

USABILITY OF HOSPITAL BUILDINGS

Is patient focus leading to usability in hospital buildings?

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Abstract

Experience from several hospitals indicates challenges according to usability of hospital buildings, associated with the rapid and continuous changes in the hospital organization and use of technology. Experience also shows that the hospitals are having difficulties in adapting existing buildings due to new requirements and user needs. The quality of hospital buildings depends on the buildings ability to absorb organizational, operational and technical changes.

Usability is defined as the “...*effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment*” (ISO 9241-11, 1998). According to this definition, a product’s usability is determined by 3 key factors:

Effectiveness – whether users can achieve what they want to do with the product

Efficiency – how long it takes them to achieve it

Satisfaction – their feelings and attitude towards the product

Hospital buildings are characterized by major complexity, and hospital operation are affected by rapid changes and trends. Planning and design of hospital buildings reflect a view of society, humanity and patients at all levels, from the location, overall concept and urban plan, down to the architecture and design in the immediate surroundings of the patients and staff. In recent years there has been a changing trend in cultural and ideological aspects due to hospital operation, and an increased focus at the patient, patient’s rights and participation in the treatment situation.

Will this ideological change affect usability of hospital buildings? This paper is discussing some of those challenges arising according to the relationship between usability of buildings and a patient focused hospital, and is discussing whether patient focus is leading to usability of the hospital buildings. These issues are discussed in relation to planning and design of the St. Olav’s Hospital in Trondheim.

Keywords: Building performance, hospital, patient focus, usability.

1. CHALLENGES IN HOSPITAL BUILDINGS REGARDING TECHNICAL AND FUNCTIONAL ASPECTS

Hospital buildings are characterized by major complexity, and hospital operation are affected by rapid changes and trends. In accordance to Jonassen et al. [1] the supply of health and care are continually changing world over, and the speed of change is ever accelerating. In the last decades the hospital sector has been influenced by a tremendous development within ICT and medical technology. This has led to more focus on adaptability of existing buildings.

Planning and design of hospital buildings are on all levels reflecting a perspective on the society, human beings and the patients, from localization, concept and town planning, down to architecture in patients and hospital employees close surroundings. A brief summary of hospital organization and design in the different eras is given below, based on how changes in this perspective have affected organization and physical surroundings within the hospital.

In recent years there has been a changing trend in cultural and ideological aspects due to hospital operation, and an increased focus at the patient, patient's rights and participation in the treatment situation. This paper is focusing how ideological changes due to patient focus is affecting usability of hospital buildings. Will a stronger patient focus in the planning, design and daily hospital operation lead to greater usability of buildings? We will discuss some challenges in handling the relationship between usability of the buildings as physical surroundings, and whether a stronger patient focus is leading to usability of the hospital building. In the paper we will use the case St. Olav's Hospital in Trondheim, and the planning and design of this project. St. Olav's Hospital is a large ongoing redevelopment project of the old regional hospital in Trondheim, and the project has a pronounced objective of a high degree of patient focus in the hospital development.

Our studies are based on literature studies, the theoretical framework developed by CIB TG51 "Usability of buildings" [2], and studies of project documents and interviews from the St. Olav's Hospital project. This is a preliminary study, where we develop the research questions for a following PhD-study.

1.1 A brief historical summary

In the 18th century a demographic growth in the population, wars and epidemics resulted in establishing institutions with a diffuse distinction between treatment, detention and penalty. Gradually the treatment aspect appears more and more clearly, foundation of medical science gains greater scientific understanding, and hospitals arise as separate institutions [3].

The physical surroundings in hospitals were a large problem in the public health service in the 19th century. Florence Nightingale wrote in her "Notes on Hospitals" (1859) that the death rate at the largest hospitals in town was considerably exceeding that of patients suffering from the same diseases, treated other places. In her "Introductory Notes on Laying-in-Institutions" (1871), she pointed at several cases of illness caused by physical surroundings, and referred to design, light, air and ventilation as important elements in hospital buildings [4].

The development within the hospital sector in recent decades has gone from the pavilion hospital, via the block hospital, to the "neighbourhood hospital", representing the hospital model of today. This has happened based on the development in medical technology, and the changes in main nursing philosophy have been the driving forces behind this development.

The pavilion hospital emerged as a consequence of the problems at the 19th century, and was focusing daylight, air, ventilation to offer satisfying hygiene for the patients. The hospital buildings were divided into separate pavilions, which were gradually connected with glass corridors, to simplify the work for the employees and transportation of the patients.

The major hospital development in Norway has taken place periodically, being at its maximum in the 1950ies and the 1970ies [5]. There was a large expansion in the health sector in the 1950ies, and the planners adopted organizational models from the industry aiming to increase the efficiency and productivity in the hospital sector. The nursing philosophy was based upon specialization, hierarchy, centralization and top management, and this hindered communication between the patients and the employees. Satisfying the patients' physical needs was in focus, and little attention was shown the psychological, social and spiritual needs of the patients. The block hospital was developed as a response to the quantitative objectives related to efficiency and requirements due to the technological development at that time. This was also the dominating trend internationally, among others in Germany, where "medicine in focus" was the leading ideology. In the 1960ies and 70ies the functionalism was the predominant style in the hospital architecture. Hospitals were designed and built as "nursing factories" in high-rise blocks, focusing quantity and centralization of the hospital activity. Esthetical quality was not given priority.

In the 1970ies a critical debate related to the hospitals as "nursing factories" arose, and the basic attitude towards hospital planning started to change. Bad working conditions and mechanical treatment of the patients was focused in the media, and the centralization and the de-humanizing due to the physical surroundings in the hospital was strongly criticized. This led to a search for new operational models in the hospital, and a development towards hospital projects of smaller scale, decentralization, and a higher degree of intimacy and tighter contact between the employees and the patients [6].

1.2 Patient focused hospital

As mentioned above, in recent years there has been a changing trend in cultural and ideological aspects due to hospital operation, and increased focus at the patient, patient's rights and participation in the treatment situation [7]. Hospitals have moved from being focusing efficient treatment to a higher degree of patient focus. The patient is no longer regarded merely as a "product" being in hospital to get "fixed", and respect of the patient is in a higher degree ensured in the hospitals of today. Besides scarce economical frames has been leading to further focusing efficient examination and treatment, a high exploitation of the resources and productivity, and this is changing the way the hospital is being operated.

An option of freely choosing hospital for treatment, competition from private actors within the hospital sector, together with the threat of outsourcing of services, affects the requirements of change within the public hospital sector. On this basis, the hospitals planned and built today give the expression of being founded on another fundamental attitude towards health and care than the traditional, by putting the patient in focus.

The organization and design of several projects is based on the Planetree philosophy, which is a philosophy especially focusing the patient and seeks to improve the medical treatment seen from the patient's point of view [8]. The fundamental values of the Planetree philosophy is trust, intimacy, dignity, security and confidence, holistic care and treatment, information, participation in decision-making, health promoting physical surroundings, and network support. The philosophy emphasizes to personalize and humanize the hospital treatment, and make it less

unfamiliar both for patients and relatives. The Planetree philosophy is besides representing a value based and holistic patient perspective.

1.3 Usability of hospital buildings

Experience indicates challenges according to usability of hospital buildings, associated with the rapid and continuous changes in the hospital organization and use of technology. Experience also shows that the hospitals are having difficulties in adapting existing buildings due to new requirements and user needs.

The quality of hospital buildings depends on the buildings ability to absorb organizational, operational and technical changes. To meet these changes it is necessary to design buildings with an appropriate physical and organizational adaptability over a time period. Hospital projects are characterized by an extensive planning and construction period, often lasting 10 – 15 years. During this period the project assumptions and the user organizations needs are changed, due to rapid development in technology, organizational changes and treatment methods. Not seldom we experience a mismatch between the user organization and the building at the completion time, resulting in continual building changes.

2. OPERATIONALIZING THE CONCEPTS

Both the terms usability and patient focus are hard to make operational, and are according to this often difficult to measure and evaluate in a completed hospital building.

2.1 Usability of buildings –theoretical framework

Until lately it is written and done little research on usability in buildings. Several research projects are done due to aspects concerning this concept, but few are studying the connection and dependence between the aspects. The term is vague and little tangible. The concept of "usability" is widely known in relation to applications within product design, information technology and web-design, related to user friendliness and user interface of the system.

A CIB Task Group 51 "Usability of buildings" has been created to apply concepts of usability, to provide a better understanding of the user experience of buildings and workplaces. Usability is here defined as the "*....effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment*" [9]. According to this definition, a product's usability is determined by 3 key factors:

Effectiveness – whether users can achieve what they want to do with the product

Efficiency – how long it takes them to achieve it

Satisfaction – their feelings and attitude towards the product

Usability means that systems are easy and fast to learn, efficient to use, easy to remember, allow rapid recovery from errors and offer a high degree of user satisfaction. It also means bringing the user perspective into focus. The term usability describes whether or not a product is fit for a specific purpose [10]. Usability, or functionality in use, is concerning the buildings ability of supporting the user organizations economical and professional objectives.

The concept of usability of buildings can be approached in four ways [11];

1. Criteria and parameters affecting usability
2. Usability from different stakeholder's point of view

3. The time perspective
4. Workplace and context

According to the patient in focus it is especially interesting to discuss the second approach, usability from different stakeholder's point of view.

2.2 The patient in focus

The organization and design of several projects is based on the Planetree philosophy. The last project in this development is new St. Olav's Hospital in Trondheim, a project designed in accordance with the hospital ideals of today. According to Dilani [12] no hospitals has so far been implementing the Planetree philosophy as extensive as this project. The architectural competition for the project, accomplished in 1995, was based on treatment, nursing and care to be done with the patient in focus. The term "patient in focus" is defined as a holistic view of the patient and a production oriented view on the organizational structure in the hospital. The solution for St. Olav's Hospital is a decentralized hospital with smaller, partly autonomous units in separate buildings; integrated centres in independent blocks. The fundamental idea is that the patients needs and wishes is the basis for all planning. Emphasis is made on dignity and participation of the individual patient. Through a patient focused treatment the patient is to experience continuity and connection during the treatment.

The staff is brought together around the patient, as opposed to earlier, when the patients were transported from department to department to receive the necessary treatment. The patient needs to deal with less people, giving a more humane atmosphere. Every building unit is of a smaller scale than a traditional centralized hospital complex.

2.3 Case: St. Olav's Hospital

St. Olav's Hospital is based upon a transformation of the existing buildings at the original site. 80% of the existing buildings are being demolished, and the remaining is rebuilt. The project contains 197 500 sqm new buildings. Rehabilitation and new building is done step by step over a period at 11 years.

The main objective of the project is to create an efficient and professional hospital. The development plan for the project [13] states "the patient in focus" as a main objective, and is also describing seven other objectives for the completed hospital [14], among them flexibility, which can be related to usability. The hospital is based upon a decentralized centre model, where each centre is representing self sufficient units. Necessary changes are assumed to be solved within the centre, giving few effects and consequences for the rest of the hospital.

Several concepts are affecting usability and patient focus in the hospital project [15];

- Area flexibility (possible extension and addition of buildings)
- Generality (standard design solutions)
- General centre (basic principles for building structure, communication, organizing, functional division, volumes, exterior facades, use of materials)
- Structural flexibility (focusing possible rebuilding and functional changes)
- Technical flexibility (possible changes in capacity)

In this context it is especially interesting to describe and discuss the topics *generality* and *general centre*, due to patient focused hospitals.

2.3.1 Ideas for developing patient focused design solutions, with the bed cluster as an example

The bed cluster (“sengetun” in Norwegian) is a physical and organizational model representing one way to organize patients’ rooms in the wards. According to the principal architect in The St. Olav’s Hospital Development Project, part of the challenge in planning and design of the new hospital is to transform an existing physical and organizational structure into a modern hospital according to the objectives for efficient operation and patient focused care.

The holistic model “Human and material resources” (figure 1), is developed to discuss, together with other aspects, generality in physical solutions. According to this model, hospitals can be divided into two sectors which have different sets of resources. One sector is based on human resources, and the other sector is based on material resources (buildings and equipment). Achieving value in hospital planning and operation can similarly be described in two ways. One sector describes quantifiable objectives, such as the number of health services delivered, while the other sector is based on values associated with the human experience of quality, including user satisfaction.

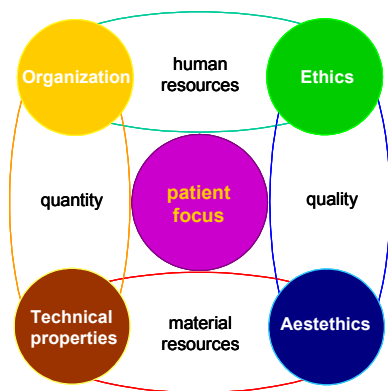


Figure 1: The holistic model “Human and material resources” [16].

The hospital organization can be placed in the intersection between the human resources and the quantitative resources. In St. Olav’s Hospital one of the goals are to build up an organization for best possible use of the combined resources of human capacity and competence in the hospital. In the intersection between the human resources and the qualitative values, we find ethics, where visions about attitudes and the human perspective must be defined. This is, among other philosophies, put into system by the Planetree organization. In the intersection between the quantitative and the material, we find the technical properties, defined as functionality and technical quality of buildings and equipment. In the intersection between the qualitative and the material resources aesthetics are created.

This holistic model describes various aspects of the hospital organism, and shows how various aspects affect each other in a development process. According to the principal architect, the development process will include all the aspects, whether they are taken into account or not. Objectives and visions for developing the hospital organism are placed in the centre of the model, so that all the secondary aspects are directed at a common focus. In St. Olav’s Hospital, the vision has been defined as operational efficiency (production focus) and patient focus (customer orientation). This involves awareness of both quantitative and qualitative values, and the whole model is activated.

The bed cluster design provides, according to the principal architect, an opportunity to develop a more practical, social and building-related environment for patients and staff. The patients' rooms are grouped around stores for supplies and workstations for the staff which care for the patients. At St. Olav's Hospital there are 6 – 8 patient rooms per bed cluster, and the clusters are placed in series with common supporting rooms in between.

2.3.2 General centre

The concept “general centre” is developed as a part of the hospital project. The target of this has been to develop a model to take care of common qualities and solutions in the project, general for all centres, corresponding with the superior objectives. “General centre” includes basic principles for building structure, communication, organizing, functional division, volumes, exterior facades, use of materials and so on, to assure superior structure, character and totality. The concept introduces guidelines for physical design, and is meant to be a “prototype” for the development and design of each centre. This is considered to be an important feature in gaining flexibility (figure 2).

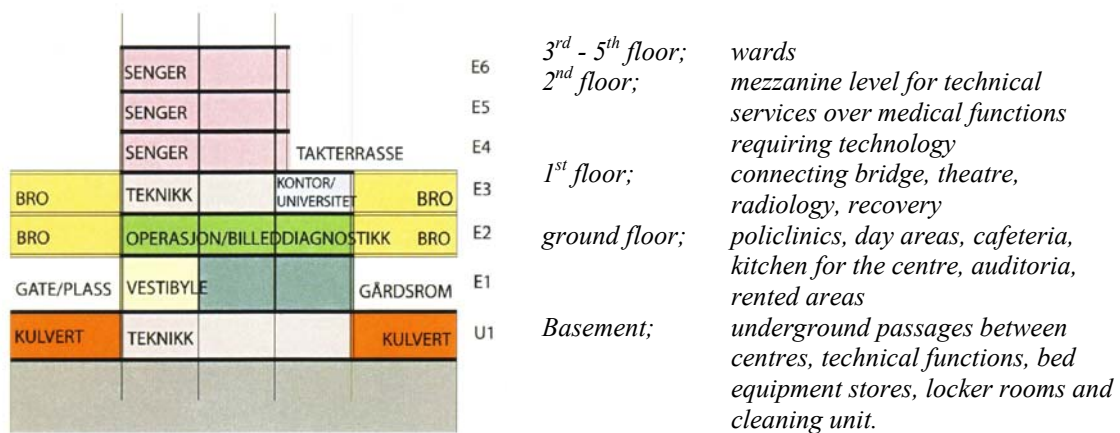


Figure 2: General centre [17].

The concept of general centre comprises the following principles;

- identical localization of functions on the floor plans (figure 2)
- functions belonging to one centre can easily be expanded into the adjacent centre
- logistics due to transverse function is improved
- concentration of activity at inconvenient time
- a continuous surgery area at the 1st floor
- a continuous university area at the 2nd floor

3. THE BUILDING VERSUS THE EFFECT OF THE BUILDING

The relationship between usability of a building and a user focus is discussed in a case study draft report [18], carried out as the Swedish part of the CIB TG51's work in 2003. In the report, which is a work in progress, it is expressed that “We can define functionality as a property given to an artefact in order to create a practical effect. An important effect can be described as usability. (...) We all know that functionality alone does not make a certain artefact usable. The technical and physical properties of the artefact and its theoretical potential to deliver a certain effect do not automatically make it usable in the real world.”

The same aspect is discussed by Granath [19]. According to Granath the Swedish society traditionally are based upon production of goods. The rationalist way of thinking is the dominating, and it is focusing at what theoretically should happen if the product is produced in a specific way, rather than focusing the result of what is done. There is however also another knowledge, even if it often is secondary. In state of being a user, we confirm how the products are working for us, whether we like them or not, in what way they are affecting our lives, and whether we think they are beautiful or ugly and so on.

Granath says that in the first perspective we are talking about buildings and products (the artifact in figure 3), in the other perspective people doing things (the effect of the artifact). We are measuring and evaluating the shape, quality and quantity of the product, but should rather be talking about how the product is meeting the users needs and requirements. We are focusing functionality believing this will lead to what really is crucial, being usability. We believe that the problems are solved when we succeed to develop tools for solving them, and think that the effect always is the desired. In figure 3 these two perspectives are visualized;

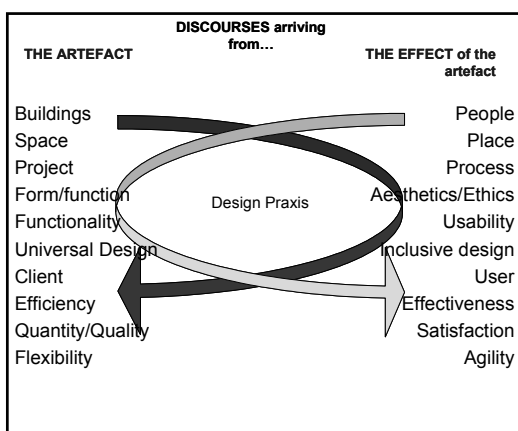


Figure 3: The artifact versus the effect of the artifact. [19]

The traditional way of thinking is visualized by the dark arrow in the figure, where the range of ideas is based on the product, and where the conclusion is a technical solution to a humanistic problem. The new and needed way of thinking is that there always is, in both new buildings and in a buildings phase of use, a need for developing knowledge starting on the right side of the figure, based on the core organization, and further to use tools and techniques on the left side of the figure to develop relevant solutions judged based on the thinking of the right side in the figure. This new way of thinking is represented by the light gray arrow in the figure. To achieve this, a change of attitude is crucial.

The model in figure 3 gives a good picture of the traditional versus the new way of planning and operating a hospital. Traditionally it has been usual to develop hospital projects in line with the red arrow, and focusing “the nursing factory” and “the medicine in focus”. St. Olav’s hospital is based upon a fundamental reorganization of the hospital activity. As we see in section 2, the planning and development of this project is based on the right side of figure 3, in a higher degree than most of the other hospital projects the latest years, by emphasizing the patient focus in the degree that is done. This can however cause some challenges related to the traditional way of building a hospital and organizing the hospital activity [20].

3.2 Possible challenges that might arise

3.2.1 Different actors – different perspectives on usability of the buildings

There are several approaches to the concept of usability. In the paper “Usability of buildings. Theoretical framework for understanding and exploring usability of buildings” [21] four approaches to the concept are described. The second approach describes how different stakeholders and organizational levels have different perspectives considering usability of buildings; *“The terms usability, effectiveness, efficiency and satisfaction is interpreted and understood in different ways. Productivity and effectiveness are generally emphasized as a strategic management issue, while individual workers are engaged with user satisfaction and practical aspects in their daily working situation.”*

In a hospital project “the users” consist of several actors, both hospital employees, patients, primary health service and so on. It is impossible to involve all these actors directly in the planning of the project in a high degree, and the user involvement in the project is due to this often based mainly on participation from the hospital employees.

The planning process in St. Olav’s Hospital is accomplished with extensive user participation, consisting of mainly hospital employees. As mentioned earlier patient focus is emphasized as crucial in the new project, and the challenge is therefore whether the hospital employees and the architects designing the project have the necessary knowledge and ability to take the patients’ perspective in the process of planning a patient focused hospital. Do the actors represented in the planning phase manage to represent other actors’ perspectives in a good way, so that the new hospital buildings are usable for the patients? Interviews done in 1999 indicates that several actors are sceptical to whether this is sufficient to gain a patient focus, because of the medical employees being mostly engaged in focusing their own medical discipline and specialization; *“The hospital employees think they are patient focused, but they are too close to the patient to see that they are not really patient focused.”* [22].

The Örebro case study, accomplished as the Swedish part of the CIB Task Group 51 work, still points at the value of user participation in the process, and concludes that *“From this case we might conclude that participation has a large value for performance and satisfaction in the near future after the move in.”* The results of the case study confirm the importance in longer terms of user participation in these kinds of building projects; *“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 regarded as an 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.”*

3.2.2 Involvement of the users in the planning – leading to usable buildings?

We have seen that rather extensive user participation is used as a mean to implement the concept of patient focus in the new St. Olav’s Hospital. Some actors are questioning the user participation in the project, and whether this is contributing to tailor made buildings rather than flexibility and usability in a long time perspective. In an evaluation of the project done in 2003 [23], it is concluded that the experience so far is that the users not are sufficiently farsighted. They are mainly concerned about their situation and activities ongoing today, and relate their own transferring of information to this, instead of being visionary and future oriented. The result is often too much focus at reaching solutions, at the sacrifice of focusing functional claims. An

important challenge is therefore to balance the individual users need for tailor made solutions with a more superior need for long-term future solutions.

Via the evaluation project some actors also express that the concept “general centre” has had too little validity in the first phase of the building project. It has been too easy to do changes and exceptions from this standard, and this has resulted in different solutions in different centres. This might be an indication on that the guidance developed due to generality and general centre have been influencing the design of each individual centre in a less degree than desired.

3.2.3 Is the patient focus affecting the traditional hierarchy in hospitals?

The interviews unveil a disagreement related to fully base the new hospital project on a patient focused ideology, due to the organizational changes needed to be done. Professional arguments are used against this ideology, and it seems like a number of hospital employees, especially within the medical profession, experience the increased patient involvement and openness in the hospital organization as a threat against their own professional integrity and expertise. It is expressed that a hospital organization according to patient focused thinking will cause a fragmentation of specialist environments and offer jobs being less professionally attractive.

Accentuating patient focus as something new and revolutionary is comprehended as provocative by the medical profession; *“The patient focus is not something new. We have done this all the time!”*. *“It is a provocation to the doctors to say that they so far not have been doing patient focused work.”*

The patient focused thinking is assuming increased communication and cooperation between the different professional disciplines than earlier. This will be crucial to develop common knowledge beneficial to the patient. The hospital is traditionally based on disciplinary development of knowledge, because it is this that gives professional status. Some actors within the medical profession are afraid this transdisciplinarity will fragment existing specialist environments, and establish interdisciplinary areas in competition to the existing specialist environments.

Implementing a patient focused thinking and the Planetree philosophy in the hospital assumes development of a socially robust knowledge within the organization. Patients and relatives must perceive the knowledge developed in the hospital as credible and functional, and an assumption for this is increased openness, access, participation and involvement than the traditional.

A change in the hospital organization considering patient participation and involvement in the treatment situation promises that it is necessary with a general change in attitude in the hospital organization, according to the traditional view of the patient as an object or a “product”. These kind of changes seems to feel like a threat for the traditional hospital organization, since the existing organization is needed to be questioned critically.

4. CONCLUSIONS

In this paper we discuss some of the challenges for planning, design and operation of patient focused hospitals. Usability forms the basis for this discussion. We are using a theoretical framework for exploring usability presently under development by CIB Task Group 51 and the Planetree philosophy regarding patient focused hospitals. The theoretical discussion is related to the new university hospital project in Trondheim, where the project organization has an expressive goal of achieving both a greater efficiency and a more patient focused hospital.

Usability is defined as the “...*effectiveness, efficiency and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment*” (ISO 9241-11, 1998). According to this definition, a product’s usability is determined by 3 key factors:

Effectiveness – whether users can achieve what they want to do with the product

Efficiency – how long it takes them to achieve it

Satisfaction – their feelings and attitude towards the product

In this paper we have discussed some aspects considering how these 3 key factors are connected to a patient focused ideology. The dominating discussion is related to user satisfaction, as an important element of gaining usability of a building. Evaluations show an immediate relationship between a stronger patient focus and satisfied patients. Implementing a patient focused ideology might however cause some challenges related to usability of the building, and thus both the hospital building and organization;

- Different actors have different perspectives on usability of buildings. The planning process in hospital projects is often accomplished with extensive user participation, but this is consisting of mainly hospital employees. The question is due to this whether the hospital employees and the architects have the necessary knowledge and ability to take the patients’ perspective in the process of planning a patient focused hospital.
- Will involvement of the users in the planning lead to usable buildings? We have seen that rather extensive user participation is used as a mean to implement the concept of patient focus in the new St. Olav’s Hospital. Some actors are questioning the user participation in the project, and whether this is contributing to tailor made buildings rather than flexibility and usability in a long time perspective.
- Another question that is important to emphasize is the relationship between efficiency and a patient focused ideology, and whether these are incompatible. Parts of the medical profession fears that founding the new St. Olav’s Hospital on a patient focused ideology will result in a fragmenting of specialist environments, and that this will cause a decrease in efficiency.

These questions and topics will be taken further as part of a PhD-study at the university. This PhD-study will be focusing usability of buildings related to a stronger patient focus, and will be discussing the relationship between efficiency at the one side, and a patient focused ideology on the other side.

5. ACKNOWLEDGEMENTS

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