# Case study: Örebro University Hospital: The O-building, Sweden

**September 2005**

CIB Taskgroup 51

# USABILITY OF WORKPLACES

## Case study: Örebro University Hospital: The O-building

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# 1 SUMMARY

This is the second workshop of the CIB51 – Usability of Workplaces series. The object is a surgery and radiology building in the University Hospital of Örebro in Sweden. The building was finished in 1997 and is used generally the same way as it was planed. The case-report is based on interviews with management and staff in the medical departments, both those who participated in the design process and those who did not. Interviews are also made with representatives of the Real Estate Department that was in charge of the design process and is now owners and caretakers of the building.

The architectural and usability ambitions with the building were high. The technological level is very high both when it comes to medical processes and from service engineering point of view. The building has got separate installation floors and some rooms are constructed as Faraday's cages not to disturb sensitive medical technology.

The culture of involving staff in design of their workplaces is very old in the County and dates back to early seventies. Also in this project the process of participation has been very ambitious. Despite a number of controversial issues during the design phase the acceptance and satisfaction of the building is today high.

The end of this case report is a discussion on the concept of *Functionality* and *Usability*. To make these concepts operational the experiences from the case is used. By doing this it becomes obvious how aspects of usability can be affected by the organisation of design and the design process itself.

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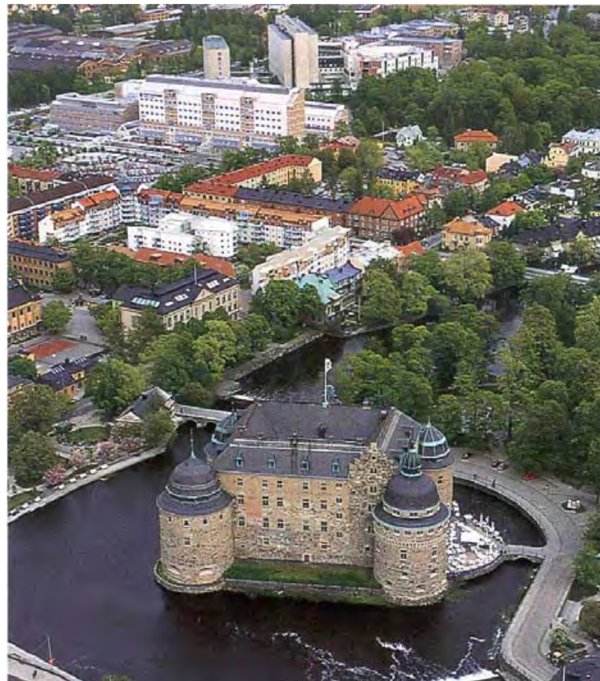

Figure 1. The Castle of Örebro with the University Hospital in the back



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# 2 ORGANISATION OF SWEDISH PUBLIC HEALTH CARE

Sweden is mainly governed by three administrative levels: The state, County Councils and Municipal Councils. Örebro is the administrative centre of the County of Örebro. The County has 274 000 inhabitants and Örebro is its largest municipality with its 125 000 inhabitants. 85% of the County Council's activities are health and medical care. The County covers an area of 9 700 km$^2$ which means it is quite thin populated outside the center of the 12 municipalities, of which some are quite small. Every municipality has at least one medical care centre, in all 29.

The largest hospital is Örebro University Hospital (USÖ). USÖ has 3 700 employees and 1100 patients a normal day.

## 2.1 Purpose

The purpose is to deliver health care and medical services to first of all inhabitants in the county, but also to deliver certain specialized medical care to patients from other parts of Sweden.

## 2.2 Structure of USÖ

USÖ is divided in eight organisational units:

Cardiac care
Head, skin and oncology
Surgery
Medicine
Rehabilitation
Laboratory medicine
Radiology
Research, development and education

## 2.3 The competitiveness of USÖ

USÖ is a development-oriented medical centre with patients from many parts of central Sweden. A number of specialist areas have attracted international attention and research is conducted in many fields. There are also extensive basic medical facilities, primarily for the inhabitants of the county. Health care is free for all inhabitants in Sweden except for a minor fee. For patients from other counties their home county will be charged.

USÖ is one of nine University hospitals in Sweden. It is among the leading hospitals in the area of occupational- and environmental medicine, ophthalmic diseases, urology, and cancer treatment. It is one of the leading hospitals in radiology and was the first in the world to link all radiology departments through a shared county network. The European Development Centre for Radiology is located at USÖ.

## 2.4 External drivers in Swedish health care

Health care is basically free in Sweden. People have the right to get adequate care in their home county. For specialist care they may go to private specialists that are licensed to deliver care. For such medical services the patient is charged a slightly higher fee and the county pays the rest. Under certain circumstances special medical care can be given outside ones own county and also in other countries. If approved by the county, this is also basically free. Patients from other counties are a source of income to the county. When a patient is medically ready different kinds of follow-up-care take place. This is administered and delivered by the municipal councils. This flow of responsibility between private and public, different counties and county and municipal council's responsibilities are important drivers in the organisation of Swedish health care.



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# 3 ÖREBRO UNIVERSITY HOSPITAL

## 3.1 History

Health care in Örebro dates back to the fifteens century when it was housed in the local monastery. This ended with The Reformation and was exchanged in 1527 when King Gustav Vasa donated a couple of homesteads for a hospital for the disabled and homeless. Not until 1708 a doctor was employed to take care not only for the County of Örebro but also the nearby County of Västmanland. The first real hospital was established in 1778. It was a county hospital with 24 beds, 16 for patients with "weak heads" and 8 for sick people.

The present Hospital was established in 1892 and has grown at the present location since then. In 2001 the hospital became University Hospital – USÖ.

## 3.2 The situation today

USÖ is located fairly central in Örebro (fig. 1) and has good communication by public busses. The usable area of the hospital buildings are over 200 000 m$^2$. The hospital is built over a long time and its olds parts goes back to the original 1892 building. The major development of the hospital was done in 1960:s but an ongoing renovation and investment in new buildings has made USÖ one of the best maintained old hospitals in Sweden today.

The site is located along a small river that makes the environment very pleasant. Especially in the newer buildings the ambition to make pleasant and high quality architecture has been high. Also the outdoor areas are well designed and form small parks and gardens, often connected to the river and the river walk.

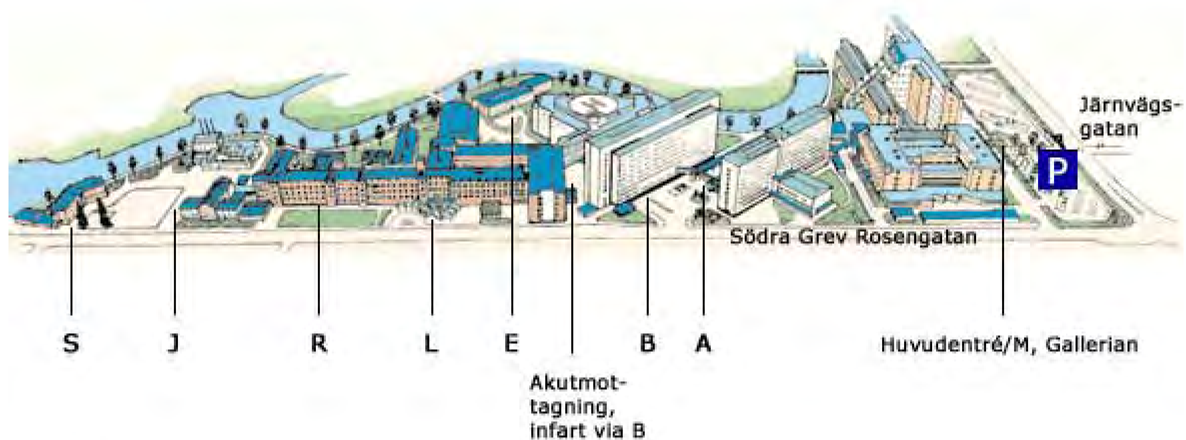


Figure 2. Aerial view of the hospital

## 3.3 Organisation of real estate and services

In 2001 a new facilities and service company was created – Landstingsservice. The new concept was to include all support to the core business in one organisation. The new company was formed by the following units:

Real estate
Environment
Purchasing
Archiving
Support



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The former Real estate company was now included in the service unit to deliver services in the following areas:

Administrating building projects and act as client
Deliver real estate services
Deliver technical services to the buildings
Administer internal and external leasing of space
Maintain all outdoor spaces

### 3.4 Property strategy

Like most public health care organisations in Europe, Swedish counties are facing difficulties financing the core business. In many counties this have resulted in low investments in real estate both in terms of new buildings and maintaining old ones. Today when the economic situation is worse than ever many counties have an enormous need for investments in a run down building stock at the same time as the deficit in core business is boosting. In Örebro County the investments have historically been high in real estate. The situation at USÖ is therefore today very positive. The building stock is in a very good condition and the need for investments is not acute.

Figure 3. The main entrance of the hospital

### 3.5 Relations in a building project

The real estate unit has a long experience as a client and organiser of building projects. Ever since the late sixties the county has established a relationship to consultants and contractors in the region to get as high quality as possible.

### 3.6 The client and core business relations

Traditionally, health care is organised in a hierarchical way. Building projects however often fall outside the ordinary relations in an organisation. The real estate unit has since early sixties had a very ambitious co-operation between core business and the building project in planning and designing new buildings. From the following case description of the O-building project we find that this participation from core business employee was very detailed and started early enough to affect strategic issues of the building project.

To understand the context for this a short history of the Swedish legislation on Co-determination is needed.

### 3.7 Co-determination in work environment related decisions in Sweden

Research and investigations in occupational health issues in the sixties showed large problems in work environment in Swedish industry. This was an important issue for negotiation between employees and employers organisation and resulted in mid seventies in Co-determination Agreements in different sectors of Swedish industry and in public sector. This was made legislation, *The Co-determination Act* in 1976. This act stated that in all matters that could affect working



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conditions, there should be co-operation between employees and management. One of the areas there this came into practice was the design of new workspaces.



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# 4 CASE STUDY, THE ÖREBRO UNIVERSITY HOSPITAL: The O-building

## 4.1 The master plan

The master plan for the hospital from 1983 laid out the detailed plan for the development of the hospital. The O-building was the final stage of that plan. A new master plan for the hospital was presented in 1990 also including the O-building.

## 4.2 The purpose of the building

The building was supposed to house two main activities, surgery and radiology. There were several surgical units that were possible tenants of the building. The decision, however, was to house general surgery, urological surgery, orthopaedic surgery, hand surgery and gynaecological surgery in the building. Very late in the process in 1995 thoracic surgery was added. The unit for anaesthesia and ICU (Intensive Care Unit) were also to be located in the building as support units to surgery. The surgical units should have their own operating theatres and separate support and administrative spaces.

The radiology department is divided in sections and in the building there are sections specialized on thoracic radiology, neuro-radiology, gastrointestinal radiology, skeletal radiology, nuclear medicine and emergency radiology. The building is used for three categories of patients. Both in surgery and radiology; these are emergency patients, planned in-patients and planned out patients/radiology.

Figure 4. Exterior and aerial view of the O-building

## 4.3 Project start and timeline

The ambition of the project was to create “Care for future generations”. This high ambition resulted in quite a high cost estimation of just over 50 million Euros. The project started in 1992 when a revised master plan for the hospital included the O-building in a concrete way on the plans.

In 1993 the report “Friska Sjukhus” [Healthy Hospitals] - a quality program for the new building was published. This report was used as a starting point for design of the new O-building.

In April 1993 the functional brief was presented and discussed with the County Administrative Board and thus presented to the politicians in the County Council. This was an important step as all relevant decision-makers and politicians were present.

The ambition from the head of the hospital was to get a building with high image value. As a symbol for this there were even suggestions to make the building round. The first complete design proposal of the building was presented in 1993. This design was fairly traditional, but more detailed investigations of the site and the interface with connecting buildings ended up in a building with a



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triangular form.

In 1993 a smaller building occupying the site of the O-building was torn down. That same year a new foundation was made for the O-building. This was done in order to connect installations and underground corridors crossing the O-building site.

In 1994 the construction of the O-building started.

In 1995 –1996 there were cut backs in the hospital budget. This had the effect that urological surgery, hand surgery and gynaecological surgery got 2 instead of 3 operation theatres and that thoracic surgery was included in the O-building.

In 1997 the O-building was finished. It had a grand opening with local and regional politicians, leading practitioners and notables from the region. The building was also open to the public.

Fotograf: Nina Broberg

Figure 5. Garden outside the personnel breakout area

## 4.4 Organization of the design process

### 4.4.1 A culture of participatory design

The project process was rooted in tradition in the County of Örebro to carry out projects in close co-operation with the users as well as aiming for a high quality building. Traditionally building design projects in the County of Örebro are set up in a close co-operation between core business representatives and the real estate department. The health care units involved organise themselves in design teams to develop useful solutions for their professional activities. The real estate department set up a project organisation to support the building project. Representatives for both these groups meet in a co-operation group to take decisions to deliver to the project steering group. The consulting architects work closely together with the teams in both core business and the real estate department.

The process to develop and design the O-building involved a large number of people. Three main groups covering both user and representatives of the construction project carried out the process, thus we distinguish between the user project, the building project and the co-operation group.

One separate user project was set up for each unit and each user project was populated by a number of actors from the respective units. However, the thoracic unit that was added to the project in 1995 did not have a user group. Due to Swedish legislation and praxis the different unions were



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represented. One person responsible for continuity and strategic issues participated, mostly the nurse who was the head of the unit. The chairman of the department (clinic) participated as well as a representative for the assistant nurses and department of medical engineering. No other representatives for services like janitors or cleaners were represented. The project group was well rooted in and chosen out of trust by the rest of the unit. They reported back at unit meetings.

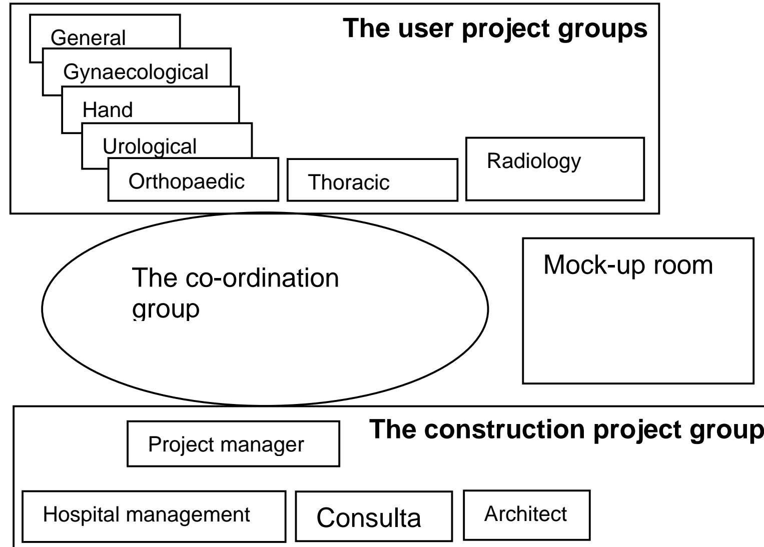


Figure 6. An organisational scheme of the design process.

A construction project manager from the real estate department led the building project. This group also consisted of the architect, technical consultants and representatives from the hospital management.

A co-ordination group was set up as a bridge between the user project and the building project. The head of the unit, the chairman of the department and representatives from medical engineering participated from the user project and architect, construction project manager and sometimes the hospital management participated from the building project. The co-ordination group took decisions regarding the development of the project. In addition to the work in the co-ordination group the architect also worked directly with the different units.

The work done in the user project groups were presented regularly at meetings on unit level. There were large papers on the walls were people could comment on drawings and other material that was displayed. The comments were later given to the architect.

### 4.4.2 Co-operation in design

#### 4.4.2.1 Surgery

The different units in the user project carried through separate design activities to investigate alternative solutions and articulate the needs of the units. An important arena that all units could use was a room where a complete mock-up of an operating theatre could be build. This was the arena where nurses, doctors and medical technicians could meet with architects and other representatives of the building project and investigate different solutions. The mock-ups were used for simulation there the degree of truthfulness to reality was extremely high and detailed.

Most of the dialogue in the design process took place directly between individuals or group from the user project and the building project and they often arrived at concrete conclusions and suggestions. Decisions, confirmation and policies were then forwarded to the co-ordinating group that had the formal power to take that role.



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#### 4.4.2.2 Radiology

The process of the radiology units was somewhat different. The chairman of the department and the head of medical engineering were dedicated at an early stage to the idea of using new digital technology in radiology. The chairman of department contacted every radiology department in the county to investigate wherever they were willing to convert to digital radiology. This would mean that the County would be the first to connect all hospital in a larger region over a network that could transfer digital x-ray pictures. All five radiology departments came to the conclusion that this would mean a great advantage to them and agreed to participate. They presented this idea to the heads of the hospital and the county politicians and got their support as long as they kept the time and money limits. The original brief for the units however suggested a mixture of traditional technology and digital technology and a step-by-step conversion to the new technology. The manufacturer of digital x-ray equipment – Philips - however took an interest in the developments and was willing to use Örebro as a testing ground for their development work. This situation and the character of the equipment made it not feasible to use the same method of a common testing arena as was done for surgery. In this case the development of technology was done through innovative work in all steps of the chain from Phillips laboratories to the actual radiology unit in Örebro with iterations of information and knowledge between radiology nurses, doctors and technicians on one side and engineers and researchers at Phillips in the other end. The result was that University Hospital in Örebro became the first hospital in Sweden that totally depended on and fully utilised filmless digital radiology technology.

Figure 7. Patterns from X-ray pictures are used for decoration in radiology department, see top of picture.

### 4.4.3 Important issues in the design process

#### 4.4.3.1 Organization

In surgery the main issue was the change from an organization where surgery was a general resource for the whole hospital and located in a central unit. In the new organisation the surgery was divided into units and organizationally belonging to different departments (clinics). This change was however decided beforehand and was a prerequisite for the new building.

In radiology the big question was the transition of technology. Many operators and nurses feared the new technology and the risk that their professional knowledge should be obsolete. As the more serious development in this direction took place after the briefing process for the building had started it was also a problem for the building project. A step-by-step move of units and a serious educational program was established to meet these problems.

#### 4.4.3.2 Daylight and other comfort issues

An absolute demand from the users was operating theatres with windows and daylight. Some questions were raised from the building project however this could be a problem for certain processes like keyhole surgery or if they not would pull the curtains down most of the time anyway. The



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experiences from the old operating theatres, located in the dark core of a double corridor building from the seventies, was however so definite that no discussion were necessary. The users were also inspired from research in environmental psychology that stressed the importance of pleasing environment both for the sake of the personnel and the patients. Aspects like colour and music in the operating theatre were discussed.

A question related to this was access to outdoor terraces. This was however a trickier question as it was easy to advocate for the hygienic risks of going outdoor when working in a surgical unit. No real excuses came up that could justify outdoor terraces, but still there are such terraces in the completed building to the pleasure of the staff. However, everyone realized that it was a calculated risk and it is now used with a very strong awareness that the hygienic regulations must be followed rigorously. No problems have so far (autumn 2003) occurred that can be related to this.

Figure 8. One of the break-out areas with a terrace

#### 4.4.3.3 Ventilation

An important issue in the operating theatres was however they had such high demands of cleanliness that they needed ventilation with a laminar air flow through the ceiling or could be satisfied with more traditional displacing ventilation. A decision was made that 4 units needed such high degree of cleanliness that the investment was justified. The thoracic surgery however, that came in late in the process, also advocated this need but according to the standard used they did not need such high quality ventilation. At that late time technology and economy also made it impossible to meet these demand.

### 4.4.4 Comments on the process

From the interviews today we find that the memories from the design process are very positive. Most of those who participated or worked in the units that moved into the building remember it as a positive experience. They are also very appreciative of the project leader of the building project who were very open and tried to meet all wishes with respect. Interesting enough persons in leading position does not remember the process being as smooth as the interviewees remember it.

The head of the real estate company at the time does remember with some uneasiness the turmoil that accidents in thoracic surgery caused at the time. The decision to install the less advanced ventilation in the operating theatres caused serious accusations against the real estate company having caused these accidents by an inadequate design. The head of radiology also remember the tough discussions he had with different professional groups who feared the introduction of digital radiology. We will describe this in more detail later.



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# 5 THE BUILDING
## 5.1 General

The result is a triangular shaped building located centrally within the Örebro University Hospital area, se figure 1. It is a seven storey building with a helipad on top. Two of the floors are service floors with nothing but installations.

The triangular shape was derived from the size of the land and because the new O-building needed to connect to the adjacent existing buildings. This applied not only to axis but also to floor levels.

It has a cast-in-situ concrete structure and was built stepwise with the floors first, then the walls. Then, when the building structure was complete all installations were brought in. The pillars have an H-shaped form to allow minor installations within it's' form.

The cast-in-situ concrete structure is a requirement of the SSIK, a governmental agency that monitors hospitals and other public buildings with respect to war and terrorism.

All vertical installations run through shafts and all installations on the floor run along the corridors. No installations run through the operation theatres and they are all fed from the corridors. This was important in order to achieve a high degree of flexibility for future changes.

The building has two full ceiling height installation floors were all main ventilation systems are installed. There are five separate ventilation systems taking care of the different requirements from the activities in the building. There are for example laminar flow systems in 4 of the operation theatres, specifically those used for orthopaedic surgery and general surgery. A central hot air system is also installed for local warming of patients post-op as this enhances their recovery.

The building has a high level of electrical security. The building uses a metal framework that has the function of "Faradays cage" and uses the "Isolated Terra" system. The latter separates the ground in the building from the ground in the power supply system. These two measures protects against magnetic- and electrical disturbances. The building also has two separate power supplies; diesel power generators and a UPS battery back up system.

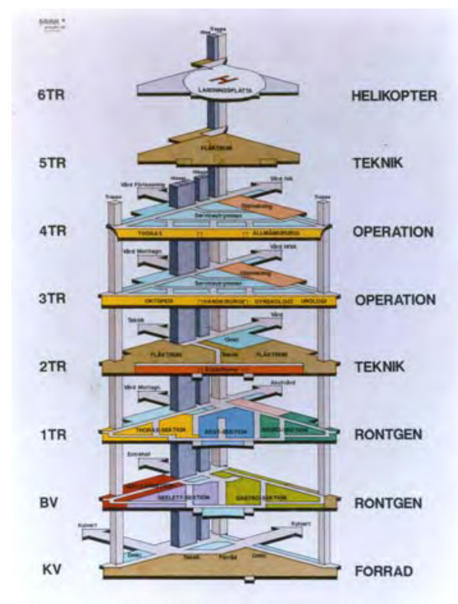
## 5.2 Organisation of the building

In the basement there are underground corridors connecting to the underground communication systems of the whole hospital. Along these corridors there are separate corridors for main feed/installations of gas, water, hot water etc.

On the ground floor are general hospital communication areas. Corridors connect to other buildings; in order to reach some one has to use covered outdoor walkways.

The emergency entrance of the hospital is also placed in a building directly adjacent to the O-building. From the emergency entrance there is also a direct connection to the intensive care unit.

The major part of the ground floor is used for the radiology department. On the ground floor the radiology department has examination rooms, meeting rooms and offices. The ground floor also has a popular outdoor rest area used by the radiology department.



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The second and fifth floors are service floors.

The third floor houses day-surgery and preparation rooms for this. The day-surgery units carry out surgery where the patient can return home in the evening. This floor also has 4 operation theatres for thoracic and 4 for general surgery. There is also a pre-operation ward currently (autumn 2003) not in use.

The fourth floor has a pre-operation ward and 10 operation theatres. These are orthopaedic surgery 4, urological surgery 2, hand surgery 2 and gynaecological surgery 2.

The top floor is used for the helipad. This is connected with elevators directly to the emergency entrance of the hospital.

Figure 9. The helipad

## 5.3 Using the building

The daily activities in the building are affected by the type of surgery/radiology that shall be done and whether it is an emergency, planned in-patients or planned day surgery. A typical process for surgery starts when the patient arrives at the O-building. If the chosen surgery is day-surgery the patient arrives at day-surgery reception. The patient is then taken to a preparatory unit. After tests and preparations the anesthetic unit brings the patient to the operation theatre and prepares for the operation. Depending on type of surgery the level of anesthetics are different. After the surgery the patient is the taken back to the anesthetic unit. When the treatment is completed the patient leaves the hospital.

When the patient comes from another department and it is planned, the patient arrives by the aid of the anesthetic department to the relevant surgical unit. At the operational theatre the patient is anaesthetized. Once the surgery is completed the patient is awakened in the pre surgery room.

Anesthetics use a pre surgery room at the O-building. This improves the quality of the preparatory process as there is more than one nurse available to check on the patients during this phase. This solution was tested during the design process.

A typical process for radiology is firstly affected by whether the patient comes as out-patient or as an in-patient. The out-patient is coming by herself and arrives at a reception. The patient is then given a space were he/she can change clothes and make preparations for the examination. The patients have their own spaces were they can control light etc. This is important as they can become more relaxed and adjust the conditions individually. At the radiology department they also have incandescent light as opposed to fluorescent tube light, which gives a warm and comfortable atmosphere. This is important as most radiology examinations imply that clothes are taken of in a more or less public environment. The light character and the small scale with individual spaces for



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change enhance the quality for the patient.

When the patient comes from another department within the hospital they are brought directly to the relevant examination room.

Figure 10. Decorations and colours are always present

## 5.4 Suppliers

During the planning there was an ambition to keep the number of storage spaces in the O-building to a minimum. Interviewing the nurses today they remember having a feeling that the architect did not really believe them when they estimated the need for storage. The result was too little storage room for medicines, medical equipments and clean linen. As a consequence new ideas were developed by the hospital staff. This has resulted in a supply situation where a number of suppliers deliver material on demand. This is done based on a preset material kit that must be available. Another solution that is used is that the supply chain is totally outsourced to the supplier who owns and is responsible for the storage in the medical unit. The supplier of general hospital material such as syringes etc. has a central storage room where goods are bar coded. The users in turn use their respective bar code when fetching material and via this system the supplier and user can keep track of use and costs. The supplier of bed linen, working clothes and other textiles deliver kits of new material every day. The departments are charged for actual use. Pharmaceutical products are delivered as pre specified products and volumes twice a week.

The above supply systems relieve the hospital staff from a number of support tasks for and are experienced as very positive.

## 5.5 Experience of use

A number of interviewees did not work in the hospital at the time of design. The difference in appreciation of the building between those who participated at the time and those who did not is not obvious from our interviews.

Most negative comments concern orientation inside the building. The triangular shape of the building is not intuitively understood.

In the interviews the building is however mainly commented in a positive way. It is described as a nice building with nice colours. Especially the different colour schemes used to indicate departments are experienced as both as looking nice as well as supporting orientation. Several interviewees also comment that the nice colours are positive for the patients.

Those that have been working in other hospitals experience the O- building as very nice. A comment was that "when I was working in another hospital I understood how great a workplace we got".



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Another comment concerns the milieu, "it is not only grey, white and with cold light".

The main concern at the surgery department is that the day-surgery work-load has increased. This results in a lot more patient transports than expected. This is due to the fact that the pre-surgery unit is on floor 4 and surgery is being done both on the fourth and fifth floor. This in combination with a shortage of staff and the construction of the O-building with surgical units on two floors is considered a significant problem in the O-building. The handling of sterile goods is a function that is carried out differently in the different surgical units. This resulted in a separate lift for this function and that sterile goods needs to be transported to another building in order to get fully sterilized.  This is due to the surgical units different views on how they wanted sterile goods to managed. It is an overall logistical difficulty although not a major problem.

In the radiology department positive comments concern the overall work environment that is considered well design, looking nice and being comfortable. However, ergonomical issues could be further dealt with as there are still problems with backs and shoulder. This might be due to the fact that although major adjustments for the radiology examination are done automatically the final adjustments have to be done by hand. A new stress factor not present before is stress related to malfunction of the computer based systems; this is experienced as frustrating when it happens.

A criticism concerning the building is that is not used at its full potential. It is only used to 1/3 of its capacity. This is however a hospital management and political issue that is related to medical care politics rather than the usability of the O-building.

In sum, the building is considered nice and well-functioning both for staff and patients. The difficulties encountered concerning ergonomics are similar to other parts of working life but compared to other hospitals it is lower. The building has unused capacity and has proven flexible enough during the first 6 years of its use. The issue of usability and views on use that are important for the long-term development of it is presented and discussed in chapter 6.

Figure 11. Pictures from radiology



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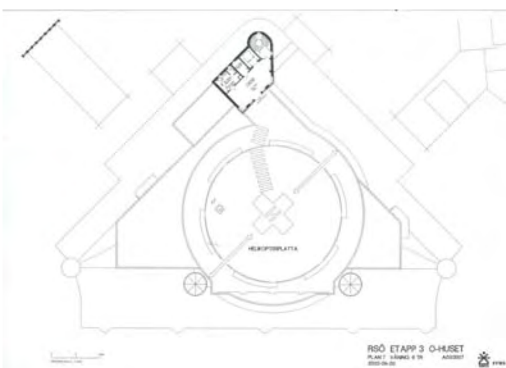
Figure 12-13. Ground floor and first floor

Figure 14-15. Service floor and fourth floor

Figure 16, 17 and 18. Fifth floor and service floor. Below: Roof with helipad.



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# 6 A THEORETICAL FRAMEWORK FOR THE CONCEPTS OF FUNCTIONALITY AND USABILITY

We can define ***functionality*** as a property given to an artifact in order to create a ***practical effect***. An important effect can be described as ***usability***. Product designers suggest two categories of functionality; ***technical functionality*** and ***interactive functionality***. Technical functionality is defined as those properties given to the artifact that makes it function in itself - ***operational functionality***, but also those properties given that makes the artifact function as a part of a larger whole - ***structural functionality.*** Interactive functionality is described as ***ergonomic functionality*** and ***communicative functionality*** and is about those properties of the artifact that interact with users of the artifact. Ergonomic functionality refers to all properties of the artifact that affect the more tangible relations between man and the artifact. Communicative functionality on the other hand deals with the more subtle effects that the form and aesthetics of the artifact have in terms of supporting meaning, values, identification or sensory aspects.

In ISO standards three factors are described that determine usability. ***Efficiency*** means that the artifact allows the users to perform with ease and with little use of resources. ***Effectiveness*** describes the ability of the artifact to deliver a certain desired effect. The third factor is ***satisfaction*** that describes the users feeling and attitudes to the artifact and its effects.

We all know that functionality alone does not make a certain artifact usable. The technical and physical properties of the artifact and its theoretical potential to deliver a certain effect do not automatically make it usable in the real world. As a result of the definition of usability it also depends on the ***context*** the artifact is designed and used in and the ***values*** of the designers and users. Both context and values change with ***time*** and ***place***.

The above discourse on the definitions of functionality and usability must be made operational in the real world. This is done through the planned set of case studies that we perform in the project. An important step is therefore to reflect on every case to determine whatever the definitions of functionality and usability are usable and helpful in real life situations to guide briefing for buildings and help in post occupancy evaluation of build space. Another aim is to use the cases to further enrich and elaborate the definition of the concepts for a better theoretical understanding.

## 6.1 How was usability created in the O-building – an operational reflection on the concept of usability

### 6.1.1 Functionality

Örebro County Council has a long experience as a builder of hospital units. They also have a long relation to consultants in health care design which has given them a solid know-how and experience in how to equip and dimension buildings for their purposes. The tradition in the organization is not to make detailed and voluminous lists of all equipment and building properties in the brief.

The functional brief was more or less developed through work with the mock-ups and through the hands on co-operation with Phillips. Tacit and explicit knowledge embedded in the minds of the users was an important source of information and knowledge. Visits to other hospital were also together with experiences within the building project from other object useful.

The strategies were a little different in radiology and surgery. In surgery ***technical functionality*** was secured through working with mock-ups. By doing that it was possible to both investigate the properties of every single piece of equipment to make sure they functioned well itself but also worked in the context of the operating theatre. In the radiology departments the functionality was secured through the co-operation between Phillips and the radiology department. The equipments used on the patients in radiology do not differ much from analogue radiology. The big difference is that film is not used in digital radiology which makes a difference in development, handling and storing of the pictures. It also makes a big difference to doctors in terms of diagnostic praxis and effectiveness in operating situations. As the experience of the actual technique was little and some technology did not even exist in reality one defined functions rather than equipments in the briefing and procurement



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process.

In surgery ***ergonomic functionality*** was secured through extensive use of the mock-up. A number of issues were discovered. As the equipments used on the patients in radiology were rather like traditional equipment existing know-how could be used. New functions in handling and maintenance of the equipments were dealt with in co-operation with Philips.

***Communicative Functionality*** was important in both the operating theatres and radiology. Partly it was a matter for communicating certain values to the patients, partly of symbolic meaning to the staff. Windows in operating theatres, colours and decoration had this double meaning. In interviews we can clearly see how relative these aspects are. It is not before people have been to other hospitals or heared the comments from patients on the environment they realize what a pleasant work-place they have. Having this pointed out to them they feel a certain pride of their work environment.

### 6.1.2 Efficiency

The process of working with prototyping in the mock-up room safeguarded against solutions that would not work when it came to reality. A semi-conducting floor that fulfilled the functional specifications had a pattern that made sutures, needles and other small items visually disappear if dropped, which could have caused serious hazards. The new organization in surgery is well supported by the building. It is today, due to proximity, easier to be flexible and borrow staff from other surgical clinics if needed.

In radiology the decision to change to digital radiology coincided with an independent demand from the hospital management to save money by cutting down staff throughout the hospital. The new technology made it possible to analyse the work organization and the competence needed in the department. This ended in a new competence structure were more responsibility was given to qualified radiographers and the competence of the radiologists was used in a more efficient way. The new technology made the group of assistant nurses obsolete and allowed less staffing during examination.

### 6.1.3 Effectiveness

A good example of how effectiveness was allowed to rule over what we maybe could argue would have been more efficient is the total transition to digital radiology. It might have been easier to take it slowly and transform the technology in a pace that would have been more in line with the personnel's skills and knowledge. It might also have been less risky not to stand in the front line of a new technology. However with a procedure of planned transition combined with education of personnel the hospital became a very effective unit when it came to radiology. Due to the late introduction of the new technology in the project there were quite large spaces left empty that originally were meant to be archives.

### 6.1.4 Satisfaction

It is hard to find anybody that has anything negative to say about the building today. The real estate and service department call the building "the jewel in the crown" and staff in surgery and radiology say their work place is both pleasant and working well. Long distances and a difficulty to orientate due to the triangular floor shape are however mentioned. It is even hard to get people who were involved in the design process to remember the doubts and objections that they once had. We have to interview those who were targets of this dissatisfaction to get a good picture.

One of the major conditions to achieve satisfaction with the new building was to involve users in a very early stage of the process. This was not a novelty in this project. It is a part of the culture in Örebro County Council. Already in the late sixties the first attempts to involve users in the design processes took place and the use of mock-ups as a tool in the design process goes back to the early seventies.



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The surgical departments could have a major impact on the design through this process. The absolute demand on daylight in the operating theatres was a soft issue that could have been questioned. So was the access to balconies. Both demands were met by the project and in the case of the balconies there were no other reasons to meet this demand than to make people happy. The project group merely closed their eyes to the risks it could mean and put a lot of efforts into preventing anything to happen in the use of the balconies by strongly alerting the awareness of hygienic rules.

There were however some serious discussions during the design process and after in both surgery and radiology departments.

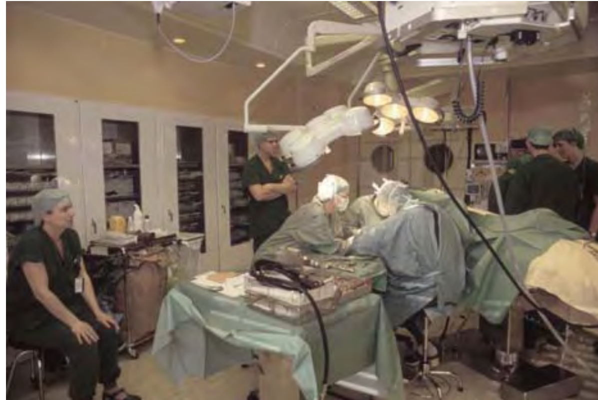

Figure 19. A surgical unit

#### 6.1.4.1 Surgery

The thoracic surgery unit was not happy with the decision to give them “ordinary” displacing ventilation as they argued they needed laminar airflow ceilings. Short after moving in there was an increase in infections in the unit and one patient died. This was argued to be caused by insufficient cleanness. The immediate conclusion from the users was that this was caused by, what they regarded to be, an inadequate ventilation system. This attracted quite a lot of attention, not only in the hospital but also in media. Accusations were delivered in different directions and the hospital management and politicians had to investigate the cause of these unfortunate accidents. It was a specially hard time for the real estate and service department that was responsible for the design and functionality of the ventilation system and that also had a part in the suggestion to deny the unit to get what they regarded an absolute minimum standard of ventilation. However, the real estate and service department did not question the relevance of the complaints, but initiated a thorough investigation of the ventilation system and a parallel investigation was done of the procedures of the health care chain in the unit.

There was no evidence at all that anything was wrong with the ventilation system. The investigation of the health care chain, however, proved that the hygienic alertness standard had been less than satisfactory in the unit since they moved into the new building. It was also interesting to note that the unit had for many years operated in premises with displacing ventilation without being aware of it and with no incidents at all.

##### *6.1.4.1.1 Reflections on dissatisfaction in the thoracic surgery*

The unit had joined the design process late and did not have the same possibility to have influence on the solutions and therefore had not the same feeling of ownership of the process as the other units. They had one strong demand that was rejected by the project. One suspicion could be that the attitude to moving into the new premises was not positive which probably caused the staff to immediately blame the ventilation system, and indirectly the building project, when accidents occurred. If this dissatisfaction with the project also was to blame for the temporary malfunction in the nursing chain is not possible to know.



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### 6.1.4.2 Radiology department

The dissatisfaction in the radiology department was of a quite different character. There was a substantial risk to push the new technology as fast as one did. We know from other areas that dramatic changes of technology can cause fear and alienation among professionals that find their traditional knowledge and skill being obsolete. To make such a major change at the same time as a substantial cut down of staff was forced on the unit was risky. A very articulated and resourceful group was the orthopaedic surgeons. They traditionally used the x-ray films to sketch on when planning an operation. To have all images on computer screens would mean a change in procedures to this group. They also feared the quality of the pictures would be of lower quality in the digital format. Other surgeons were however positive as they saw advantages in the new technology for their praxis.

Figur 20. Radiology examination room

The radiology engineers were strongly affected by the new technology as some of their old knowledge might be obsolete and they had to learn totally new thing.

Some assistant nurses in the Radiology department realized that the new technology would make their group obsolete as their work was connected to the handling of film. Radiographers feared the cut down of personnel in connection to the new technology.

#### *6.1.4.2.1 Reflections on dissatisfaction in the radiology*

The radiology department is today one of the model clinics in the world. The staff is very aware of the fact that they are working in a clinic that is the state of the art in the area. The new technology has developed in such a way that it is to a tremendous help for surgery of all kinds.

Evidence from interviews shows that despite the serious doubts and fears during the process there was a counterforce in the process represented by the persons who pushed the project forward. The technicians mention the trust in the very skilled colleagues and managers that were involved as a reason why they accepted the solutions despite their fears. The head of the radiology department who was the initiator of the new technology managed to get all hospitals in the region to join in the new technology project and to get approval from hospital management and the public owners. The fact that staff that remained in the organisation got better and more rewarding job content and larger responsibilities was an additional aspect that made the project successful in the long run. A massive education program and a step by step moving into the new premises was the strategy for the project. The openness from the building project and the external consultants when it came to the actual design of the work place also contributed to the acceptance of the total project.

## 6.2 What do we learn from the design of the O-building?

We can clearly see the importance of participation from this case. Örebro County has a long tradition of involving the users in the design of places for work. It is a natural part of the culture and is not



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regarded as an isolated event.

*It is interesting to discuss how this culture of participation has an impact on trust between employees and employer and how that in turn makes it possible to impose even more drastic changes like the change of technology in the radiology department.*

From the thoracic surgery department we learn that lack of influence and participation can have severe consequences on the acceptance and perhaps also on performance. From the radiology department we learn that usability to some extent is a subjective feeling that is affected by ones own role in the process, how other aspects develop with time and how the workplace relates to other experiences of work situations.

From this case we might conclude that participation has a large value for performance and satisfaction in the near future after the move in. From the interviews we see that problems during the process was forgotten among the employees but was still in the minds of those who were subjects to the protests. Is this true only if the organisation has a mature culture of participating in these situations or does dissatisfaction during the design stage wear off also in other organisations?

A related question is whatever the culture is the strongest driver for satisfaction or is it the behaviour in a single project?



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