it all? Maybe it is during the hallway walk that health care workers gather their thoughts and prepare themselves for the next task? (Field notes 2000)

The question for the Future Lab was – What information do nurses need when they are mobile? The nurses expressed that they had communication difficulties with the doctors. There would be information about the patients that were of importance for the nurses, their work and interaction with the patients, which they could not pass on to the doctors. The doctors are often only interested in the clinical data, but there are many episodes, happenings or situations that the nurses' experience when working with the patients that they would want to inform the doctors about. The designers and engineers at the Future

Lab thought about making icons or symbols on the computers that could represent incidents or patient related information. We could, for example, imagine that a “Z” covered by a “\” could represent a sleepless night. The icons could serve as an effective boundary object mediated by IT to express to the doctors some of the experiences of the nurses when they work with the patients (Field notes 2000).

In the continuance of the CyberNINA project the people of the Future Lab will make solutions and suggestions which, at first, will be tested out in the lab. Through role-plays and simulations, the users can give feedback on what they want to make use of or what improvements they want etc.

Chapter 4

4.1 Basis of analysis

To examine the implications telemedicine might have on medical science and practice, I will limit my scope to filter the information from the fieldwork into categories that I find important in medicine.

Constructivist studies of science and technology show how scientific practices need to find boundaries, which can stabilise “facts”, and make the work “manageable” (Latour 1987, Latour & Woolgar 1986, Baszanger 1998, Fujimura 1992). Medicine is a co-operative action. The practices and the methods they use to seek out reliable evidence to rationalise clinical decisions, is interrelated to the way the medical system is organised, to the institutions, to the way medical work is co-ordinated, to the cultures and roles that are formalised, or are under negotiation, in a diversity of fields (Berg 1995, Casper & Berg 1995). Rationalities of medicine are products of how medicine is shaped and constructed, and how work is organised to create clinical settings, which can facilitate an effective practice for the patient and for the diagnosis and treatment of his/her disease.

I will look at how the cases I have studied can imply changes to some factors that are important “building blocks” of medicine. I will explore how telemedicine can influence the medical system by its inscribed visions on how institution, co-ordination, work, roles and identities might be affected.

4.2 Institution

Ole Berg argues that a reductionistic logic together with the influence of technological development and the demands for more specialised knowledge is reflected in the way medical institutions are organised (Berg 1987). What does telemedicine imply for medical institutions? The NCT has, to a large extent, a "revolutionist" view on the telemedicine development. Inspired by the solutions that are used in banking, trading, mobile telephones and Internet industries etc. they expect that the tempo in the ICT development will increase and that the tendencies we have witnessed in trading and banking, will also be seen in the health care service in the years to come (Pedersen & Hasvold P 2000).

In principle health services can be globally accessible via Internet based technology. The institutional implications of networks and technologically mediated and mobile health workers can be many. One can imagine some big impacts. A regional network can expand to become a national or a global one. The use of large information exchange networks can contribute to a development where the delegation of tasks is distributed and controlled in ICT networks and where specialised knowledge is equally accessible to everyone. Radiology departments of the future might not all be like we have traditionally viewed them. Some might not include people or laboratories. It can, for example, be a virtual department, which stores, distributes and prioritises pictures. A virtual radiology department becomes an important institution in a regional network and different ways of organising the use of the network can have different implications for how centralised or decentralised the services will be, in regard to production numbers, specialised competence etc. These factors become important in the creation of the network and can later influence the results of the use of networks.

Strengthening the accessibility to specialised competence in remote areas is a leading goal for Norwegian health authorities. We have also seen the arguments for a network as a solution to make the situation easier for small hospitals that struggle to hold on to valuable resources. Methods that were traditionally very resource demanding are now more accessible for smaller hospitals as many methods have become more digitalised. But there is no certainty that a network would only strengthen the decentralised services. Part of the development within the radiology service at UHT show that expensive and complex technology has lead to creating teams with high competence within certain fields, and thereby created a high degree of centralised competence (Regionalt helseutvalg 1996). In Bardu the former visiting radiologists is now only to be reached by electronic mail, the service might be more efficient, but not all the people were pleased with the change in social interaction between the primary - and the specialised health care service.

In the initial processes of making an IT infrastructure at the radiology ward, one could see how knowledge and control of the development could create *expert systems* where the leading actors could gain power in the organisation by controlling knowledge of the systems. The machines and those who control them become important within the institutions and place themselves in powerful positions in the hierarchy. The number of technical personnel has also increased substantially at UHT since the early 1990's and has become a crucial part of the hospitals administration (Regionalt helseutvalg 1996).

> *"Domination consists in one's own capacity to escape, to disengage, to "be elsewhere", and the right to decide the speed with which all that is done - while simultaneously stripping the people on the dominant side of their ability to arrest or constrain their moves or slow them down"* (Bauman 2000 p. 120)

Zygmunt Bauman (2000) discusses, among other things, the implications of increased use of mobile technologies, and removing the importance of the electrical socket. How global systematic structure is unreachable coupled with the "fluid" state of life-politics and human togetherness. He argues that we are going towards a *liquid modernity.* Liquid modernity or not, the implications of wireless and wearable computers for the medical institutions might change our traditional view on hospitals and medical workers. It implies that hospitals are built around computers and networks, where electronic censors and remembrance agents can distribute, sort, delegate, retain or authorise information to mobile health workers. Removing the importance of the electrical socket can imply removing the importance of offices, of laboratories, of wards and other areas we relate to time and place. Mobile health workers connected to information networks and virtual departments, accessible to everyone, everywhere, at any time, does seem "fluid" or "liquid". Maintaining good co-ordination and overview might be a challenging task in a hi-tech hospital.

4.3 Co-ordination

> *"Plotseling realiserede ik mij hoe complex de situatie was[18]"*

Even though there can be many implications and possibilities with making use of information networks and cyber nurses, there are many factors that stall and slow down the development. A radiology network is thought to be organised by the collegial will and trust among radiologists to run the network. This implies adjustments. A collegial network within a hospital is different from a regional network consisting of many hospitals. Since the counties are responsible for the hospitals and there are three counties in the region, agreements on investments in equipment, on organisation etc. is not just a question for radiologists, but also for three sets of politicians, three budgets and between 10-15 health care institutions with varying IT infrastructure and with different policies, challenges and work load. Not to forget, other influential actors, such as, technology firms, national health policies, patient organisations etc. Bureaucracy can either slow down the development or make it difficult to maintain control and an overview when there are so many actors involved.

The political goals of the health service states that it should be cheap, accessible and of high quality (HSA 1996). Since many hospitals in the region are having a scarcity in specialised competence, radiologists in particular, it can be argued that the telemedicine development is lead by unreachable intentions given by the health authorities. And that the techno-scientific premises are more important in a digitalised service, than the social steering mechanisms (Ekeland 1999). The telemedicine development is not

[18] Wall inscription at cafe Marks & Kampstra in Maastricht.

welcomed by everyone as a good development. Many are sceptical to medicine being increasingly dependent on technology.

> *"As product and producer of modern society, technology stood as both fortune and alienation, for development towards a rich life or as an instrumental nightmare"* (Rasmussen 1995 p. 170 my translation)

EBM implies a practice where information and communication - and the structuring and analysis of these, are the main tools in decision making. With an increased use of technology, tools and new decision techniques, it implies more delegation of work to socio-technical systems, or overturning power to machines, so to speak. As described by Max Weber's terms of the *"iron cage of rationality"* or Herbert Marcuse's *"one dimensional man",* we see that fears of *technocratic* control and alienation is deeply embedded in us and have been central in social theories of science and technology. A complex network of communication and information exchange implies a high degree of trust between the actors and it is a difficult and important task to co-ordinate the administration of a network. (Latour 1992).

The tools are meant to contribute to a better order and overview, but out of the new order, grows new disorders (Berg 1998 a). Unsolved problems of co-ordination and control seem to become *antiprograms*[19] to the developers. Questions around the role of NNH in creating a regional information network were important for the hospitals. There were strong reactions on making use of remembrance agents in the CyberNINA project and there were different opinions on who should control and administrate the

[19] Used by Bruno Latour as the reaction to "programs" of action. See Latour 1992.

teleradiology network. NCT's strategy as a co-ordinator in both the radiology network and in CyberNINA develops to become a socio-technical network where they have a close interaction between developers, evaluators and enthusiastic health workers.

> *"Our best machines are made of sunshine; they are all light and clean because they are nothing but signals, electromagnetic waves, a section of a spectrum, and these machines are eminently portable, mobile – a matter of immense human pain in Detroit and Singapore. People are nowhere near so fluid, being both material and opaque.(...)"* (Haraway 1991 p. 153)

Dealing with people is different from dealing with technological possibilities. The CyberNINA project changes from being a hi-tech cyborg on paper to, at best, become a nurse with a laptop in real life. And some radiologists just don't like to examine pictures on computer screens. In hospitals and in medical work there are cultures, routines, methods and practices that sometimes are difficult to pre-scribe in technology drafts.

4.4 Work

Inscribing telemedical practices is much more than finding the technical solutions and the sufficient funding. The differences in medicine become quite apparent in the two cases. In the radiology department, digital practice has reached a closure at UHT, but teleradiology is not a common practice among other hospitals. Cultural exchange and negotiations has been the status of the network project for the past four years. We can also see how a digitalisation of a white board could create difficulties in respect to the social function it served within the existing culture. In the CyberNINA project the initial problems was to convince "conservative" doctors that wearable computers could be a useful tool. It might not be a coincidence that nurses took onboard and used the concept ideas. They might be more flexible to organisational adjustments. The rationality of the doctors is linked to the minimising of risk, the safety of upholding traditional routines, of scientifically based practices.

> *"(...) science is a system of knowledge by virtue of its being a system of trusting persons"* (Shapin 1994 p. 417)

To rationalise telemedicine, it must be understood as a standardised package, which can be related to existing practices that can bring the social worlds together and at the same time embed a stabilisation of the science and practice. Virtual meeting places and virtual practices require a trust in the technology and in the practices that it creates. Lehoux et al have studied how trust becomes a key factor in telemedical consultations, they state: "The use of teleconsultation depends on prior contacts between a referring physician and a consultant, the ability of the former in piecing together relevant information, and the spectrum of information needed the latter to thrust a clinical advice. The way clinical responsibility is shared also influences the use of the technology" (Lehoux et al submitted a p. 1).

The unfamiliarity of remembrance agents and how doctors viewed them as "digital spies" can illustrate a clash between the technical and the medical world. A patient record is not just pieces of information, which can be distributed to relevant people in a network, it is the doctor's personal paper and it embeds cultures of medical work. Trust and control is important parts of this culture.

Making work manageable in diverse practices of medicine is not just a question of finding the right tools for communication, but also of how to communicate. The nurses at the heart, lung and cardiac department expressed a wish to provide the doctors with information they felt was relevant in their work situation. Icons and symbols of communication seemed more important than AR glasses.

Like the monster in “Frankenstein”, the projects begin to live a life of their own. When they merge with the medical culture, they adapt, shape and get shaped within the culture. Instead of practice Y being changed to practice X, the practice become a hybrid of Y and X (Berg 1998 a). This is also partially the intention of the creators, that the technology should live a life out of the hands of the creators and become an integrated part of the medical practice. And once the seed is sowed it will grow new branches. The pioneering work done at the radiology ward resulted in a spin-of effect to the rest of the hospital as well as to the rest of the region in terms of making use of IT and in digitalising the radiology practice. CyberNINA also implies changes to the infrastructure that can open for new developments and new projects related to telemedicine activity. But only if the technology can be used and interwoven in the practices by creating boundary objects between the new concepts and the rationalities and logics of the existing practice.

The two projects imply changes in medical work and therefore also changes to how the medic relates to the new practices. How he or she can find the right positions and the suiting role and identity when performing virtualities.

4.5 Roles and identities

> *"(...) People are nowhere near so fluid, being both material and opaque. Cyborgs are ether, quintessence."* (Haraway 1991 p. 153)

Donna Haraway's "cyborg manifesto" is a vision of politics of hope. The socio-technical culture and a "cyborg imagery" can suggest a way out of the "maze of dualisms" that have been persistent in Western traditions. By studying the roots of gender in biopolitics, science and culture, she describes a cyborg imagery which can provide new visions to troubling dualisms of domination, such as race, gender and class. Or; white/black, male/female, civilised/primitive, culture/nature, right/wrong etc. Hybrids of social culture and high technology makes our dualistic ways of explaining bodies and tools become quite confusing (Haraway 1991).

Dagny Stuedahl (1999) describes how concepts of identities are changed in "cyberspace". How new and virtual meeting places creates new forms of togetherness and communication. E-mail, Internet, chat etc. represents new channels of communication and socio-technical cultures. Where our conceptions of roles, identities, gender and race can change in a timeless and "bodyless" environment.

Having a collegial conversation in the hallway of a hospital is clearly different from writing e-mail as a consultation practice. Telemedicine, inter- and intranett technology might imply a creation of virtual -, or cyber roles and identities within the medical community. These roles and identities are not clearly inscribed in the projects. I will not go into legal or ethical implications, but defining some of the differences of performing virtualities compared to traditional face-to-face communication might be an important issue to explore.

In the two cases we can see that the radiology practice is digitalised and that the collegial community will expand with a network. The hierarchy, the institution and the ones you relate to, changes with a regional network and thus, how one sees ones role within the system. CyberNINA implies a totally new perception of health workers. Hi-tech health workers are not only mobile and accessible. They are cyborgs, being both human and machine. Interacting with computer networks makes the distinction of human and non-human action become bleary. What is the identity of a CyberNINA? If the users can give oral commands to their computers while they are simultaneously talking to a colleague and a patient, one can ask if the computer is a virtual colleague? Is it a re-representation of the health worker? Is it a virtual extension of the health worker, or is it just a traditional health worker doing work mediated by new communication tools?

Questions of where the technology ends and where the human action begins and vice versa, becomes a difficult distinction also for the developers and health workers. The radiology network is referred to as a “department”, and remembrance agents are “spies”, who shouldn’t be “dealing” with patient files. Networks, cyborgs, electronic censors and other devices serve roles and functions, and they get their identities ascribed by the actors in the heterogeneous network. We can see that new roles and identities are constructed with the projects, they are also pre-scribed in the drafts and illustrations. This might also be some of the reasons for the resistance towards cyborgs, remembrance agents and virtual departments. Who are they? And how do we relate to them?

Chapter 5

Summary & Conclusion

To explore the theories of medical science and practice engendered by the use and development of telemedicine, I first gave a general description of telemedicine (Chapter 1), the activities, the arguments for- and some of the problems with telemedicine regarding clinical aspects. I then gave a review of theories of medical science and practice (Chapter 2) and showed how medical science has developed to make more and more use of tools and techniques which can minimise risk in evidence based practices. I showed how medicine is heterogeneous and vary within diverse fields and how important it is to stabilise differences in medicine. In Chapter 3 I described two limited case studies done at NCT and UHT. The story of a regional teleradiology network and CyberNINA showed how telemedicine projects are being discussed between innovators and users and how the meeting point between technological and medical "worlds" are negotiated to reach agreements on the use of telecommunication for health purposes. In Chapter 4 I discussed some of the implications networks and cyber nurses might have on the medical system. I showed how the projects could imply changes in the institutions and in the way they relate to each other. How issues related to co-ordination and work became important to the development and processes of telemedicine. I also discussed some implications the medic might be faced with when going in "virtro". I will now try to draw my lines of argument together and make some concluding remarks.

- Telemedicine is not just related to infrastructure adjustment, legal issues, on making administration and organisations more efficient, or to economic gain. It is also a process, which is interwoven with a diversity of rationalities and practices of medicine.

- The leading methodology in today's medical practice is based on reducing the risk of making wrong decisions. To make decisions on diagnostics and treatment, a high degree of co-operation and teamwork between general and specialised competence is needed. Calculations, measurements, techniques, standardised routines and assisting technology, which can contribute to safe outcomes based on evidence is used in an, often, uncertain and unpredictable practice.

- To understand how technologies can be incorporated in medical practices and how they can imply new developments, it is important to follow the involved actors and the processes that leads to telemedical activity.

- In telemedicine there is no linear and evolutionary transformation from innovation to use. Projects in telemedicine meet obstacles and challenges, which has to be solved by interaction between relevant social groups.

- The two case studies show that traditional routines, cultures and practices has to be taken into account and be embedded in the new concepts. Making technology manageable and "trustable" within existing routines by finding boundary objects and standardised packages becomes important. But the projects also inscribe visions of new ways of organising and performing medical work. Telemedicine and medical science and practice are *co-constructed* in socio-technical networks consisting of human and non-human actors, who seek closure by negotiation and compromise.

The telemedicine development is partially driven by a technological pull engendered by the possibilities embedded in modern ICT solutions, it is also depending on the engagement of enthusiastic health workers. National health plans and political goals promote an increased use of telemedicine and network based co-operations. Evidence based medicine implies an openness to solutions that can provide and structure information and make communication between professionals possible and reliable. Artefacts, humans, culture, science and practice all make up a complex interrelationship, which together constitute notions on future health work and on new developments in the medical system.

What are the implied theories of medical science and practice engendered by telemedicine? It implies a use of digital and virtual mediums, which can create boundaries between professionals, information and patients. Networks and hi-tech health workers makes all to all communication and co-operation possible and can therefore serve as “saving angels” or hope for solutions, which can reduce diversities and differences in medicine and assist the medic in making the “right” decisions, as it provides increased access to knowledge and expert advice. When the concepts are rationalised and co-constructed to fit the logics of medicine we might find that the future medical science and practice might not be too far from what Tore Jensen experienced. Will we experience the medicus in virtus? We will have to wait and see.

Chapter 6

Post script: Automatic for the people?

THE-MACHINE-THAT-SAYS-"PING"

(A description of a scene from "The Meaning of Life" (1983), a film by Monty Python)

Two doctors enter an empty delivery room in a modern hospital. They look at each other and one of the doctors' (D1) says to the other (D2): **"Something is missing here. But what? Oh, yes. We need technology. Get some apparatus in here!**
D2 orders some nurses to go and bring some machines. In the matter of seconds, different apparatus and technological devices are rolled in and soon fill the previously so empty room. One machine, in particular, attracts the doctors' attention, we are informed that this machine is the favourite of the hospital's administration. We don't really get to know what function it has and the doctors themselves don't seem to be quite sure, but we can clearly hear the sound that it makes. It says, "ping". The doctors also only refer to it as "the-machine-that-says-ping". They are extremely proud to have this invention and they constantly point out how fantastic it is.
D1: "It is the most expensive machine in the hospital."
D2: "Yes, it costs three-quarters of a million pounds."
D1: There is still something missing here though.
D2: What?
D1: Hmmm, PATIENT! Where is the patient?

Monty Python's scene with the-machine-that-says-"ping" is clearly making a mockery out of the modern hi-tech health service. This, however, is not my intention by including it. On the contrary, in my experiences with health workers, my impression has always been that they have a sincere care and interest for the welfare of the patient. Technology is never the first priority and is only interesting if it can help the scared and suffering people whom the doctors and nurses care so much for.

The reader might think that I am making some critical remark to the nature of the projects in telemedicine, or even wonder if there might be some reflexive irony to the fact that the patient has been somewhat absent in this thesis. I will find pleasure in leaving some things open for interpretation. But would I forget about society in an ESST thesis? Certainly not.

It is easy to get blinded by all the possibilities that lie in modern technologies. Utopias are attractive and scary at the same time. The clinical aspects of the development is of course also linked to the every day cases of disease and the health workers meetings and interaction with patients. Therefore one of the most influential actors in the processes is those who the medical community is to serve. The patients, including you and me. Our reactions to the development are important. What kind of health services do we want?

> *End line from Monty Python's scene: The-machine-that-says-"ping".*
>
> *D2 says to the patient:* **"You can find out all about the birth when you come home. It is available on Betamax, VHS and Super 8.**

Do you want clothes with in-built emergency control systems? Do you want surgeons who can work "inside" bodies? Do you want VR glasses, cyber nurses, teleradiology networks, hospitals built around electronic censors, a personal card with a chip containing your medical record? Or did I hear you say: "Just some penicillin to cure my sore throat, please"?

Medicine is faced with, what is often called, "the paradox of health" (Barsky 1988). The population is getting healthier, but the demands for health services are increasing. With more and more specialised services, knowledge and with better accessibility to expert opinions, the use of health services increase, health centres expand, gets more complex and the challenges grow.

Society wants the health care service to be safe, cheap, accessible, efficient and reliable. Like Winnie the poo, we desire both milk and honey. To find a practice, which can combine the demands for efficiency and a reduction of waiting lists, with maintaining high standards of care and spending time to listen to the patient, is a difficult task. Medicine has to make choices between conflicting interests, one could say it is a battle between the ideals and values of Hippocrates versus those of Adam Smith[20].

The challenges represented by demands from society makes medicine widen its field of interests to areas where it becomes difficult to uphold practices based on traditional sciences. The extremely deterministic French astronomist Pierre Simon de Laplace (1749-1827) once imagined a machine, or a calculator, which could be fed with all the data and variables of the world. With such a super-intelligence, he said; "Nothing would be uncertain, the future and the past would lie open for its eyes" (Laplace; In Stigen 1992).

Neither medicine nor we has Laplace's machine. But maybe we can find some comfort in telemedicine. Can it provide answers to the challenges of medicine? I have discussed some of the aspects of telemedicine related to medical science and practice, still there are many stones that I have left unturned. Many aspects can be explored and telemedicine provides many interesting cases and problems to be studied.

Inspired by Fritjof Nansen, I imagine Hippocrates coming back to us. Modern medicines complexity and technology would probably amaze him. But would he

[20] Inspired by Olaug S. Lian's Ph.D. dissertation title; *Mellom Hippokrates og Adam Smith. Om utilitarisme, helsereformer og den medisinske kultur;* University of Tromsø; 1999

question how the hi-tech service can provide quality care for humans? Would he see how diversity has replaced the holistic view on the body? Would he witness all the challenges that are still unsolved and then say: “So we were not Gods after all”?

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