Usability briefing for hospital architecture – exploring user needs and experiences to improve complex buildings

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Abstract

Thesis statement:

This completed Ph.D. research is a contribution to an ongoing debate in Europe about improving the building design processes of complex buildings, especially in relation to the current hospital developments. It provides knowledge about capturing user needs and defines the process model for usability briefing for hospital architecture from a user perspective.

Methodology:

The thesis is based on comprehensive literature studies, three main case studies at hospitals, numerous expert interviews and workshops.

Results and conclusions:

The research results generate a better understanding of how knowledge about user needs, acquired from workshops and evaluations, can be fed into briefing and design processes. This PhD thesis proposes methods for usability briefing.

Usability is a concept similar to functionality, but usability depends on: subjective view of users, context, culture, situation and experience. Understanding usability is achieved by involving users. The PhD thesis extends the research in usability of buildings to include all building design phases, therefore not only proposes usability evaluations, but also defines usability briefing. *Briefing*, also called *architectural programming,* is usually understood as one of the first phases of a building project. In practice the process, led by experts, involves the users as data sources, and results in the program of requirements for the building.

The PhD thesis synthesizes the research findings and proposes a Usability Briefing process model, where briefing is a dynamic and continuous process throughout all the building phases: from pre-project, through design and construction phases to handover and in-use. In the proposed Usability Briefing model the activities of briefing and design are not sharply divided, but support each other in frequent interactions. User involvement and evaluations support briefing and design by common learning, participatory data collection and analysis of needs. Therefore, the model combines all interrelated activities and provides a visual overview of them throughout all phases. Additionally, the model includes the focus, users and methods for each phase.

Furthermore, the practice could go further with user involvement, compared to the usual *user-centred design*, where users passively reveal their needs and the professionals continue with the design. Instead, this thesis proposes a move towards *user-driven innovation* and Scandinavian *participatory design*,

where users are seen as partners and co-creators, and where innovation and design are not done 'for' users, but 'with' or 'by' users.

Research results from the presented hospital cases demonstrate that user-driven innovation is possible even in the hierarchic and technically advanced healthcare environment, and that patients and medical staff can have a positive influence on the prospected architectural environment, provided that the user involvement occurs early and is managed properly.

Moreover, the model incorporates the evaluation activities in the process, also at the front-end, where evaluation can give input to briefing and design, and can occur as participatory methods, i.e. simulations. In order to choose an appropriate method, the various methods and tools for evaluating facilities are grouped according to their main focus: technical building performance, function/usability or form/beauty. Furthermore appropriate methods are selected specifically for hospital projects.

Implications:

The results are published in five scientific articles and are summarised in a PhD thesis. It provides tools that contribute to satisfying the needs of future building users and maximising the usability of complex buildings, such as hospitals. The research results have relevance to researchers, architects, facility managers and client organizations planning new complex facilities, and especially for professionals working with briefing and design of hospitals.

Introduction

This completed Ph.D. research is a contribution to an ongoing debate in Europe about improving the building design processes of complex buildings, especially in relation to the current hospital developments. This conference paper shortly summarises the results of the Ph.D. thesis with same title, contributing to achieving hospitals of excellent architecture and usability, supporting the needs of future patients, healthcare professionals and society. It provides knowledge about capturing user needs and defines the process model for usability briefing for hospital architecture from a user perspective. Furthermore, a few examples are given in topics usability, briefing, participatory design, evaluation, user involvement and innovation. The presented tools can contribute to satisfying the needs of future building users and maximising the usability of complex buildings.

In complex buildings with many types of users, such as hospitals, it can be difficult to satisfy the numerous, different and often contradictory requirements of all users. At the same time the construction industry today is plagued by adverse and antagonistic relationships between participants that could be resolved by effectively structured, trust-based collaboration (AIA 2007). Furthermore, firms are realising that when projects are carefully programmed, design can start earlier, proceed more efficiently and suffer less client rejections (Duerk 1993).

Most research on usability focuses on evaluating products or facilities with users, after they were developed or built. The Ph.D. thesis extends the research of usability of buildings to include all phases, also before the buildings are built. It refines the concept of Usability Briefing and presents a process model for how to include Usability Briefing in complex building projects. Usability Briefing is a structured process in which stakeholders and users are actively involved in the trust-based collaboration, not only in evaluations and data gathering, but also in a continuous briefing process with the aim to create better architectural design for supporting the users. The model was developed inductively from a literature review, expert interviews, workshops and three case studies at hospitals in Denmark and Norway.

Method

My Ph.D. thesis presented a new model of a Usability Briefing process and recommendations for processes of user involvement, evaluation and their interactions with design activities. The model was developed inductively, using a triangulation of methods (Flick 2008) for collecting empirical data. The methods were: three long-term case studies (Yin 2003) of hospitals in Denmark and Norway; literature review, presented in the background section and 140 events: expert interviews, presentations, meetings with architectural and engineering companies specialised in design or briefing for hospitals. An earlier version of the model was verified at a conference (Fronczek-Munter 2014), additional expert interviews and one focus group interview/workshop (Morgan 1997) with 17 practitioners. The usability briefing model was therefore modified and further improved to the current version.

The three case studies were chosen because of novelty and variety of procedures. Some experts were interviewed as participants in the case studies, some were external experts adding more information about specific topics of hospital design, user involvement, briefing or evaluations. All the interviews were semi-structured.

The development of the models - usability briefing process model and evaluation flower model, has taken place by combining the theories with the case study findings and expert interviews. The usability briefing model was based on RIBA's planning phases from 2013 as the backbone for the approach, chosen as means to connect to practice. The aim has been to translate the many different concepts into a single model for Usability Briefing.

The approach of the study is inductive - particular examples are used to reach a general conclusion. The case study methodology is chosen for the examination of details, for seeking answers to *how* and *why* questions and making broader generalisations and reaching conclusions from existing practices (Yin 2003). It allows testing speculative ideas and theoretical concepts based on empirical data (Ragin and Becker 1992).

Introduction of the hospital projects – three case studies

Bispebjerg Hospital project (BH) located in Copenhagen capital area in Denmark, was studied in the period 2010 - 2012, following the processes of user involvement and briefing for the master plan competition with additional buildings of 100.000 m^2 and rebuilding existing buildings of 57.000 m^2 until 2025. The case study was including interviews with managers, architects and workshop facilitators.

Healthcare Innovation Lab (HIL) was a case study conducted in 2010-2012 at the Gynaecologic Department at Herlev Hospital as part of **Healthcare Innovation Lab** (HIL), which is a public-private collaboration project testing simulation and user-driven innovation between users and companies at Hospitals in the Danish Capital Region. The case study focused on the different ways of involving users in planning healthcare facilities. The case study was participative 'action research', with active involvement in workshops with users / medical staff.

St. Olavs Hospital in Trondheim, Norway (SOH), was conducted in 2012-2013 partially as a historical study from literature, document reviews and interviews with Chief hospital architect and Chief medical manager, who were responsible for user involvement; and site visits and trial of usability evaluation method USEtool on one department building.

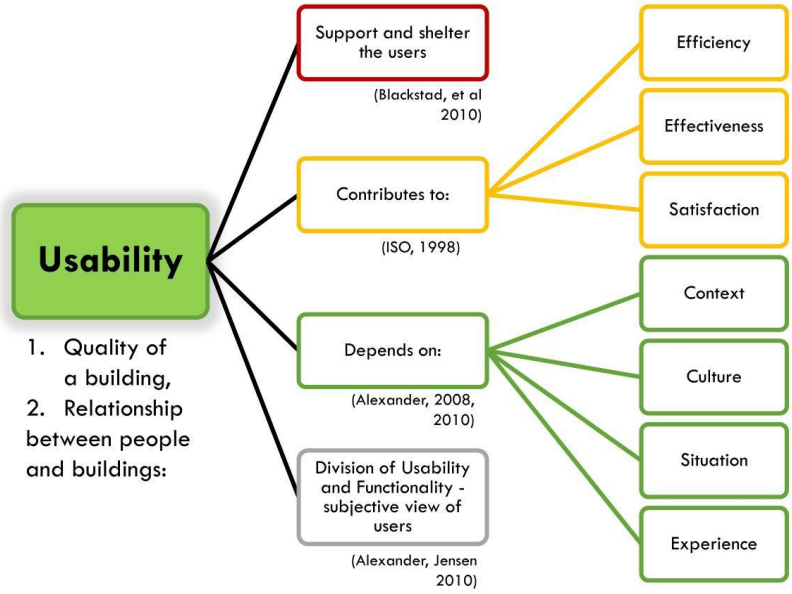
Figure 1 Photos of theree hospital cases, 1) Healthcare Innovation Lab (HIL) at Herlev Hospital, Denmark 2) Bispebjerg Hospital (BH), Denmark and 3) St. Olavs Hospital in Trondheim (SOH), Norway

Usability

The concept of usability has its roots in evaluations of consumer products and user interfaces of computer software. In ISO 9241-11 it is defined as: 'The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use' (ISO 1998).

In the field of architecture the usability concept is known and often translated as functionality. Nevertheless some researchers prefer to make a distinction between functionality and usability (Alexander 2006, 2008, 2010; Jensen 2010; Fronczek-Munter 2011), where functionality in the building industry is objectively measurable, while usability introduces the subjective views of the users. The result of this is that usability can be evaluated differently by different groups of users. Furthermore, researchers suggested that usability depends on the context, culture, situation and experience (Alexander 2008, 2010).

Figure 2 Recent understanding of Usability concept and its main ingredients, (Fronczek-Munter, 2011, 2016)



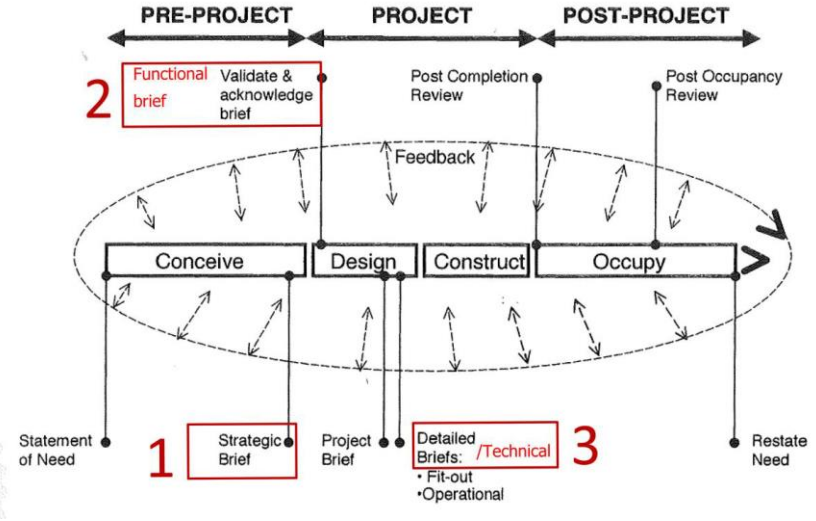
Briefing

Briefing (American English: architectural programming) is usually understood as one of the first phases of a building project, before the design activities start. Guidelines in UK, USA and Denmark name it as

the first or second phase of a building project (RIBA 2013; AIA 2007; DANSKE ARK/ FRI 2012). AIA (2007) presented an Integrated Project Delivery, where the first phase is called Conceptualization (Expanded Programming) and design decisions are moved earliest in the process, where they are more effective and less costly. Peña (1987) calls briefing a 'problem seeking' phase, while the design is 'problem solving' phase. Briefing is defined as a process of managing information to be ready at the right stage of the design process in order to make the best decisions in shaping the outcome of the building design (Duerk, 1993, pp8). Briefing saves both the firm and the client time and money (White n.d. in Duerk 1993).

Briefing is a process that in practice often results in program documents (program of requirements, brief) that contains the client's requirements for the building. When finished, the document is handed over to the design team who is then expected to translate it into a design proposal. Several researchers suggest that: 1) Briefing should be dynamic (Nutt 1993, Prins et al. 2006). 2) Briefing should be a continuous process (Barrett and Stanley 1999; Blyth and Worthington 2001; Fristedt and Ryd 2004; Voordt and Wegen 2005; Jensen 2006; Jensen et al. 2011). Furthermore, it literature proposes several different programs with different purposes (Nutt 1993; Fristedt and Ryd 2004; Blyth and Worthington 2001, 2010).

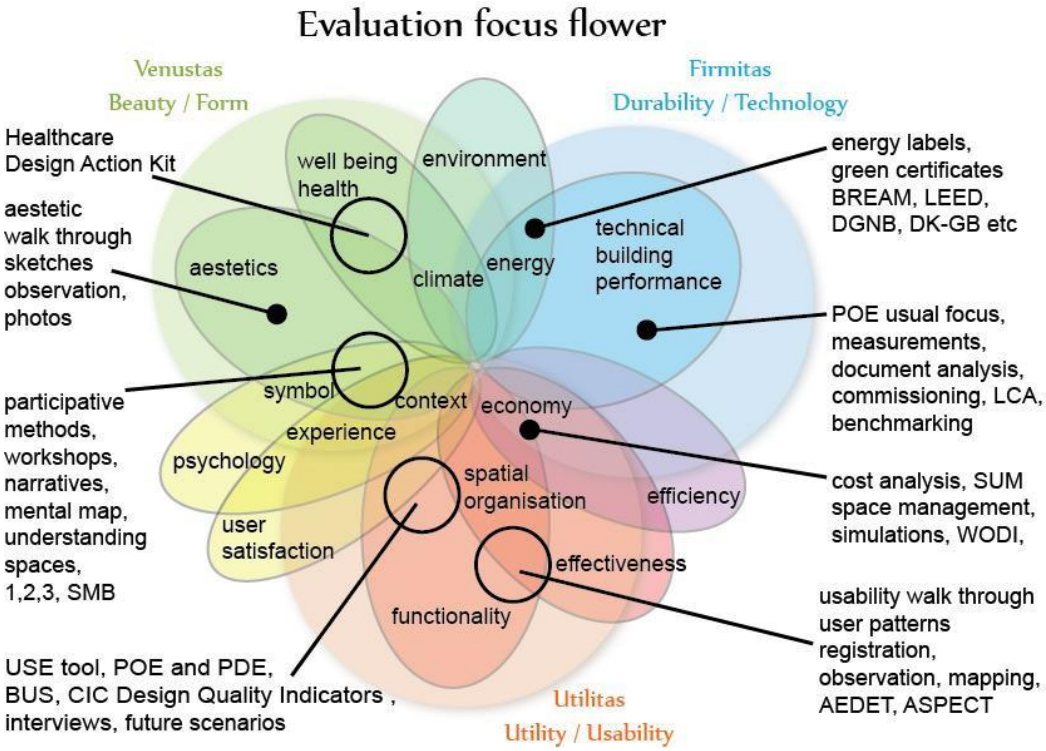
Figure 3 Different briefs in different building phases (Fronczek-Munter, 2016, adapted from Blyth & Worthington, 2001, 2010)



Evaluations

Evaluation is one of the key processes to achieve usability and effective facilities (Blakstad et al 2010, Jensen 2010). Various methods and tools exist for evaluating existing facilities. Post-Occupancy Evaluation (POE) is the most known building evaluation methodology. Preiser et al. (1988) and Preiser and Vischer (2005) define POE as 'the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time'. Figure 3 presents the Evaluation focus flower (Fronczek-Munter, 2013), with an overview of evaluation methods divided in three Vitruvian focus areas of usability, beauty and durability. The many focus areas are represented by flower petals with overlaps. The methods are grouped and placed on the Evaluation Focus Flower model in order to easily find the right evaluation method fitting the focus area to study.

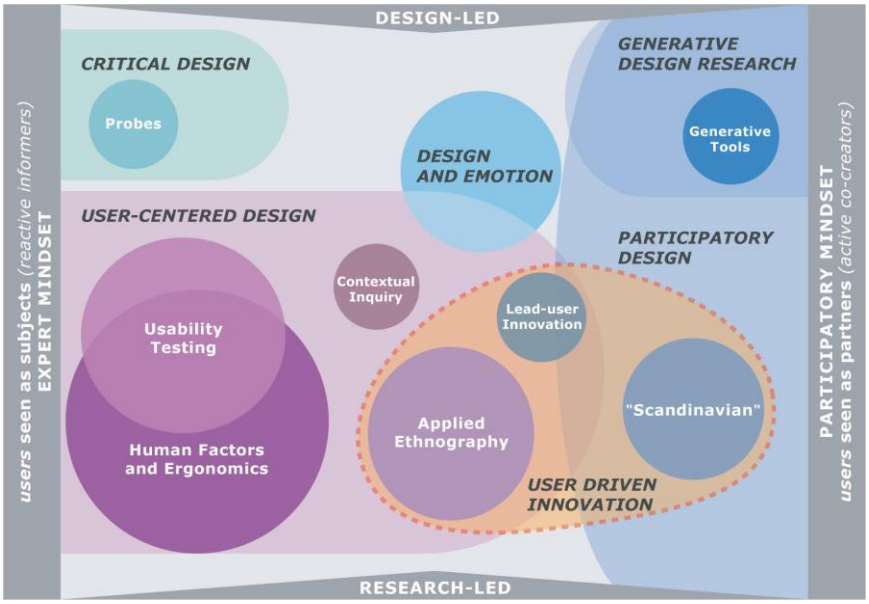
Figure 3 Evaluation focus flower (Fronczek-Munter, 2013), with an overview of evaluation methods



User involvement, user driven innovation, participatory design

Figure 4 shows different approaches to user involvement and methods, where users can be seen as either co-creators or merely data source. The approaches are positioned in the framework with two axes. The vertical axis is stretching from design-led to research-led, while the horizontal axis is stretching from an expert mindset, where users are informants and design is FOR people, to participatory mindset, where users are co-creators and design is made WITH people.

Figure 4 User involvement approaches, (Jensen, Alexander, Fronczek-Munter, 2011) adapted from Sanders, (2006). Emerging trends in design research



Participatory design actively involves users throughout the design development and is gaining popularity. *User driven innovation* (Ehn and Kyng 1987) is the participatory design process in which users are (co-) creators of design. Von Hippel (2005) claims that most innovating users have characteristics of lead users - they are ahead of the majority. This is different from the standard practice of involving users as merely passive informants. Moreover, AIA (2007) suggests, that in an Integrated Project Delivery the key participants are involved from the earliest practical moment. Their combined knowledge is most powerful during the project's early phases, where the decisions have the greatest effect.

Usability briefing process model

The aim of the model is to give an easily understandable overview of the engagement over time in the different processes that can constitute Usability Briefing in the building design process. The four activities in the model are: 1) briefing, 2) evaluations, 3) user involvement and 4) design, each shown as a layer in the graph. The model is based on the building design phases presented by RIBA (2013), numbered from 0 – Strategic Definition, to 7 – In Use.

There is an arrow showing circular and repetitive process, because hospitals usually exist before new building projects start and are rebuilt after some years of use and changes in technology and population age. The effort shown for the four activities are not to scale, instead the thickness of layers symbolizes increasing or decreasing effort.

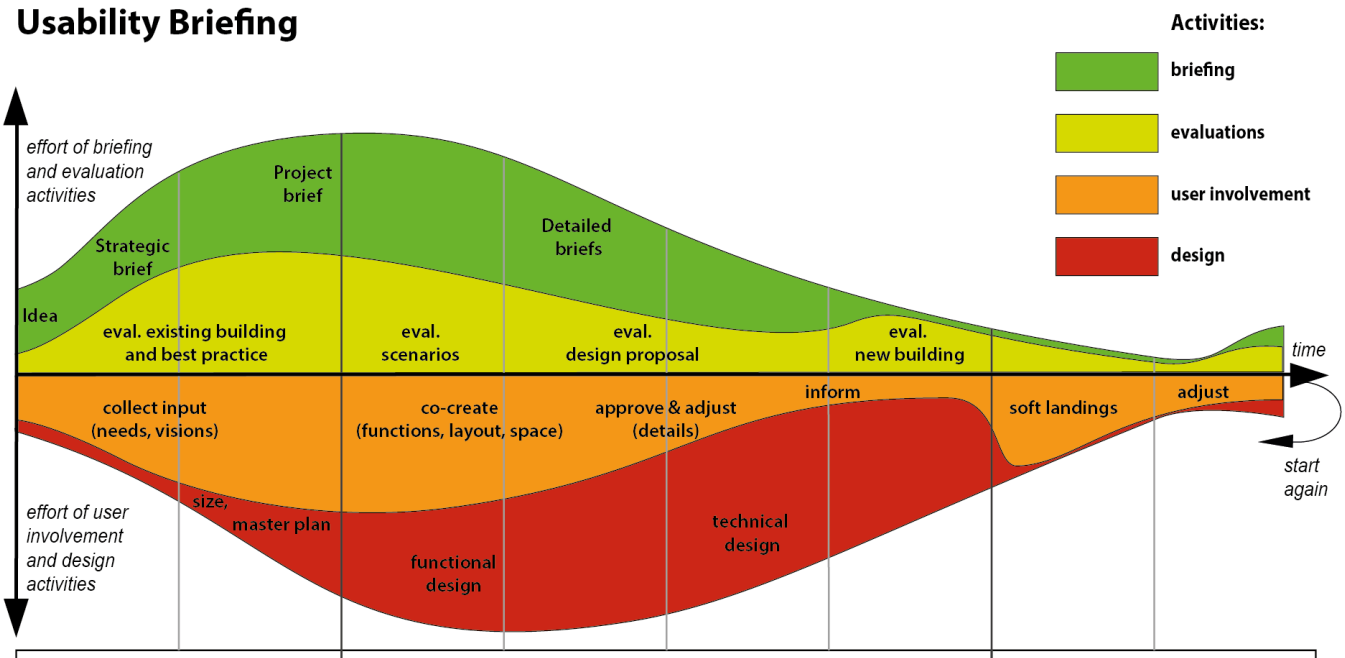
The four activities are considered as essential for a good briefing process with a focus on usability. They are shown as separate layers, added on top of each other, but they do and should interact with each other in each phase. While many professionals agree that briefing should be initial to and separated from design (Cherry,1999; Duerk,1993), others are 'sceptical about the assumption, that briefing is distinguishable from design' In this model the border between briefing and design is fluid, allowing for frequent, regular interaction (Duerk, 1993) between all the activities. The intimate connection between briefing and design, to the point that they become indistinguishable is also suggested by Blyth and Worthington (2010). Furthermore, briefing can be seen as a design process and you develop the brief through design (Nicholson, 2010).

The table below the model shows different focus, users/stakeholders and methods that are recommended throughout the project.

The novelty of the usability briefing model is combining of the four known activities of briefing, user involvement, evaluations and design and arranging them throughout all building design phases, relative to each other and additionally recommending the main focus of the phases, users and methods to be applied. The model strenthens the early phases and the usability focus between the activities and acrosss time.

The premise of the model is that usability topics are formalised in each of the 4 activities (e.g. in agendas, notes, documents), discussed (in workshops, design meetings) and systematically evaluated (e.g. in design appraisals). Furthermore, the idea is that usability topics are explicitly held on to when switching from one activity to another, avoiding that issues get 'lost' along the way. The usability focus shall therefore be kept throughout all the phases. The model is developed to be generic and easily adaptable, such that it can be used for planning new complex building projects and include the activities that fit exactly that specific project.

Figure 6. Usability Briefing process model



	PRE - PROJECT		PROJECT				POST - PROJECT	
Phases	**0** Strategic Definition	**1** Preparation & Brief	**2** Concept Design	**3** Developed Design	**4** Technical Design	**5** Construction	**6** Handover	**7** In Use
Focus *- what?*	Estabilish a shared vision by top decision makers: ambitions, goals, strategy, organisation, collect data, prioritise decisions		Architectural vision, layout, rooms, co-learning, co-designing, usability, innovation	Usability and functionality of design proposals, transforming visions to prioritized needs and solutions, from general to detailed and operational		Maintain usability while changes occur	Successful move-in, learning how to use the new facility, evaluations - requirements tests, further improvements	
Users *- with whom?*	Managers, top level users, define user groups	Lead users, patient organisa-tions, managers, top level users	Various users/stakeholders: patients, relatives, doctors, nurses, architects, secretaries, facility managers, service staff, operational staff		Nurses, doctors, technical users, facility managers	Varied groups of users	Varied groups of users	Varied groups of users
Tools, methods, boundary objects *- how?*	Meetings, feasibility studies, document reviews, dialogue, visioning, pick a picture, walk-through	Surveys -BUS, brainstorming, evaluations: PDE/POE, usability assessment – USEtool	Participatory workshops with users, design games, pictures, observation, charrettes - collaborative sessions, visioning, Healthcare Design Action Kit; simulations: table top, Virtual Reality, AEDET, prototypes, mock-ups		Workshops, user approvals, evaluations of building quality, commissioning, certifications DGNB, LEED		Soft landings -users learning building operation, building evaluations	Satisfaction surveys, WODI, DQM, POE, ST&M, ASTM standards, 5-years check

Examples from hospital cases in phase 1 of the usability briefing model

A few examples from hospital cases are presented to illustrate Phase 1 in the Usability Briefing model. This phase is chosen as most activities have highest intensity there. The focus is on creating a *Project Brief* (Blyth and Worthington, 2013), also called Functional Brief (Blyth and Worthington, 2010; Arge and Blakstad, 2010) or Design Brief (Roberts, 2010). It is based on relevant information from experts, users and evaluations in order to strengthen the visions, clarify the data about the size, extent and form of the project.

Briefing activities are strongly connected to user involvement and evaluation activities, with several work meetings, workshops and site visits. Initial user workshops are focusing on capturing strong visions for the new facilities, such that they reflect on prioritised needs and can be accepted and followed by the whole organisation and at the same time inspire the architects in next phases.

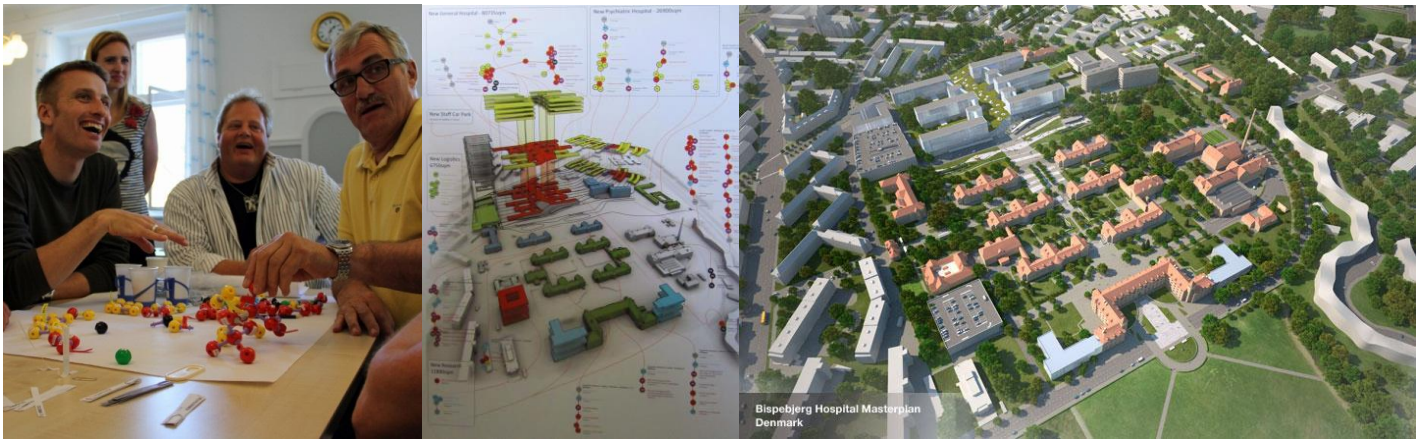
The interplay with user involvement and briefing is illustrated by **Bispebjerg Hospital** project case **(BH)**. The BH appointed six thematic user groups with different focus for a series of three workshops,

with ambitious goals, but restricted focus and power, so they could talk openly and efficiently collect ideas, knowing that not all of them will be satisfied in future project. In fact they got aware of the dilemmas and took them directly to the master plan competition brief, along their direct citations. For example one of the groups were discussing the gardens and accesibility. The assignment in the competion was structured as follows: ”plan for traffic and parking, with description of how to make good coherence with main traffic arteries around the grounds,…, traffic and infrastructure for bicyclists, pedestrians, public transport and parking”. The next chapter in the programme stated the dillema: “The overview of the site and easy orientation must be ensured. How can this be achieved whilst preserving the site’s historical identity of small and intimate rooms and niches”

Figure 7 Bispebjerg Hospital (BH), site, garden and winning proposal, photos:Fronczek-Munter, BDP, http://www.bdp.com

BH case had also good experiences with lead users’ workshops, which gave important input to structure and content of the master plan competition brief. One of the results was a model of the whole hospital structure and proximity of all hospital functions, see Figure 8.

Figure 8 Bispebjerg Hospital (BH), model of hospital functions and visualisation of masterplan of the winning proposal of BDP, TKT and Rambøll, photos: K. Grønkjær, A. Fronczek-Munter, BDP, http://www.bdp.com



Healthcare Innovation Lab (HIL) case is an example of user driven innovation with users as co-creators of new hospital architecture and organisation. Innovation occurred in both areas at once. Many design games (Brandt, E., & Messeter, J., 2004) were tested. Two of the methods and physical objects were found best to inspire users to innovate and be in a designing state-of-mind: the design game *Ovals* and *Table simulations*, see Figure 9. They proved to be both playful and highly effective (Fronczek-Munter, 2012).

Ovals/ Flower consisted of a poster with abstract oval forms, small papers with icons/photos/names of rooms, and a possibility to make new ones and placing them according to users’ own rules and common agreements. The task was to translate the drawing freely and organise the functions

accordingly. The participants were very excited and discussed the understanding of the task and possible solutions. The ideas were innovative and discussions covered both physical and organisational topics. The result was a design of the department on three levels with common areas in a central position, and all patients arriving the same place. Another new idea was a command bridge with a coordinator.

The *Table Simulations* were using paper sheets, empty boxes representing rooms, colourful post its, markers and Duplo figures representing patients and medical staff, egg timers, typical patient flows and typical disruptions. The tasks were to arrange the room boxes on the table and play typical patient flows through department in steps with specified time use. The users and facilitators were playing one figure at a time, moved it between the rooms, drew the walking lines with markers and set the allowed time for each step with the timers. The number of participants was 10-15 and quite realistic. The aim was to test the basic models of functional and organisational plans and evaluate the effectiveness, quality and overview. The exercise was very dynamic and quickly the previous solutions were abandoned and new ones developed by the group. Several concepts, like *Royal Model* and new "what if" ideas were tested and finally a *Star Concept* was chosen. It had a coordination function, placed in the central room for medical staff. The central coordination room is innovative for outpatient clinic both functionally and organisationally. The table simulations were flexible, quick, easy to use and surprised by not only allowing the quick tests of models, but also the strong potential for new innovations. The validation of concepts, turned into innovation and development of new, improved concepts.

Figure 9 Design games- Ovals and Table Simulations used in Healthcare Innovation Lab (HIL)

The case at **St. Olavs Hospital (SOH)**, see Figure 10, is an example of extensive user involvement both by healthcare employees and patients, as well as its effects on architectural design, which in fact received seven awards at Design & Health International Academy Awards in 2014, including best International Health Project. **SOH** had a successful patient involvement, with 10% patients in user groups, both individuals and representatives from patient organisations. Moreover, patient input gave a lot of design solutions to improve the hospital, both for patients and staff, which would not have appeared otherwise, ie. choosing only single bedrooms for the whole hospital development, and focusing on better privacy. This positive evidence can convince some, who unjustifiably consider patient involvement as a difficult process not producing results.

Figure 10 St. Olavs Hospital (SOH) photos Aneta Fronczek-Munter, SSCgroup.se, Stein Risstad Larssen, Arkitektur N

Conclusions

This paper reports from a completed Ph.D. research on *Usability briefing for hospital design*. It presents *Usability Briefing process model*, combining the four continuous activities of: 1) briefing, 2) evaluations, 3) user involvement and 4) design. This model provides visual overview of the activities in all building design phases, and focus, users and methods in each phase. In the proposed Usability Briefing model the activities of briefing and design are not sharply divided, but support each other in frequent interactions. User involvement and evaluations support briefing and design by common learning, participatory data collection and analysis of needs.

Further two models of *Evaluation focus flower* and *User involvement approaches*, together with hospital case studies, give evidence and guidelines to succesful application of the four activities in *Usability Briefing process* in building projects. By applying the models to hospitals it becomes possible to enable users, client and designers to co-create and take evidence-based decisions as part of the continuous process, resulting in more usable hospitals for the future.

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