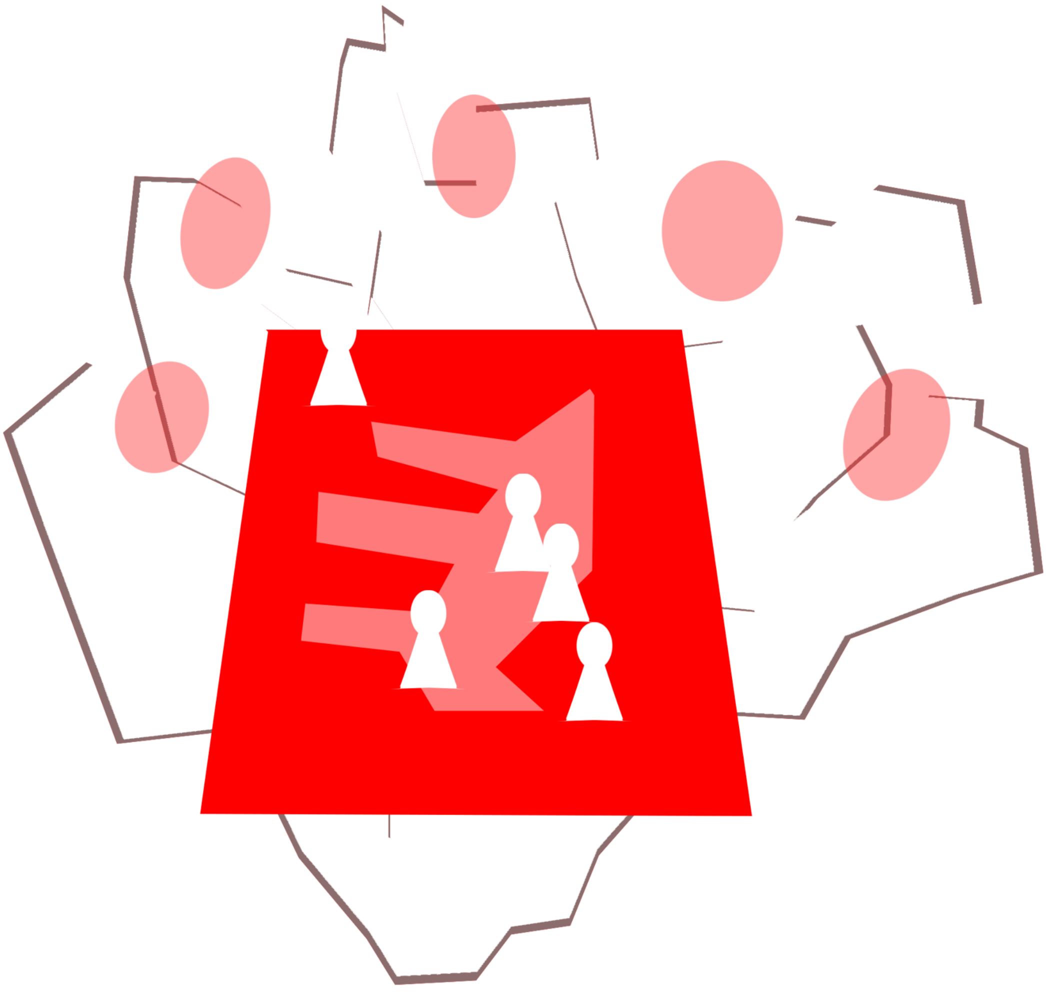
Julia A. Garde

Everyone has a part to play: GAMES AND PARTICIPATORY DESIGN IN HEALTHCARE



EVERYONE HAS A PART TO PLAY: GAMES AND PARTICIPATORY DESIGN IN HEALTHCARE

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SUMMARY

The design of new and improved work processes and work environments in healthcare is an important but challenging task. The stakes are high since changing work processes does not only have financial consequences, but may also directly affect the well-being of patients. Furthermore, the design problems are often highly complex because they involve complicated processes that take place over different physical and virtual domains, deal with a large number of different types of stakeholders with diverse demands and requirements, and make use of a rich set of tools and appliances. Finally, changes to existing work processes are often met with resistance by employees if they do not understand why the changes are needed and how the changes came to be. To address these challenges designing and implementing new and improved work processes, environments, tools and appliances in healthcare can benefit from three things: (1) access to experience and knowledge of all the stakeholders involved, (2) a detailed understanding of the total use situation[1], and (3) the commitment of the stakeholders.

This thesis offers a new approach to designing new work processes, work environments, tools, and appliances in healthcare that deals with all three challenges.

In particular, the contributions of the present research are fourfold: (1) the development of the Healthcare Environment & Activity Design (HEAD) game to enable practice experts from healthcare to explore complex design problems, elicit tacit knowledge, and derive creative design solutions, (2) showing that the developed game has a high overall usability and ability to empower the development of feasible design solutions, (3) assessing the usability and benefits of a participatory design approach and showing that by carefully implementing the HEAD game in a participatory design project approach convincing staff commitment can be achieved, (4) verifying the value of the design game for applications outside of a genuine participatory design approach with (a) participants with knowledge and expertise relevant to the use context, but no stakes, and with (b) designers who possessed design skills, but had no expertise relevant to the project's use context.

The HEAD game is played in group sessions. Participants use game materials to develop, alter, and re-enact use scenarios[2] in order to solve an assignment regarding a design project. The game aims to provide a holistic overview of a (future) use context and the corresponding activity task-flow. The HEAD game achieves this task with the help of (1) a miniature environment including playing figures, and (2)

[1] *A use situations includes one or more actors, their goals, the 'product', the context in which the use situation is taking place, the actions an actor takes and the events he or she has to deal with during their actions.*

[2] *A scenario is a rich descriptions of a use situation.*

a task-flow. The miniature environment is a physical representation of the people and places involved in the use scenarios in the work environments. The task-flow keeps track of the chronology and timing of tasks with the help of task-flow cards.

The present research verifies the usability of the HEAD game as well as the participatory design approach-induced commitment effects with the help of two real world design projects. The first project focussed on the redesign of the nursing work processes for a new building of a major Dutch hospital. The project, referred to as SWING[3], was a large project with 54 project members and over 13 workshops that was completed over the course of two years. The second project dealt with the design of a mobile hospital for disaster situations and was set-up for- and with the support of Holland Medical Services, a Dutch company. It was significantly smaller in scale than SWING, involved two separate workshops, and took several months to complete. Both projects were used to analyse the HEAD game's overall usability and ability to empower the development of design solutions. Furthermore, in SWING changes in the participants' attitudes in the context of a participatory design project approach were assessed. The second project was used to explore the relevance of the design game outside of a genuine participatory design approach, to reconfirm the game's benefit for a distinct design problem and to develop guidance about which kind of participants are suited for different project aims. To this aim, two design game workshops were held (a) with participants from hospital practice who had no stakes in this specific project, and (b) with designers.

For the analysis, qualitative methods such as observations, video analysis, interviews, questionnaires, and a detailed analysis of the design results were used. Both projects convincingly show the effectiveness and quality of the HEAD game for the generation of novel and feasible design solutions. Furthermore, combining the game with a participatory design project approach as in SWING is effective in increasing stakeholders' commitment. However, while the HEAD game is indeed an effective idea generation method, the type of game participants seems to determine to a large degree the characteristics of the design solutions. The design results of the SWING project were feasible and useful but rated as lower on the innovation scale than expected. The design results of using the HEAD game with trained designers without practical experience in healthcare and without stakes in the project, as in the mobile hospital project, produced highly innovative solutions on a lower detail level. In contrast, the design results of the group of healthcare experts without stakes were very in-depth but incremental.

Overall, the HEAD game offers valuable support for the design of new and improved work processes, environments, and/or tools and appliances in healthcare. The game supports communication and idea generation when applied

[3] *SWING is an acronym for the Dutch "SamenWerkprocesssen Inrichten for het Nieuwe Gebouw", which essentially translates to "jointly designing work processes for the new building".*

with stakeholders and healthcare experts as participants. It can however also be used purely for generating design ideas with designers. The combination of a participatory design project approach with the game lends itself very well to gain commitment to change processes.

SAMENVATTING

Het ontwerpen van nieuwe en verbeterde werkprocessen en werkomgevingen in de medische sector is een belangrijke maar uitdagende opgave. De belangen zijn groot, aangezien veranderingen op dit gebied niet alleen financiële gevolgen-, maar ook directe invloed op het welzijn van patiënten kunnen hebben. Tevens zijn dit type ontwerpproblemen vaak complex: Zij behandelen processen, die zich binnen verschillende fysieke en virtuele domeinen afspelen en grote aantallen stakeholders met variërende eisen en wensen en een grote verzameling van hulpmiddelen en apparaten omvatten. Tenslotte worden veranderingen in bestaande werkprocessen door stafleden snel met weerstand ontvangen, wanneer voor hen niet duidelijk wordt waarom de veranderingen nodig zijn en hoe deze tot stand zijn gekomen. Om met deze uitdagingen om te gaan kan het ontwerpproces en de implementatie van nieuwe en verbeterde werkprocessen, hulpmiddelen en apparaten profiteren van: (1) toegang tot ervaring en kennis van alle betrokken stakeholders, (2) goed overzicht van de complete gebruikssituatie[4], en (3) creëren van draagvlak bij de stakeholders.

Dit proefschrift presenteert een nieuwe benadering voor het ontwerpen van werkprocessen, werkomgevingen, hulpmiddelen en apparaten in de medische sector, die rekening houdt met alle drie bovenstaande aspecten.

De bijdrage van dit onderzoek is viervoudig: (1) de ontwikkeling van de "Healthcare Environment & Activity Design (HEAD)" game om medische experts uit de praktijk in staat te stellen complexe ontwerpproblemen te verkennen, toegang te verkrijgen tot impliciete kennis ("tacit knowledge") en creatieve ontwerpoplossingen te ontwikkelen, (2) het aantonen dat de ontwikkelde game een hoge algemene gebruiksvriendelijkheid ("usability") heeft en het vermogen om het genereren van nuttige en haalbare ontwerpen te faciliteren, (3) het aantonen van de gebruiksvriendelijkheid ("usability") en de voordelen van een participatory design project aanpak en dat bij een zorgvuldige implementatie van de HEAD-game in een participatory design project overtuigende betrokkenheid en draagvlak bij de deelnemers bereikt kan worden, (4) de verificatie dat de design game ook waardevol is bij toepassingen buiten een echt participatory design project, namelijk binnen toepassingen met (a) deelnemers met kennis en expertise die relevant zijn voor de gebruikscontext, maar die geen belang hebben bij het project zelf, en (b) deelnemers die ontwerpvaardigheden bezitten, maar geen expertise relevant voor

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[4] *Een gebruikssituatie omvat een of meerdere actoren, hun doelen, het "product," de context waarin de gebruikssituatie plaats vindt, de handelingen die de actoren uitvoeren en de gebeurtenissen waarmee zij tijdens het uitvoeren van de handelingen te maken krijgen.*

de gebruikssituatie.

De ontwikkelde HEAD-game wordt in groepssessies gespeeld. Deelnemers gebruiken hierbij spelmaterialen om scenario's[5] te ontwikkelen, na te spelen en te veranderen om ontwerpopdrachten op te lossen. De game is bedoeld om een holistisch overzicht van een (toekomstige) gebruikssituatie en de corresponderende werkprocessen te geven. De HEAD-game bereikt dit middels (1) een miniatuur omgeving met spelfiguren en (2) een overzicht van de taakvolgorde('task flow') van werkprocessen. De miniatuuromgeving is een fysieke representatie van de mensen en de ruimtes die bij de gebruikssituaties betrokken zijn. Het taakoverzicht legt met behulp van taakkaarten de chronologie en het moment waarop taken uitgevoerd worden vast.

Dit onderzoek bevestigt zowel de gebruiksvriendelijkheid ("usability") van de HEAD game als het positieve effect van de participatory design aanpak op draagvlak en betrokkenheid aan de hand van twee ontwerpprojecten uit de praktijk. Het eerste ontwerpproject richtte zich op het herontwerp van de verpleegkundige werkprocessen voor toepassing binnen de nieuwbouw van een groot Nederlands ziekenhuis en droeg de titel "SWING"[6]. Het project was een omvangrijk project met 54 projectdeelnemers en meer dan 13 workshops en heeft twee jaar geduurd. Het tweede project richtte zich op het ontwerpen van een mobiel ziekenhuis voor rampsituaties en was georganiseerd voor- en met behulp van het bedrijf Holland Medical Services. Het project was significant kleiner dan SWING, omvatte twee workshops en duurde enkele maanden. Beide projecten werden gebruikt om de gebruiksvriendelijkheid ("usability") en het vermogen van de HEAD-game om ontwerpoplossingen te genereren te evalueren. Daarnaast werden in SWING eventuele veranderingen in de attitude van de deelnemers in de context van een participatory design project in kaart gebracht. Het tweede project werd gebruikt om de relevantie van de design game buiten een participatory design aanpak te onderzoeken. Doel was het nut van de game voor een ander ontwerpprobleem te verifiëren en advies te ontwikkelen betreffende de vraag welke deelnemers het beste voor welke projectdoelen betrokken kunnen worden. Hiervoor werden twee workshops gehouden met (a) deelnemers uit de ziekenhuispraktijk die geen belang bij het project zelf hadden en (b) met ontwerpers.

In de analyse zijn kwalitatieve methoden zoals observatie, video-analyse, interviews, enquêtes en een gedetailleerde analyse van de ontwerpresultaten toegepast. Beide projecten bevestigen overtuigend de effectiviteit en kwaliteit van de HEAD-game voor de generatie van nieuwe en haalbare ontwerpoplossingen. Verder is de combinatie van de game met een participatory design aanpak zoals toegepast in SWING effectief in het verbeteren van het draagvlak en de

[5] *Een scenario is een uitvoerige beschrijving van een gebruikssituatie.*

[6] *SWING is een acroniem voor "SamenWerkprocesssen Inrichten for het Nieuwe Gebouw".*

betrokkenheid van de deelnemers. Hoewel de HEAD-game inderdaad een effectief ideegeneratie- middel is, lijkt het type deelnemers de karakteristieken van gegenereerde ontwerpoplossingen te beïnvloeden. De ontwerpoplossingen in SWING waren haalbaar en realistisch, maar werden als minder innovatief dan verwacht beoordeeld. Binnen het mobiele ziekenhuis project resulteerde de inzet van de HEAD-game met getrainde ontwerpers zonder praktische ervaring in de medische sector en zonder belang in het project in zeer innovatieve oplossingen op een lager detailniveau. De oplossingen van de medische experts daarentegen waren zeer gedetailleerd, maar minder innovatief.

De HEAD game is een waardevolle ondersteuning voor het ontwerpen van nieuwe en verbeterde processen, omgevingen, hulpmiddelen en apparaten in de medische sector. Wanneer de game toegepast wordt met stakeholders en medische experts, ondersteunt deze zowel de onderlinge communicatie en begrip als ook de ideegeneratie. De game kan echter ook puur als ondersteuning voor ideegeneratie met designers worden toegepast, die geen relevante kennis en expertise hebben m.b.t. de gebruikscontext. De combinatie van een participatory design project aanpak met de game leent zich zeer goed om draagvlak en betrokkenheid voor veranderprocessen te genereren.

VOORWOORD

Met het idee dat er binnen de zorg nog veel te verbeteren valt, ben ik aan mijn promotieonderzoek begonnen. Natuurlijk, omdat deze verbeteringen dan mensen zouden kunnen helpen (ja, cliché). Maar ook omdat, als IO-er, gewoon mijn vingers beginnen te jeuken als ik iets zie dat de potentie heeft leuk en uitdagend werk op te leveren - en in de zorg zijn veel uitdagingen met voldoende complexiteit te vinden. Aangezien het moeilijk is om je dan tot slechts een klein deeltje van het geheel te beperken, heb ik er naar gestreefd om alle delen van “Healthcare environments en Activities” in een ontwerpproces mee te nemen. Tijdens mijn onderzoek was mijn uitdaging om het overzicht te bewaren tussen Participatory Design (mijn waardering voor dit vakgebied wisselende sterk gedurende het onderzoek), Design Games (leuk, spelen met LEGO en pionnetjes) en de ziekenhuispraktijk (boeiend, complex en soms verbazingwekkend), en tegelijkertijd de balletjes van projectmanagement en onderzoek (en onderwijs) in de lucht te houden. Terugkijkend was mijn onderzoek heerlijk praktijkgericht, ben ik een beetje ouder en wijzer en houd ik een kleine hoop dat mijn inspanningen meer hebben opgeleverd dan dit boekje.

Ik ben dankbaar dat ik mijn promotieonderzoek op het gebied van ontwerpen voor de zorg heb kunnen uitvoeren. Dit was zo niet mogelijk geweest zonder mijn promotor Fred van Houten en mijn assistent-promotor Mascha van der Voort, die mij naar mijn studie in dienst hebben genomen en mij veel vrijheid hebben geboden in het kiezen van mijn onderzoeksthema. Fred, dank je voor deze vrijheid en het vertrouwen. Mascha, dank je voor al je ondersteuning, je opbouwende kritiek en je uitgebreide en snelle feedback op mijn werk. Behalve van dit inhoudelijk advies heb ik dankbaar gebruik gemaakt van de praktische tips die je voor iedere situatie paraat hebt. Je bent een goede luisteraar - ook met betrekking tot dingen die niets met het werk te maken hebben. Behalve tijdens het werk hadden we veel gezellige momenten bij lego workshops, tijdens het versieren van taarten, en met de onderzoeksgroep.

Marieke Holtslag, Cees Berger en Lidy Schoolkate, bedankt dat jullie project SWING mogelijk gemaakt hebben! Het was fijn om met jullie samen te werken. Ik heb zeer genoten van het meelopen op de afdelingen en de gesprekken met alle verschillende mensen bij het Medisch Spectrum Twente en de inzichten die dit heeft opgeleverd. Een grote dank aan de SWING deelnemers, in het bijzonder aan de enthousiastelingen die erg van de workshops konden genieten, en zo het project voor mij nog meer de moeite waard hebben gemaakt. Jos, je hebt veel tijd in de ontwikkeling van de VR-tool voor het SWING project gestoken. Deze tool was een goede toevoeging aan het project, die veel projectdeelnemers geboeid heeft.

Bert Hamming, dank je voor de interessante case over het mobiele ziekenhuis, de samenwerking en het gezellige bezoek aan de MOGUS (dat ermee begon dat ik in de ochtendmist met een Opel Corsa tussen de tanks bij een militaire oefening belandde - met op de achtergrond het knallen van schietoefeningen). Ook ben ik blij met de deelname van drie specialisten en een aantal collega-ontwerpers aan de workshops voor de mobiele ziekenhuis case - Ellen, Wouter, Jos en Mascha, hartelijk bedankt!

Helemaal in het begin van mijn onderzoek heb ik een aantal artsen en technische medewerkers van twee ziekenhuizen (UMCU en Meander) en een bedrijf mogen interviewen. Dit heeft mij voor het vervolg veel inzicht en een goede startpositie gegeven. Ik ben dan ook dankbaar voor deze boeiende gesprekken. Sanne-Marye en Willem-Sander, bedankt voor het werk dat jullie tijdens je masteropdracht en capita selecta op mijn onderzoeksgebied hebben verricht. Willem-Sander en Jesse, bedankt voor de assistentie tijdens enkele SWING workshops. Anke, dank je voor je goede tips voor de lay-out van dit proefschrift!

Het afgelopen jaar stond bij mij alles in het teken van het afronden van dit proefschrift, waardoor familie en vrienden te weinig aandacht hebben gekregen. Vanaf nu is er hopelijk weer meer tijd voor jullie. De collega's die bij het onderwijs rekening ermee hebben gehouden dat ik vaak fysiek en in gedachten bij mijn proefschrift was komt dank toe. Arie-Paul, excuses dat ik de afgelopen tijd maar weinig aanspreekbaar was en bedankt dat je zo'n leuke, soms heel rustige en soms heel grappige kamergenoot bent. Met de OPM collega's heb ik vermakelijke momenten aan de koffietafel, tijdens de pub quiz, spelletjesavonden, sinterklaasspelborrels, etentjes en natuurlijk in het BATA team beleefd. Maaike en Wouter, jullie zorgen voor gezellige koffiemomenten en een plek om zorgen te delen en bieden me nu ook paranimfisch support.

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1 INTRODUCTION

1 INTRODUCTION

1.1 CONTEXT

An ageing population and the continuous introduction of new treatment possibilities place a heavy burden on healthcare budgets in the Netherlands. In reaction to increasing healthcare expenses, the Dutch government introduced a new health insurance act in 2006, which introduced managed competition[1] to the Dutch healthcare system. The act puts pressure on healthcare providers to deliver high quality care more efficiently (Meijer, Douven, & van den Berg, 2010). Dutch hospitals started competing for patients and staff by (1) buying new technology and constructing new buildings, facilities, and outpatient centres for specific treatments, or (2) by setting up mergers and cooperation between hospitals to increase market power and efficiency gains (Meijer, et al., 2010).

Another development putting pressure on Dutch hospitals is the increasing replacement of treatments involving hospitalization by policlinic treatments. In the Netherlands, the number of hospitalizations has increased in the last decades, but the time of hospitalization decreased from fourteen to seven days on average in the period from 1981 to 2005 (VTV, 2010). The only patients that remain in hospitals for a longer period are those who are severely ill. These developments lead to a higher turnover of patients that stay only one or two days. These aspects increase the care load of the hospital staff. When faced with increased workload and need for more efficiency, solutions are traditionally looked for in the design and application of new technology, which overlaps with the above-mentioned strategy one. Technologies such as tracking and tracing of people and items, smart environments, telecare, or ICT in general offer many opportunities to make healthcare safer, more efficient, and faster. However, implementation of such technologies is difficult and progresses slowly, due to a conservative environment, high safety demands, and uncertainty about social effects.

This research aims to support healthcare organisations in reorganising themselves by supporting the design of healthcare environments and activities. A healthcare environment is a context in which occupational caretakers or companies deliver services to people in order to defeat illnesses. Healthcare environments can be characterized by the patients, the staff and their roles and responsibilities, the facilities, the space available, the information flow, appliances and materials. These elements are part of every activity that is carried out in care-, examination- and treatment processes. Healthcare environments can take on many different forms,

[1] *Managed competition refers to the idea that insurers and healthcare providers compete on price and quality while the government establishes certain rules to guarantee public objectives (see, e.g., Kleef, 2012).*

ranging from hospitals, outpatient clinics, and family doctor practices to patients' homes. Each environment poses different challenges for the design process. This thesis focuses on design problems in hospitals, as they provide the most challenging environment in terms of complexity of treatment procedures and scale of both space and activities.

Once strategy one - buying new technology or constructing new buildings, facilities and outpatient centres - has been chosen and a hospital is renewing healthcare environments and activities, it can be faced with a complex design problem. The stakes are high, since changing work processes do not only have financial consequences, but may also directly affect the well-being of patients. Furthermore, the design problems are often highly complex because they involve complicated processes that take place over different physical and virtual domains, deal with a large number of different types of stakeholders with varying demands and requirements, and make use of a rich set of different tools and appliances. Finally, changes to existing work processes are often met with resistance by employees if they do not understand why the changes were needed and how the changes came to be.

Unfortunately, the current approach to healthcare environment and activity design is fragmented across different specialists' fields such as architects, ICT experts, and process optimization experts. Each specialist tends to focus on his own field and possible solutions in that field. This fragmented approach does not deliver the holistic overview that is generally needed to improve the complete healthcare environment including the activities.

1.2 RESEARCH FOCUS

This research proposes that healthcare environments and activities can benefit from a holistic, less fragmented design approach in the early design phases to generate an overview of how all involved elements of the healthcare organisation are linked in daily practice. Such an approach can prevent unanticipated effects of development efforts by one specialist area to the other. Furthermore, such a holistic approach supports looking for opportunities and solutions beyond the limitation of one area of expertise.

To acquire a good overview about how the different elements are linked in healthcare environments and activities, practical knowledge and experience from the healthcare domain are essential. In daily healthcare work practice, the specialist fields come together when performing care processes. Hence, to work towards solutions that are fit for practice, the practical knowledge and experience from healthcare practitioners from all relevant domains must be included in the design process. Furthermore, changes to the way staff do their daily work are usually not received gracefully, if they are imposed. Main reasons are the believe that management or contracted designers do not have enough knowledge about workplace reality to develop practice fit solutions, and the fact that the need for the change is often unclear. These challenges in developing and implementing changes can be addressed by allowing staff to have a say in how these changes are shaped. Due to the need for practical knowledge and experience and the need to smoothen implementation processes, this research proposes a participatory design approach for healthcare environment and activity design. Participatory design is a set of principles and values for participation in design processes that centre on partnership between designers or researchers and prospective users[2] and other stakeholders, mutual learning and equalizing power relations in order to develop artefacts, activity flows and work environments (Kensing & Greenbaum, 2013; Robertson & Simonsen, 2013; Spinuzzi, 2005). Hence, practitioners who have substantial stakes in the project are included as partners in the design process.

However, involving healthcare practitioners in the design process for healthcare environments and activities requires dedicated facilitation. Practitioners are usually easily capable to provide evaluative feedback to proposals for small changes to the current situation. Yet, reflecting on a proposal for a completely new situation, based on e.g., technical or architectural drawings, is much more difficult. Developing new ideas by oneself, while continuously anticipating possible consequences of design decisions, makes the highest demands on a person's ability to envision a future situation with all its variables. Therefore, including healthcare practitioners in the development of new ideas must be supported by appropriate design techniques and tools that allow them to imagine the future situation and explore the consequences of their design decisions. The present research proposes a design game to bring together practitioners and enable them to participate in the design process. A design game is a setting in which *"a diverse group of players is gathered around a collaborative activity guided by simple and explicit rules, assigned roles and supported by pre-defined game materials"* (Brandt, 2010, p.131-132). The many specific elements of healthcare environments and activities demand a dedicated design game that provides a holistic overview of the complete situation.

2 *Some researchers argue that the term "user" is defamatory, since it could refer to people as passive beings on which products are imposed. This thesis introduces the term only to distinguish people who will eventually use a product/environment from stakeholders, who have stakes in the design, sale, or use of a product, but are not necessarily using it themselves.*

1.3 RESEARCH APPROACH

The present research aims to support the (re)design of healthcare environments and activities by means of a dedicated design game combined with a participatory design approach. The proposed design approach intends to (1) take into account the experience and knowledge of all the stakeholders involved, (2) facilitate a detailed understanding of the total use situation, and (3) foster the commitment of the stakeholders. To show the usability of the proposed game as well as a participatory design approach, the design game was tested within different design projects and with participant groups, in- and outside of a participatory design approach. Hence, this research has four foci: (1) developing a design game to enable practice experts from healthcare to explore complex design problems and derive creative design solutions, (2) testing whether the developed design game has a high overall usability and ability to empower the development of feasible design solutions, (3) assessing the usability and benefits of a participatory design approach and in particular testing, whether by carefully implementing the game in a participatory design project approach convincing staff commitment can be achieved, (4) providing insight about the relevance of the design game outside of a genuine participatory design approach with (a) participants with knowledge and expertise relevant to the use context, but no stakes, and with (b) designers who possessed design skills, but had no expertise relevant to the project. Two real-world design projects were executed to analyse the design game's overall usability and ability to develop feasible design solutions.

The first project was set up as a participatory design project to assess the benefits of such an approach. The project, referred to as SWING , was executed for and with Medisch Spectrum Twente (MST), a regional hospital which has a new hospital complex currently under construction. Aim was to develop new work processes and make recommendations for supporting ICT technologies and other tools for the new building. Important drivers of the project were changes in the new building layout (going from two- to five-person rooms to all single person rooms), a new catering concept and the aim to become a paperless hospital. This large project with 54 project members and over 13 workshops was completed over the course of two years.

The second project was used to explore the relevance of the design game outside of a genuine participatory design approach, to reconfirm the game's benefit for a distinct design problem and to develop guidance about which kind of participants are suited for different project aims. To this aim, two design game workshops were held (a) with participants from hospital practice who had no stakes in this specific project, and (b) with designers. The second design project was provided by Holland Medical Services, a Dutch company, and dealt with the design of a mobile hospital for disaster situations.

1.4 THESIS OUTLINE

The first four chapters of this thesis provide a detailed overview of the practical problem and the relevant design research. In particular, Chapter 2 describes the current approaches used for healthcare environment and activity design, the design challenges, and the need of a holistic design approach. Chapter 3 introduces the reader to participatory design, its challenges for practitioners and researchers, and its assumed benefits for healthcare environment and activity design. Finally, Chapter 4 addresses different creative techniques that can be used within design games and the benefits as well as challenges of design games in general. Next, the research methodology of the thesis is outlined in Chapter 5. It explains the research questions, the data collection process, and the analysis methods used. Chapters 6, 7, and 8 address the execution of the research, starting with a presentation of the dedicated design game and the choices that have been made in its design process in Chapter 6. Chapter 7 presents project SWING, the large participatory design project build around the use of the design game. The second design project, dealing with the application of the design game to the mobile hospital project outside of a participatory design context is presented in Chapter 8. The thesis concludes in Chapter 9 with a reflection on the research results, its implications as well as limitations, and opportunities for future research.

2 HEALTHCARE ENVIRONMENT & ACTIVITY DESIGN

2 HEALTHCARE ENVIRONMENT AND ACTIVITY DESIGN

2.1 INTRODUCTION

Under the pressure of a changing patient population and higher competitiveness, hospitals are forced to change the way they work and optimize their work processes. However, the design and implementation of new and improved work processes and environments in the healthcare sector is a challenging task. The stakes are high, the design problems are often highly complex, and changes to existing work processes are often met with resistance by employees. Unfortunately, the current approach to healthcare environment and activity design is fragmented across different specialists' fields such as architects, ICT experts, and process optimization experts, and as a result fails to provide a holistic overview that is required to meet all the challenges. This chapter defines "healthcare environment and activity design" (Section 2.2), describes its major challenges (Section 2.3), provides an overview of current approaches (Sections 2.4 and 2.5), and discusses the requirements as well as promising directions for a new holistic and "designerly"[1] approach (Section 2.6).

2.2 HEALTHCARE ENVIRONMENT AND ACTIVITY DESIGN: DEFINITION AND PURPOSE

The delivery of healthcare services in hospitals is enabled by the entangled activity-flows of different staff members and patients. Activity-flows are sequences of several activities that are executed in order to complete tasks of a higher order. E.g., providing a patient with an infusion involves a sequence of activities including walking to a storage room, using a key card to open the door, picking tubes and other material from different cabinets, measuring fluids for the infusion, documenting the infusion, etc. The activities typically take place over different locations, include the use of different tools (key card, tubes, pen etc.), and interaction between different people.

As a result, "healthcare environments and activities" are defined by (1) the activities of the activity-flows, (2) the components of healthcare environments that

[1] *A "designerly" approach is characterized by the ability to "tackle 'ill-defined' problems", being "solution-focused", a "constructive" mode of thinking, the usage of "'codes' that translate abstract requirements into concrete objects" and the usage of these codes to "both 'read' and 'write' in 'object languages'" (Cross, 1982, p. 226).*

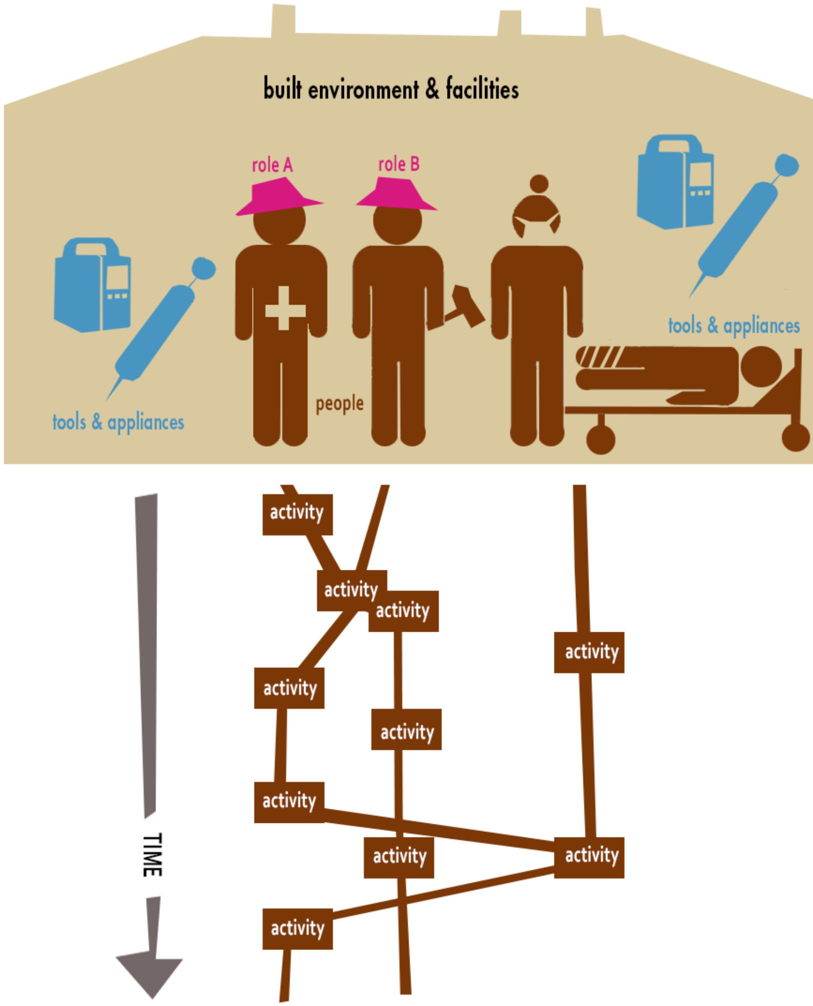

Figure 2.1: Healthcare Environment with people with different roles, products (appliances & tools), and space, (top) and entangled activity flows (bottom).

are involved in these activities, including (a) persons with various roles and (b) tools and appliances (or products), and the (3) space and the locations of people and tools in the environments (see Figure 2.1).

Many of the activity-flows in hospitals are part of standardized procedures, which are continuously reinvented and improved (Morrison & Blackwell, 2009). As these standardized activity-flows form a central part of practice, they should be central to designing healthcare environment.

The efficiency, effectiveness, and perceived pleasantness of the activity-flows depend on all the components of healthcare environments, including the arrangement and availability of tools and facilities and the order in which activities are executed. Therefore, a holistic overview of the complete use situation[2] is needed. When a hospital is at the verge of a major renewal of its healthcare environment, it is important to know all components that are involved in the care- and treatment processes. However, knowing the components alone is not enough, since one also needs to understand the dependencies among them. Altering one component of the healthcare environment will typically affect others elements as well. For instance, the introduction of a medical appliance has the tendency to alter the treatment procedures in which the appliance will be used: The type of activities that need to be executed, their order, the location where the treatment is given, and the number of people needed to deliver the treatment might change. In case there is no complete understanding of the environment, the designer of the medical appliance can unknowingly alter the treatment procedure. Another advantage of taking a holistic perspective first is that it tends to broaden ones perspective and avoids short-sighted design biases, e.g., redesigning a tool rather than the activity-flow itself. The *"what"* and the *"how"* - the type of solution needed (a new tool, a new work-flow, a reorganization of responsibilities etc.) and the way in which it will work –should be developed in parallel (Dorst, 2011, p.524).

A holistic design approach for healthcare environments and activities is the most essential in the early design phases to provide guidance about what problems to tackle and in what areas the solution could be looked for to inform the subsequent detailed product, facility, and procedure design. However, such an open approach in combination with many variables is also very challenging and overview over the complete healthcare environment with all its component and the activities can be lost easily.

2.3 CHALLENGES FOR HEALTHCARE ENVIRONMENT AND ACTIVITY DESIGN

Healthcare in hospitals is a highly specialized field including sometimes complex treatment procedures, various professionals and hospital characteristic organization structures. A suitable approach for healthcare environment and activity design must address the peculiar design challenges of this field addressed in this section.

2.3.1 ACTIVITY FLOWS: DYNAMIC, SCHEDULED OR UNSCHEDULED, AND COMPLEX

Many activity-flows in healthcare procedures contain dynamic use situations. In dynamic use situations a product is used by different people with diverse capabilities and goals in various situations (van der Bijl-Brouwer & van der Voort, 2008). In hospitals, for instance, software to view and edit digital patient data is

2 *A use situations includes one or more actors, their goals, the "product", the context in which the use situation is taking place, the actions an actor takes and the events he or she has to deal with during their actions.*

used differently by doctors and nurses. It may be used in various locations such as the patient room, the staff room, and the doctor's home office. The goal of the nurse might be monitoring the health of patient and therefore she needs to keep the patient data up to date by, e.g., inserting blood pressure measurement numbers whereas the goal of a doctor might be providing a treatment including specific drugs and therefore he needs to write a digital prescription for the drugs. Furthermore, nurses and doctors may be using the software simultaneously and be looking at the same screen when doing the ward round together. As medical appliances are often used by several different hospital departments (Martin, Norris, Murphy, & Crowe, 2008), users with differing backgrounds must be able to work with the appliances equally well.

There are two different types of use situations that must be addressed in the design process: (a) work processes that follow a predefined procedure, i.e. scheduled use situation, and (b) situations that cannot be planned in advance, i.e. unscheduled use situation. Using the above example again, the software is for the most part used during the scheduled ward rounds to find and edit information, but may also be used in unscheduled emergency situations during which patient data must be accessible on short notice. The complexity of activity-flows depends on the type of hospital environment (e.g., examining rooms versus operating rooms) and activities involved. The most complex activity-flows are characterized by critical decision-making, low tolerance for errors, the need for team collaboration, the need for highly specialised knowledge and skills, and include that unforeseeable events can have catastrophic consequences (Restrepo, Nielsen, Pedersen, & McAloone, 2009).

In summary, a design approach for healthcare environments and activities should provide an overview of scheduled and unscheduled activities, dynamic use situations, and complex activity-flows.

2.3.2 SPECIALIZED KNOWLEDGE AND PRACTICE

Designing for healthcare environments and activities is designing for a world of professionals and hence forms a challenge for designers or development teams who usually do not have personal experience with the staff perspective of healthcare. Whereas in designing consumer products the chances are good, that designers have a sufficient personal frame of reference to anticipate product use, for healthcare most extern designers miss such a frame of reference of work practice.

Besides need for practical experience, there is another challenge that is related to designing for complex activity flows: A design for professional work situation that takes into account all identifiable variables and works in theory, might still not work in practice, because behavioural aspects were not anticipated fully. How things should be done in theory and how they are actually done in practice, does not always match, especially not when the planners are not the same as the executors. In practice, approaches might be taken that are not optimal from a planner perspective, because they fit the current work practice better or due to personal preferences or they just seem more straightforward. This discrepancy is not necessarily due to user ignorance, but can most likely be credited to the human unpredictability involved in how different persons operate and not least to a lack of practical understanding on the side of the developers about the actual context of products and environments.

In order to deal with both challenges, it seems natural to incorporate the knowledge and experience of future product users and stakeholders into the design process in some structured way.

However, including stakeholders into design processes in a sensible way faces its own set of challenges. Firstly, the stakeholder consists of people with very different backgrounds, interests, skills, and hierarchical standings. The group of stakeholders consist of doctors, nurses, people from ICT department, people from the facility management department, and hospital managers (Martin, et al., 2008). Sometimes, the hierarchical structure with the special high status of medical experts poses problems on including practitioners in design, making the doctors less approachable, less available or even dominating group meetings. Managing these differences is not easy. Secondly, including medical staff in design projects is difficult because they typically have a high workload and often many acute situations that they have to deal with. This makes the staff less accessible for innovation projects that take place "next" to the regular work. Thirdly, large and long projects in healthcare have to deal with the problem that current users may not be the actual future users, due to high staff turnover (Balka, 2013). The latter situation can lead to problems since design results should be future proof, and hence it is important to limit the danger of designing for the preferences of a small group of specific individuals.

In conclusion, future users and different stakeholders must be included in the design process to gain access to their specialized knowledge and practice. However, their inclusion is not straightforward; an approach should take into account their limited availability, their differing skills and interests, hierarchies and the high staff turnover in hospitals.

2.3.3 EXISTING STRUCTURES

For nearly every design situation there is a point of departure that imposes some requirements and constraints. There will almost never be a tabula rasa situation in which a completely new hospital with new staff, appliances, and procedure should be designed. There will be existing structures based on which something new must be built. Existing structures include systems or products a hospital has invested in financially or the current organization structure that needs to be taken along to the new situation. These existing structures can provide benefits to the design process, e.g., communication channels in the current hospital that can be used in the design process, but also hinder the process of implementing something new.

Hospitals are known for existing organization structures consisting out of a large number of small departments (silo organization) who do not necessarily communicate with each other. As a result, the patient might move through multiple silos on his “customer journey” (Stickdorn & Schneider, 2011) through a hospital without complete communication and cooperation taking place.

The introduction of new technologies or new organizational systems in hospitals, as in any other organization, requires careful change management. The existing structures cannot be simply overturned in a top-down fashion without expecting some resistance from the staff. Beyond the structures that are often defined top-down (schedules, material, tasks), staff do (and should) shape their own tasks in detail. Changing the way work is done can be difficult, as staff does not always see the necessity to change the way they handled things for years. Similarly, the introduction of new technologies in hospitals can be difficult due to institutional behaviours, conflicting incentives, and cultural issues (Sutherland, van den Heuvel, Ganous, Burton, & Kumar, 2005).

A design approach for healthcare environments and activities should take into account existing structures and use them for the advantage of the project whenever possible. Furthermore, the approach should promote communication between departments (or silos) if needed and take into account possible resistance to changes.

2.3.4 ONE OF A KIND DESIGN

Healthcare environment and activity design projects are often one of a kind projects. While this applies to building design, product- and software tools usually are not one of a kind designs. Information technology in hospital practice, e.g., is for economic reasons often deployed across a large number of client institutions (Morrison & Blackwell, 2009). Hence, hospital- or department- specific requirements for software and products can only be realized, if it either is financially attractive for the vendor and hospital or it can be accomplished via end-user customization.[3] In case there is a vendor monopoly, it can become even more difficult to realize user requirements from a single organization in a product (Kensing & Greenbaum, 2013).

A design approach to healthcare environment and activity design should find a balance between providing realistic boundaries with respect to product and tool design and leaving enough room for idea generation.

[3] *The end-user creates the final product by, e.g., composing predefined components or by making changes to an existing product.*

2.4 FRAGMENTED APPROACHES TO HEALTHCARE ENVIRONMENT AND ACTIVITY DESIGN

Currently, hospitals (and vendors) apply, often in parallel, a variety of different approaches related to the design of healthcare environments and activities. Most of these design approaches deal with the optimization or design of specific areas of the healthcare environment. This section gives a brief review of the most important approaches used in practice.

2.4.1 ENVIRONMENT AND PROCESS OPTIMIZATION

There are several different expert approaches for process *optimization* that deal with specific areas of healthcare environments and activities. Expert approaches are characterized by experts from specific professions or fields of science who aim to approach a problem from the perspective of their specific expertise. E.g., experts from operations research apply mathematical techniques to optimize care processes with respect to quality and costs. While this approach requires some understanding of the underlying healthcare practice to formulate a meaningful mathematical optimization problem, the level of details of the work processes is usually rather limited. While the operations research approach is very useful for a particular set of well definable problems, it is not suited to provide guidance towards novel and innovative design solutions.

Another popular approach is the Lean or lean six-sigma approach which aims at the elimination of excess in work processes, improvement of client satisfaction, and shortening of lead times. The focus here is on structured *incremental improvement* of processes and the product (in this case the healthcare service). It is not an approach to develop completely new processes or promote larger changes. The "productive ward" and "productive operating room" are methods that are based on the lean approach, specifically developed for the National Health Service (UK) by consultancy McKinsey (see, e.g., (Wilson, 2009)). These approaches are not pure expert approaches, since they actively include hospital staff in the process and look at the overall healthcare environment.

In evidence-based design, knowledge about existing solutions from, e.g., literature is gathered, analysed, applied, and the effects of the design are measured (Hamilton, 2003). Evidence based design aims to improve staff effectiveness, staff stress and fatigue, patient safety, patient and family stress and well-being, and overall clinical outcomes. There is a growing body of knowledge that aims to find evidence for the healing properties of specific environments (see, e.g., Altimier (2004)) Evidence-based design is predominantly applied in the design of physical environments (architecture and interior) and typically does not actively include users in the design process. In addition, it does not provide guidance about what problems to tackle and in what kind of area the solution could be found. It essentially is not a well-defined method to generate new design solutions, but rather demands that design decisions are based on sufficient evidence.

2.4.2 APPLIANCE AND IT SYSTEM DESIGN

Appliances and healthcare IT systems are usually developed by vendors outside hospitals, but sometimes also internally by hospitals. The appliances in healthcare are of varying complexity, ranging from simple blood sugar meters to highly complex robots for minimal invasive surgery.

Currently there are several problems with the use of appliances and IT in hospitals. The use of a mix of many different appliances in hospitals can cause usability and safety problems due to the lack of common industry standards for medical appliances and their interfaces (buttons, screens, and connectors) or simply substandard usability. An often cited example where bad usability can lead to safety issues are the interfaces of infusion pumps (see, e.g., Garmer, Liljegren, Osvalder, & Dahlman, (2002)). With more advanced treatment procedures, such as surgery, new technology is often pushed into practice instead of required by surgeons and hence does not always completely comply with their needs (Jalote-Parmar & Badke-Schaub, 2008). Medical device companies generally lack understanding about which methods to apply to include practice knowledge into the design process and how to transform user requirements into product features (Restrepo, et al., 2009).

Many new IT systems in healthcare suffer from serious introduction problems and bad usability, even though there are various guidelines and standards prescribing the application of human factors and co-design approaches (Freudenthal, van de Geer, Stappers, & Pattynama, 2013). One of the reasons could be that end-users did not - or not effectively - participate in the design process, whereas end-user participation in in the design of Information Systems in Healthcare Organizations has proven to positively influence on the quality of the systems and organizational effectiveness (Vimarlund & Timpka, 2002).

2.4.3 HEALTHCARE ARCHITECTURE

The lack of standardization is not limited to appliances; there is also a lack in standardisation in clinical layout. Hignett and Lu (2008) mention a participant who had been involved in design projects in fifteen different hospitals, which had fifteen different layouts for the same functional area. This might indicate that there is little mutual exchange of good practices between hospitals, the current design processes do not lead to an optimal solution, or there does not exist an ideal solution.

A factor that might contribute to a lack of usability in hospital architecture is that the hospital building design needs to be flexible. Large hospital projects are planned decades before the actual hospital is put to use and must remain useful for periods longer than 40 years (Olsson & Hansen, 2010). This situation can lead to generic rooms and wards that are suboptimal. A good example from one of the researcher's projects involved a neonatal care ward that had large windows, because all wards had them. While large windows may have benefits for adults, they were inappropriate for premature babies whose eyes are underdeveloped and must be protected from light.

In general, effective stakeholder consultation does not take place when it comes to hospital building practice (Kleinsmann, 2010), hence stakeholders' practical experience and knowledge are not applied in the new building designs.

2.4.4 DESIGN FOR EXPERIENCE

Besides safety and efficiency, an important factor to consider in hospital environment and activity design is how patient- and staff experience a healthcare environment. The impression patients get of a hospital is more affected by their whole experience than by an assessment of the quality of the care they receive, since they have difficulty to judge the latter. The patient experience is created by the personal attention that is received, friendliness of the staff, a subjective perception of efficiency and effectiveness of the treatment, the competence of the staff, and their comfort.

The area of experience design, related to service design, receives growing attention in the healthcare sector, because some hospitals hope to achieve a competitive advantage in this area (see, e.g., the popular book "If Disney ran your hospital: 9 ½ things you would do differently" by Lee, (2004)). However, not only the patient experience, but also a positive work experience for the hospital staff should be promoted. This is not only advisable because staff should be treated well for ethical reasons, but also needed to compete for good staff. Since there is a relation between nurses job satisfaction, turnover and elements of the nurses' work environment (Kotzer & Arellana, 2008), it becomes an important factor in design how nurses experiences healthcare environments.

There are various different approaches to experience design. Some of them are holistic, designerly approaches that use techniques and tools similar to product design (e.g., customer journey in service design, Stickdorn & Schneider, (2011)) and often include stakeholders if not as project participants at least as informants or solution testers. While there are many positive aspects to them, the approaches are obviously limited to the experience part of the healthcare environment and do not consider the complex healthcare activity-flows of healthcare environments nor are intended to generate ideas on how to improve work processes that happen "behind the customer scenes".

2.4.5 APPROACHES FOR MORE RADICAL CHANGE

When hospitals in the Netherlands aim to invest in expensive new technology or new buildings that entail radical changes to the care processes, the current practise is that they formulate lists of requirements for competitive bidding. The lists of requirements are usually composed by a project team consisting of users, managers, and medical experts (Freudenthal, et al., 2013). Since this approach is more holistic and aims at more radical changes than the previously presented approaches this approach is explored in more detail in the following section.

2.5 THE CURRENT DESIGN APPROACH FOR MORE RADICAL CHANGE[4]

To identify barriers and enablers of the current approaches to healthcare environment and activity design an exploration of recent projects of change-oriented design in different hospitals in the Netherlands was performed. To provide focus in the assessment of current design practice, an exemplary part of the hospital healthcare environment was chosen. At the time of the research, projects for the development dedicated endoscopic operating theatres had taken place in several Dutch hospitals. An endoscopic operating theatre is a healthcare environment with a critical activity-flow, using complex medical appliances. In addition, it involves numerous ergonomic issues, as surgeons operate with their arms in elevated positions for long times and only have an indirect view of their own activity with the instruments on screens. Central topics in the development of endoscopic operating theatres are the functionalities and arrangement of the medical appliances. The endoscopic operating theatre projects were useful to this research, since dedicated endoscopic operating theatres meet the criteria of complex healthcare environments (many people involved in the treatment procedure, complex products and information systems, etc.). Furthermore, the processes around the changes were still fresh in hospital staffs memories.

The research question in this exploration was how endoscopic operating theatre development had been realized and what had been the degree of stakeholder participation in this process. For the exploration, seven interviews and one workshop were conducted.

The interviewees were a representatives from a company (c1) that sells complete operating room equipment, a surgeon, a technician, an operating room assistant, and a staff manger from hospital one (h1), a technician from hospital two (h2), and a surgeon from hospital three (h3). The interview questions addressed two

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[4] *This section is adapted from Garde, J. A. and M. C. van der Voort (2010). Participation in the Design of Endoscopic Operating Theatres in the Netherlands. Participatory Design Conference. K. Bødker, T. Bratteteig, D. Loi and T. Robertson. Sidney, Australia, ACM. 11: 263-266.*

aspects: (1) The design process of the operating theatres and any positive aspects as well as problems related to it, and (2) positive aspects as well as problems with the daily use of the operating theatres. Interviews were semi-structured and made use of a list of questions prepared in advance. They took about 60 minutes on average and were audio recorded.

The workshop consisted of eleven participants and included an architect, two staff members from an ICT department of a hospital, a hospital project leader, a company representative, three hospital technicians, and three university researchers (including the researcher of this thesis). During the workshop participants were asked to write the problems, they encountered in earlier design processes on post-it notes. The notes where then sorted and arranged on a poster. Next, each participant was asked to place in total five stickers on problems on the poster they believed to be of highest priority to be solved.

For the analysis the interview statements and workshop results were coded either as barriers or enablers for the design process in a similar procedure as the one used by Kuijk, Kanis, Christiaans, & Eijk, (2007) . There were two emerging themes that are relevant to this thesis: (1) the internal communication in the hospital, and (2) the operating room design process by the planning team of the hospital. The positive aspects or problems in the daily use of the operating room were simply coded as positive or negative results. The interviews revealed a large number of different barriers and enablers. The discussion will concentrate on the barriers and enablers concerning the internal communication and design process in the hospital as these were mentioned most often. The researcher translated all citations.

2.5.1 ENABLERS

Internal communication in hospitals

The enabler concerning the internal communication in hospitals that was mentioned most frequently in the interviews (three times) is that there was good cooperation between different stakeholders in the project, as stressed by the staff manager (h1): *"[...] if you do not listen carefully to a [medical] specialist [...] in my experience you will get lots of nagging afterwards [...], and now [in this project][...] they have taken part in decision making this way they accept it [the design] much better."* In the second place came the importance of a good project leader (two times). Other enablers mentioned by the participants were the ability to solve conflicts together, a good distribution of information from the start of the project, the determination of requirements and distinct decision making, pleasant cooperation with other staff members, cooperativeness of the hospital's ICT department, support from the board, and a project manager from the hospital who was closely connected to the operating room practice (all named once).

Design process in the hospital
Several stakeholders emphasized a good cooperation with other stakeholders as enabler in the design process. Other enablers that were all named once included extensive efforts to achieve good ergonomics, the consultation of different companies about requirements to create a good overview of the options, a well-constructed list of requirements, good planning and execution of operating room realization, providing the medical specialists with a good overview of possibilities in the beginning of the project, clear deadlines, and a small budget working as incentive to become creative. Most of these enablers relate to general project management topics and should be come as no surprise.

2.5.2 BARRIERS

Absence of a shared vision for the future
In the experience of the workshop participants, the absence of a vision for the future of the hospital leads to myopic design solutions. Instead of developing new, long-term solutions, solutions are geared towards today's situation and consider only incremental improvements. This problem area has also been widely referred to in the interviews (six times), e.g., the surgeon (h1) said, *"There were still light boxes on the walls of the [new] operating room. At the time the operating room was built we already had a digital radiology archive. So I said: The light boxes must go, they do not fit current times. For people who are undertaking an operation we must use recent images and those are not printed anymore. Then the operating room management told me, they wanted me to individually ask every specialist who might potentially ever be working in the operating room if the light boxes may be removed. This was for me a prime example of obstructive behaviour and not having the willingness to strive towards a shared goal."* Related to this problem is the feeling some interviewees got during the process that others in the planning team wanted to stick to what they knew instead of creating a project for the future (three times). Consequently, some stakeholders perceived the design process only as fine-tuning of an existing company offer instead of a proper design process that involved thinking about the ideal situation and exploration of requirements (three times). One technician (h2) said that *"In my opinion no one has ever been talking about a real design, it was just like: we have this offer, actually we want to implement this. This was the complete trajectory."* The feeling that others did not share one's vision and bad communication in general within the hospital was mentioned twice during the interviews.

Lack of participation
During the workshop, it was agreed that it is a challenge to involve people in a design process and keep them involved for long stretches of time. For medical specialists patient care always comes first and time for innovation activities is rare.

Furthermore, the participants agreed that participation needs to be supported by a transparent and well-structured approach to make decisions in a timely manner. In addition, all participants need to be up to date about decisions and back them up. The feeling that others in the planning team were more interested in obstructing the project than in solving problems was also named as a barrier (three times). For instance, the surgeon (h1) said *"… but the communication with the anaesthesia department was not optimal. They kept on lamenting over the responsibility for the safety of the patient, especially [when it came to] the placement of the robot […]. They had not communicated well [in the beginning of the project] and they were a priori against the plan. […] The fact that we communicated like that, frustrated me. I thought: why don't you think along with me about future developments, and: anaesthetist, take your chance now to design your own work environment the way you want it to be over ten years."* Also named three times was the reluctance of some important stakeholders to participate, as mentioned by the surgeon (h3) *"What is also quite cumbersome is to include specific groups in the beginning of the project because they have the idea that they do not need to be included or they do not want to be included. Especially the ITC group […]. But that is the group which is essential to include because it [the operating room] demands a lot from the ITC facilities."* Furthermore, there was the problem that some stakeholders were not included right from the start of the design process and that some stakeholders' interests were simply not recorded properly (twice). The staff's lack of interest and connection with the project and the feeling that the project did not start well, because the surgeon had already been far ahead in the research about the project, were both mentioned twice.

Absence of insight into consequences of decisions

Not only the absence of a future vision but also the absence of insight into design decisions led, according to the workshop participants, to incremental improvement. This aspect is related to a barrier that was named twice during the interviews, namely that doctors with a non-engineering background have to make decisions about a technically complicated project. The result is that they have difficulties to oversee the consequences of their choices because it is a difficult task for anyone and they are not trained to do so.

Limited use of available knowledge and information

According to the workshop participants, there is not a lack of knowledge and information for the design of operating rooms, but this knowledge is rarely used effectively. The same applies to the knowledge of evidence-based design and to the knowledge and experience that hospital employees have. In addition, there is hardly any organized evaluation of existing operating rooms taking place. This situation is echoed by Jalote- Parmar & Badke-Schaub (2008, p.354) who conclude, *"due to the often unstructured approach adapted by the product managers, findings and important* *requirements from the discussions with the surgeons may get lost or only randomly documented. Thus, the critical findings are difficult to access in order to provide valuable input to the product design".*

2.5.3 ADDITIONAL ORGANIZATIONAL PROBLEMS

In addition to the problem fields pinpointed during the workshop, the interviews revealed several problems that were related to the organization and management of the hospitals. A major problem was that the planning group had to intensively engage in the project before any budget was approved (five times), as exemplified by the company representative's statement "... *people are feeling less involved. [...] people need to engage with the content of something they do not know whether they will get.*" It was also mentioned that the participants had no incentives to save money, since it did involve their own money and leftovers needed to be returned (twice). The participants were also frustrated with the fact that design projects in hospitals take a very long time (twice).

2.5.4 QUALITY OF RESULTING LISTS OF REQUIREMENTS

The design processes in the hospitals often involve the development of lists of requirements. However, as was referred to by hospital employees as well as the company representative these lists are often of low quality (too detailed and/or contradictory) (mentioned four times). It seems that hospitals in general have problems to produce feasible lists of requirements and as a result manufacturers have difficulty to deliver optimal customer specific solutions (Morgan & Mates, 2006).

2.5.5 SUMMARY

The results of the exploration indicate that the main barriers in the current design process are (1) an absence of a future vision in the hospital, (2) a lack of genuine participation in the design process, (3) limited insight by stakeholders who participate in a planning team into the consequences of decisions and (4) limited use of the knowledge and information in hospitals available. The main enablers are more general project management qualities; (1) a good communication with in the development team, (2) cooperation with other stakeholders and (3) a competent project leader.

2.6 TOWARDS A NEW DESIGN APPROACH

The review of general design approaches and current practices in the Netherlands revealed that there is currently no satisfying approach to healthcare environment and activity design. In order to meet the challenges described above, a new approach for healthcare environment and activity design is needed that provides a holistic overview of healthcare environments, includes different stakeholders, takes into account existing structures, and respects the need for change management. More specifically, the new approach should meet the following requirements:

a) ***Holistic approach.*** The new approach should provide a holistic overview of the products, locations, activities, and roles and responsibilities that are involved in the care or treatment procedure, including scheduled and unscheduled dynamic use situations.

b) ***Use available knowledge and information.*** The new design approach should take into account the knowledge and daily work experience of different stakeholders and users to develop feasible healthcare environments and activities.

c) ***Staff consultation for staff commitment.*** The introduction of new technologies or new organizational systems in hospitals requires careful change management. The design approach should use consultation of the staff and possibly co-designing as a way to increase staff commitment to design changes (Carayon & Smith, 2000; Davies, 2004).

d) ***User perspective first.*** The new design approach should give the user needs a larger role in a design project and provide more independence from vendor ***recommendations.***

e) ***Shared vision.*** A new design approach should start with the development of a shared vision and goals for a project. The vision can be preserved or collaboratively altered throughout the design process due to the participation of stakeholders.

Requirements a) until e) point strongly towards stakeholder inclusion in the design process. When choosing for involvement of stakeholders in the design process, the following requirements must be met:

f) ***Enabling participation of different stakeholders in the design process.*** Stakeholders with different backgrounds should be able to contribute to a design project in a way that suits their background and understanding.

g) ***Foster communication between different stakeholders.*** The new design approach should facilitate communication between stakeholders with different backgrounds, professional languages and hierarchical standings.

h) ***Insight into consequences of decisions.*** The new design approach should help participants to anticipate the consequences of their design decisions.

i) ***Stakeholder motivation.*** All stakeholders should get the opportunity to influence their work environment, gain insight into technological possibilities at an early stage, and contribute in a pleasant way.

j) ***Time efficiency.*** The new approach should be time efficient in view of the limited availability of time of medical staff.

In this research, the design of healthcare environments and activities will be approached from the perspective of product design. The reason to apply a "designerly" approach to the complex problem of healthcare environment and activity design is that, as Dorst (2011, p. 525) states, *"Designers have been dealing with open, complex problems for many years, and the designing disciplines have developed elaborate professional practices to do this"*. A strength of the designer approach lies in the ability to perform *"the complex creative feat of the parallel creation of a thing (e.g., object, service, or system) and its way of working". "This double creative step requires designers to come up with proposals for the 'what' and 'how', and test them in conjunction"*. In other words, a central characteristic of a designerly approach is developing the type of solution and how the solution should work in parallel. This is usually approached by an iterative process that includes reframing the problem and design techniques such as prototyping to gain new insights about potential solutions.

As healthcare is a highly specialized field, practical experience and specialist knowledge must be made accessible in the design process by including stakeholders. The role of stakeholders in the design process can be passive (as informants) or active (as co-designers). There are two arguments for active involvement: (1) richer insights into the knowledge and experience by applying it directly in the design process for design and concept evaluation and (2) gaining commitment for changes. Renewal in healthcare (as it does in other fields) can bring about staff resistance, if not applied in a transparent, practice oriented, and participative way. Therefore, a better approach to the design of healthcare environment and activities should include a transparent design process with active stakeholder participation to give stakeholders a voice in determining the characteristics of changes.

Active participation of the actual stakeholder stands central to the approach of participatory design. Participatory design aims at giving staff a voice in the design process and mutual learning between designers and staff. No other approach puts that much emphasis on including actual stakeholders in design processes to empower them and enable mutual learning between stakeholders and designers. While in current design projects in hospitals some of the stakeholders participate in a sporadic way, the interviews revealed that this form of participation cannot be identified with "genuine" participatory design as defined by Bødker, Kensing,

& Simonsen (2004), which demands active participation in the project group by (representatives of) all staff members who will be affected by the future design. Including hospital staff in the design process in a genuinely participatory way could also be beneficial to the hospital organization, since it could facilitate the staff commitment to changes and improve the design results. Chapter 3 will therefore introduce and explore participatory design as a design approach for healthcare environment and activity design in more detail.

However, including stakeholders who are not designers themselves in the design process for healthcare environments and activities calls for a structured approach that helps them to generate design ideas and to explore their consequences. Furthermore, the approach should use techniques, that overcome differences in professional knowledge and hierarchical status between stakeholders. There are several techniques available for actively involving stakeholders. There are very open techniques such as brainstorming and very focused ones such as prototyping. Very open techniques provide little support to enable non-designers to engage in the design process, while very focused ones, such as prototyping specific products, are only possible when a type of solution (a specific product) has already been determined. When the type of solution and its working are yet unclear, a lot of negotiation between different stakeholders still has to take place. Bringing together different stakeholders to negotiate in a low threshold way is a central quality to design games. A design game is a playful activity in which one or more persons are asked to achieve a specific design goal with a set of rules and materials. While this definition is quite general and may apply to any design approach, the tools used in design games are usually more elaborate and inspired by traditional board games (e.g., role-playing turn-taking, make-believe, see Vaajakallio (2012)). Design games come in many different forms, but especially table board games with tangible game pieces as boundary objects promise engagement of all individuals in a low threshold manner.

To explore the potential for healthcare environment and activity design, Chapter 4 discusses design games in more detail, with a focus on tangible group design games.

3 PARTICIPATORY DESIGN

3 PARTICIPATORY DESIGN

3.1 INTRODUCTION: USER CENTRED DESIGN AND PARTICIPATORY DESIGN[1]

The previous chapter revealed that for healthcare environment and activity design an active involvement of stakeholders and users is recommended. According to the User Centred Design philosophy, prospective end users should be given a central role in design processes. The foremost purpose of including users in the design process is to get better insights into future use situations in order to design products, services or forms of organisation that better meet the users' needs.

There are numerous approaches that promote a specific implementation of User Centred Design. These differ in the way they involve users (e.g., users as designers and users as concept testers) and in the design activities they target (e.g., early design phase activities or detailed design phase activities). Figure 3.1 illustrates the position of active user involvement and participatory design within the field of User Centred Design. The horizontal axis outlines the project phases in which the approaches can be used and the vertical axis outlines the intended level of user involvement achieved with each approach. The two bottom rows of the diagram represent "traditional" User Centred Design approaches in which the roles of designers and users are quite distinct; designers generate solutions for users based on explicit knowledge. This knowledge can be gathered through ethnographic research such as interviews, surveys with the user, or by observing users during product use. Users are the objects of study and, during usability testing, the testers of solutions. These methods are commonly used in the product design industry.

In contrast, active user involvement aims to give users an active role in product design in order to produce insights into users' needs, their practical knowledge and into the use situations that products are used in. Participatory design is a specific form of user involvement that serves a democratic ideal by accentuating the aim of giving workers or citizens a voice in design decisions that influence their lives.

Participatory design has its roots in the Scandinavian workplace democracy movement of the seventies (Robertson & Simonsen, 2013), where it was used for the design of tools and organisational structures with the goal of representing the interests of workers in the design process. Since then, participatory design has found its way into other fields such as civic participation, healthcare design, and architecture. The broad adoption of participatory design in the design and

[1] *Parts of this chapter are adapted from Thalen, J. and J. Garde (2013). Capturing use: user involvement and participatory design. Advanced design methods for successful innovation. C. d. Bont, E. d. Ouden, R. Schifferstein, F. Smulders and M.C. v. d.Voort. Den Haag, Design United: 33-54.*

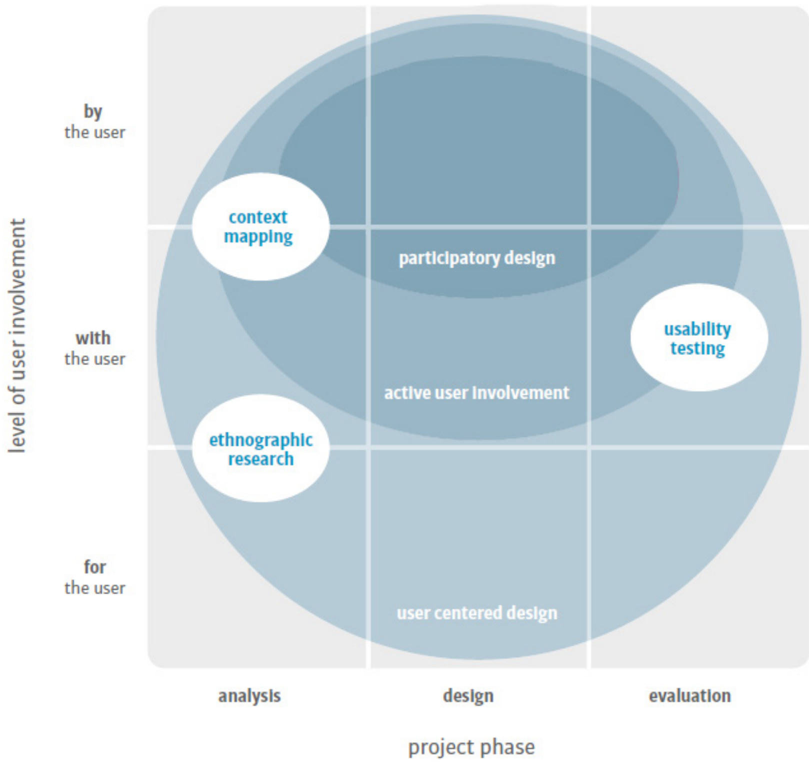


Figure 3.1: User centred design, active user involvement, and participatory design, and several user centred design methods, adapted from Thalen & Garde (2013).

production industry appears moderate. This is probably due to practical reasons, as industry mostly develops products for various organizations or consumers that cannot be represented by a homogeneous community or a clearly definable group of users. Furthermore, in the design process of consumer products there probably is less need for democratic participation, as users have the option of 'voting' by either buying or not buying the product. However, for organisations such as hospitals that have to find design solutions for healthcare environments and activities for themselves, the situation is different and participatory design can offer a number of benefits such as tapping into the in the hospital available knowledge and experience, providing staff with the opportunity for self-determination, and fostering commitment to changes.

Section 3.2 gives a definition of participatory design and briefly compares it to other approaches. Section 3.3 sketches its history. Section 3.4 describes, what place participatory design can take in the design process. The benefits and challenges of participatory design are worked out in Sections 3.5 to 3.7. The chapter ends with a discussion about the value of the participatory design approach for healthcare environment and activity design and a proposal of research questions with respect to participatory design in Section 3.8.

3.2 PARTICIPATORY DESIGN: NOT A DESIGN METHOD

Participatory design is not a prescriptive design method, but a set of principles and values for participation of stakeholders in design processes of – originally – information technology. Besides principles and values, participatory design practice has furthered the development of a collection of various design tools, techniques and methods.

3.2.1 DEFINITION

Most recently participatory design was defined by Toni Robertson and Jesper Simonsen (2013, p.2) as

"*a process of investigating, understanding, reflecting upon, establishing, developing, and supporting* ***mutual learning*** *between multiple participants in collective 'reflection- in – action'. The participants typically undertake the two principal roles of users and designers where the designers strive to learn the realities of the users' situation, while the users strive to articulate their desired aims and learn appropriate technological means to obtain them.*"

The definition rightfully emphasizes the mutual learning between designers and participants but another important aspect of participatory design is that it enables all participants, not only the dominant ones, to express themselves. This is stressed in the guiding principles of participatory design as described by Kensing and Greenbaum (2013, p.33):

- ***Equalising power relations***
- ***Democratic practices***
- ***Situation-based actions*** *(working directly with people in their homes or workplace to understand actions and technologies in actual settings), mutual learning*
- ***Tools and techniques*** *(to help participants to express their needs and visions*
- *Alternative visions about technology.*

These descriptions of participatory design do not explicitly address the design process. Spinuzzi (2005, p. 164) puts in his description of Participatory Design the design results more central and names iteration as a relevant aspect. He writes

"*It [participatory design] attempts to examine the tacit, invisible aspects of human activity; assumes that these aspects can be productively and ethically examined through design* ***partnerships with participants****, partnerships in which researcher-designers and participants* ***cooperatively design artefacts, workflow, and work environments****; and argues that this partnership must be conducted iteratively so that researcher-designers and participants can develop and refine their understanding of the activity. The result of the research typically consists of designed artefacts, work arrangements, or work environments.*"

In this thesis, participatory design will be defined as a design approach that incorporates six elements, which are elicited from the previous definitions. Four of them are values and two are design principles. The values are:

Cooperative design of artefacts, workflow, and work environments - This value emphasizes the cooperation between designers and the future users in the design process, and explains the area, to which participatory design is applied; artefacts, workflow, and work environments.

Democratic partnerships with participants – Future users are not mere informants but actually have decision authority in the design process (Robertson & Wagner, 2013). Segalowitz (2012) developed a construct to describe the extent of participation in a participatory design project, consisting of three elements: (1) the impact a project has, which is defined by the two variables *"use of the generated information"* and *"quality of that information"*, (2) the influence participants have in the project, which is defined by the variables *"scope of the decision"*- and *"number of the decisions"* participants can make, and (3) the agency in a project, which is defined by the variables *"solidarity"* and *"willingness"* of participants. According to Robertson and Wagner (2013), a design approach should even include the users' evaluation of the design process and the opportunities for genuine participation it offers, on top of the development and evaluation of the object of design. However, there is little evidence in literature about this type of evaluation by participants.

Mutual learning – The design approach should enable designers to learn about user practice, and vice versa enable users to learn about the possibilities of new technologies and other aspects the designers can bring to the cooperation. Hence, a design tool should encourage participants to learn and herein consider their abilities (Robertson & Wagner, 2013).

Equalizing power relations – The design approach should include all types of participants, including the ones that are less dominant and harder to reach, and enable them equally to bring their opinions to attention.

The two design principles are:

Tools and techniques to help participants to express their needs and visions – The applied design tools should enable users to share their expertise. These tools should leave users in their own world of expertise, and not force them beyond their practice to think about detailed technical solutions. Furthermore, design tools must be open enough, to allow for design suggestions with respect to all areas of artefacts, workflows, and processes, e.g. when the initial focus was on information technology, also solutions that are not information technology should be allowed (Robertson & Wagner, 2013). Most of the participatory design tools are also applicable outside of a participatory design context.

Situation-based design – explores the current situation or possible future design solutions in situ, thus with the actual users and in the actual (future) use environment; e.g., in the actual work environments or in peoples home's, if these are the places, where new artefacts, processes and environments will be put to use. In case the goal is the design of the environment itself, one must find a different way for the design explorations.

3.2.2 PARTICIPATORY DESIGN IN COMPARISON TO OTHER PARTICIPATIVE APPROACHES

Its four value related elements already indicate that participatory design comes with the position that designers should recognize the accountability of *"design to the world it creates and the lives of those who inhabit them"* (Robertson & Wagner, 2013, p. 70). According to the International Handbook of Participatory Design, continuous reflection about how and by whom participation is established and accomplished, distinguishes participatory design from other user centred approaches (Robertson & Simonsen, 2012).

While co-design and participatory design are often used interchangeably, co-design *"carries perhaps a bit lighter weight on the political attitude"*(Matelmäki & Sleeswijk Visser, 2011, p.3). Co-design also aims at including users in the design process, to supplement the design process with information that leads to products, which are more usable or better fit user needs, but in participatory design more emphasis is placed on the demand that all users who will be affected by the future design are included in the design project (Bødker et al. 2004) and on mutual learning. Both, participatory design and co-design seem in practice not necessarily applied in the design stage in a design process. They are often used only for preliminary research or analysis of a design problem. This is, because participants usually are not designers themselves, and hence, it is a challenge to let them participate in the product design phase in other ways than as informants, evaluators or possibly let them arrange predesigned components.

There are other approaches that are ostensibly related to this research, since they use the term "participatory" in their title, such as "participatory ergonomics" and "participatory medicine". In participatory ergonomics typically a group of staff members with various different functions receive a training in ergonomic principles and then try to improve the ergonomics of their work situation (Rivilis et al., 2008). In contrast to participatory ergonomics, the participation of staff in participatory design of the work organization includes not only implementation of ergonomic principles but active involvement of the participants throughout the design process. Participatory design of the work organization exceeds ergonomic questions, as participants have to address elements of, e.g., logistics, and work experience as well. Examples for "participatory medicine" range from patients with the same medical conditions sharing information with each other to participative involvement of patients in their own treatment by interventions via behavioural changes. Hence, "participatory medicine" aims at participation of patients in their own care. It might only relate to participatory design in a healthcare context, where "care" is interpreted to also include care environments and processes.

3.3 PARTICIPATORY DESIGN FROM THE SEVENTIES TO TODAY'S CHALLENGES

The original application of participatory design as it is discussed in the bi-annual Participatory Design Conferences since 1990 lies in the field of information and communication technology in the workplace: Participatory design has its origin in the seventies of the previous century in Scandinavia, at that time computers were introduced to workplaces which had consequences for the way people had to do their work. In that context, a political workplace democracy movement in Scandinavia wanted to empower the workers in that automation process. Hence, they engaged with skill preserving and even extending the workers skills and providing them with adequate tools (Robertson & Simonsen, 2013). To develop adequate tools and give workers a voice in the determination of their work situation, they were included in development and decision making process for new work tools. These projects are considered the first genuine participatory design projects. Besides developing tools for work and work processes, the aim of participatory design at that time was also the development of *"strategies for dealing with collective agreement and legislative conflicts by developing negotiation models,"* (Björgvinsson, Ehn, & Hillgren, 2010, p.41).

Since the 1970's, this aim has been more and more abandoned, but the context in which participatory design is applied has widened. Currently designers aim to enable stakeholders to participate in the design process of not only work tools, but also environments, businesses, and social institutions (Robertson & Simonsen, 2012). Furthermore, there is a reorientation of the field towards everyday life and the public sphere, while it is according to Björgvinsson (2010, p. 42) *"open to interpretation", "whether there is more democracy at work"*. This reorientation brought about new challenges. While in workplace projects the stakeholders are clearly identifiable, in projects for the public sphere or people's homes there can be large groups of possible stakeholders, hence it is unclear who exactly might be a stakeholder and should be approached to participate.

Yet, participatory design continues to play a part in design projects, which is, according to Dalsgaard (2010), because it is not just a collection of practical tools, but also a set of values, which are still relevant and flexible enough to embrace new challenges. Currently, participatory design is applied in projects with a complex mix of various stakeholders and new technology, e.g. in the development of mixed reality experiences for museums (Hornecker et al., 2006), in the development of information systems in education (Carroll, Chin, Rosson, & Neale, 2000; DePaula, 2004), in projects for architecture, for service design (e.g. government services), and also widely in world of healthcare (Bratteteig & Bødker, 2013; Pilemalm & Timpka, 2008).

The Participatory Design Conference in 2010 and 2012 even had topic session about the application of participatory design in healthcare. In participatory design projects in healthcare, the objects of design are mostly IT systems. Good examples for that are the “Florence project” (Bjerknes & Bratteteig, 1988) which aimed to develop a computer system for nurses and a number of projects in the last decade dealing electronic patient records (see e.g. Bossen, (2006); and, Simonsen and Hertzum (2012)). There are also participatory design projects in healthcare about the design of technology outside of hospitals (see e.g. Clemensen, Larsen, Kyng, and Kirkevold (2007) for the development of new technology and organization for treating diabetes related foot-ulcers at home). Only few participatory design projects in healthcare did not aim directly at the design of information technology, but were designed to be open with respect to the type of solution to improve a healthcare environment (e.g., Cain, Marshall, and Payne (2011), redesign of an emergency department). Hence, while participatory design and design for hospitals are a common combination, there are few projects for hospitals that do not focus on predefined types of solutions, e.g., software.

The design tools used in the early workplace democracy movement were mock-ups, prototypes and scenarios, similar to today. Until today, the repertoire of design tools is growing, but today focus is mainly on the development of new products or services and less in engaging in the direct development of democratic strategies to empower workers.

3.4 PARTICIPATORY DESIGN IN THE DESIGN PROCESS

The reason to start a participatory design project in work environments is usually, when the introduction of technology is expected to lead to big changes in the work-flow and the tools used in the work environment (Spinuzzi, 2005). Since designing and implementing products or work processes that lead to significant changes in the work environment requires staff commitment and a throughout understanding of work practices, staff participation in the design process is essential.

This research examines the usefulness of participatory design in the early design phases of healthcare environment and activity design, because a holistic overview of the design problem at the front end of the design process is often lacking. However, that does not mean that stakeholder involvement in the follow-up phase is not useful as well. In fact, participatory design can and should – according to the participatory design values - be applied throughout complete design processes, i.e. the analysis phase, the design phase with the development of visions and possible futures, and the implementation phase (Bødker, et al., 2004) (see also Figure 3.1).

Currently, arguments are voiced to -, and projects are executed that involve stakeholders even in "design after design", during the use phase (Bratteteig & Bødker, 2013). According to Robertson and Simonsen (2013), the introduction of new technology will always change practice, and even when including future users before implementation, not all effects can be predicted, which supports the "design after design" idea.

When developing a participatory design approach, it is important to think about the total experience of the project the participants go through. Every activity should lead to the next and prepare ("prime") participants to be successful in making a contribution (Sanders, Brandt, & Binder, 2010). Usually, participation of stakeholders in design projects start with a preparation phase, or "sensitizing phase" (Sleeswijk-Visser, Stappers, van der Lugt, & Sanders, 2005), as *"participatory creativity needs preparation"* (Bratteteig & Wagner, 2010, p.53). In this phase, stakeholders are invited to engage with the project object and its different facets and develop their own vision about it (e.g. "visioning workshops"). The preparations help participants to make a meaningful and individual contribution in generative design workshops, which are roughly the next step in a participatory design project. However, in participatory design projects, the analysis and the design phase are hard to separate, as the used tools, such as prototypes can be used for both analysis of the current or futures use situation and design (Bratteteig & Bødker, 2013).

Unfortunately, the outcomes of a participatory design project are difficult to predict since they are highly dependent on the input of the stakeholders. The high level of uncertainty does not go well with commercial practice where projects are expected to deliver specific output within a specific time and budget (Hagen & Robertson, 2010). However, the type of outcomes may be hard to predict, but participatory design is expected to generally lead to useful outcomes, if the process is guided by the appropriate tools and management. Furthermore, as healthcare environment and activity design is complex, there are always many uncertainties in the beginning. Starting to develop one single property of it (e.g., the ICT system), without planning to get an overview of the complete situation involving stakeholders will most likely require design changes in later stages of the project, and closes the door for opportunities to improve other aspects of the problem.

3.5 BENEFITS OF PARTICIPATORY DESIGN

The foremost benefits of participatory design are obviously based on the participation of users: participant benefit, commitment and better acceptance of new designs, and access to the knowledge and experience of specialist user groups.

3.5.1 PARTICIPANT BENEFIT

A participatory approach is intended to give its participants the opportunity for self-determination of their own future. In addition, participants can gather new knowledge and skills in a participatory design project, since the process of mutual learning stands central in participatory design. The knowledge and skills that can be acquired can involve new insights in the way they work, new technologies or other tools, or even the way designers work.

3.5.2 COMMITMENT AND BETTER ACCEPTATION OF NEW DESIGNS

It can be difficult to change existing work processes, because employees do not always see the need to change. Involving users in the design process can help foster user commitment for prospective changes. This can be extremely valuable for design projects that lead to substantial changes for the users in the way they execute their work. Besides those who are directly affected, there may also be other stakeholders that are hesitant to change due to problems they foresee or anticipated costs, e.g., managers and technicians (Vink, Imada, & Zink, 2008). Ideally, the positive commitment effects result in an easier implementation of solutions and a better work climate. Consequently, Simonsen and Hertzum (2012) conclude that participatory design is excellent for combining business-oriented and socially sensitive perspectives.

3.5.3 ACCESS TO SPECIALIST KNOWLEDGE, TACIT KNOWLEDGE AND PRACTICAL KNOWLEDGE

When designing for professional use situations with which designers are not familiar with, as within the healthcare context, the designer’s lack of practical experience needs to be compensated. In this case, users can be involved in analysis, design and evaluation activities to contribute the required practical insights. Involving people with a large ‘repertoire’ of practical experience in product development might decrease the number of use problems in the resulting products.

3.5.4 OBTAINING A MULTI-PERSPECTIVE VIEW

If users with different roles are involved in the use of the same product, or if the use of the product takes place at different times and places, use situations can become increasingly complex. The different roles of stakeholders in such use situations lead often to different or even conflicting requirements. Participatory design initiates participation and partnerships with different stakeholders (Simonsen & Hertzum, 2012). Stakeholder participation can help the designers to gain insights into different perspectives and in balancing conflicting requirements. Involvement of different users in joint sessions can help users and designers exchange and understand the different requirements, discover conflicting requirements, and negotiate prioritization of the requirements as a group. However, communication between the stakeholders with different specialisms is difficult in organizations (Davies, 2004). Therefore, within participatory design a repertoire of techniques and tools has been developed, to enable this communication.

3.5.5 GATHERING RICH USER INSIGHTS

Traditional marketing tools do not always result in the desired level of user insights, as they often focus on quantitative data rather than in-depth qualitative data. To obtain rich qualitative data, users should be actively involved in analysis activities to provide detailed insights into the current use context, use problems, and user needs. Participatory design provides a toolbox of different practical techniques for this very purpose (Simonsen & Hertzum, 2012). An important advantage of active user participation compared to methods, such as ethnographic studies, is that users participate throughout the iterative loops of design projects and thus allow designers to obtain feedback and user insights at different stages of the design process.

3.5.6 DEVELOPING DESIGNS THAT FIT PRACTICE

Participatory design is intended to develop designs that are fit for actual practice. Projects with a participatory approach (ideally) start with designing coherent visions for change, as well as clarifying goals and needs (Simonsen & Hertzum, 2012), instead of directly following an initial direction for a solution. Products, workflows and environments are developed with the participation of people from practice; hence, many errors that would lead to problems during use can be eliminated in the design phase. This reduces the costs for later adjustments.

3.5.7 HOLISTIC APPROACH

The participation of different stakeholders with different perspectives of the design problem and the repertoire of various design tools allows for a more holistic design approach. However, not every participatory design project does this right, as Spinuzzi (2005) criticises some strains of participatory design for focusing too much on artefacts instead of the overall workflow.

3.6 CHALLENGES FOR THE PARTICIPATORY DESIGN PRACTITIONER

Participatory Design poses specific challenges on the practitioner, may he be researcher or designer. These challenges mostly relate to the open, exploratory character of participatory design, the challenges that generally come with working with people and the contradiction that lies in including current users who initially might not want to change their practice in projects that aim at development of new practice.

3.6.1 TIME - AND HUMAN RESOURCE INTENSIVENESS

The execution of a participatory design project requires a great amount of time and human resource (Spinuzzi, 2005). As it aims at including stakeholders in the design process, it requires by definition more human resources than an expert approach. Participatory design projects are costly in term of time due to the time needed for negotiating solutions with different stakeholders and the development of case-specific design tools and techniques. Furthermore, positively affecting the knowledge, skills, and self-confidence of participants simply takes time (Carroll et al., 2000). However, the investments made during the design phase are typically expected to pay off in the future due to a smoother implementation phase and less late adjustments in projects.

3.6.2 OPEN-ENDEDNESS AND UNPREDICTABILITY OF RESULTS

As participatory design projects should be approached with an open attitude toward possible solutions, the results and the process that leads to them are not clear before the completion of the project. However, the open-ended project approach is according to some researchers the only way to achieve innovation, since *"innovation at the fuzzy front end takes discovery and unpredictable learning"* (Halse, 2010, p.16). Furthermore, it is very difficult to predict outcomes, as these are influenced by the participants (Clemensen, et al., 2007). Besides that, it is hard to commit managers to a project with unclear results, the open-ended nature can also be difficult for the project participants, as they do not know in advance what they sign up for and results cannot be guaranteed. A current approach to deal with the uncertainties is to use effects-driven methods. With these methods one tries to define in advance the (usage) effects that should be achieved, instead of defining concrete types of solutions such as specific tools. These effects are commonly evaluated after implementation of new solutions to rate their successfulness and determine whether further changes must be applied (Hertzum & Simonsen, 2010).

3.6.3 PROJECT TIMELINE

Since participatory design projects often take a long time to complete, in the organizational context one often has to deal with staffing changes, which can delay or complicate the project (Balka, 2013). This is especially true in the context of larger organizations, such as healthcare organizations. In addition, the implementation of ideas generated during a participatory design projects might take so much time that those who actually participated in their development might not benefit from their implementation (Robertson & Wagner, 2013). Additionally, in case participatory design projects are initiated and managed by researchers or designers, their engagement in practice often ends before the implementation phase (Robertson & Wagner, 2013). This could influence the researcher to focus more on research results than on the creation of feasible solutions. Furthermore, there is a chance that after the researcher has left the project is abandoned, if not someone inside the organization takes over.

3.6.4 MOTIVATING PARTICIPANTS

Even though participants are expected to benefit from participatory design projects, it is often a challenge to get participants to apply themselves in work-related projects and keep them motivated, since the staff is busy with their daily work and their immediate responsibilities (Kensing & Greenbaum, 2013). They do not easily become committed to a project about the "future", of which the impact to their own work sphere is not really clear in advance and not immediate, which is usually not until the changes come into operation (Wagner & Piccoli, 2007). A possible solution would be to start as early as possible with simulating the future, as a means to make participants attentive to the consequences to their own work sphere and prevent that technologies remaining abstract in the participatory design process (Pilemalm & Timpka, 2008).

To keep staff motivated for follow-up projects, project results must be used and ideally applied. The commitment advantage of participatory design can be lost, if predefined solutions are chosen over the design results produced with the help of the staff (Davies, 2004).

3.6.5 PARTICIPANT "SELECTION"

When choosing user representatives in participatory design, Bødker et al.(2004, p. 106) recommend that they *"should possess a good overview of the work domain concerned, [...] should enjoy broad respect and confidence among their co-workers, [...] be committed to the project, [and] [...] neither be technology freaks nor technophobes"*.

Often, the participation of so called "lead users" in design projects is advocated, instead of including the "mainstream- user" (von Hippel, 1986). Lettl, Herstatt, and Gemuenden (2006) highlight the importance to include the "right" users in projects for radical innovation in companies; as including only "mainstream" users might lead to overlooking opportunities which lie e.g. in technological discontinuities. As participatory design emphasizes including a representative set of preferably willing stakeholders, it is a practical problem to ensure that these stakeholders are also "lead users". However, including a number of lead-users in the project, and ensuring that they are listened to, might provide the desired effect of "lead-user" innovation.

In large organisations it is sometimes not possible to represent all stakeholders directly in group meetings, because it would make the meetings unmanageable (Pilemalm & Timpka, 2008). A way to solve this problem is either to only indirectly represent some stakeholders with the help of data collection and decision verification (Pilemalm & Timpka, 2008), or by starting up a double representation structure with several groups working in parallel and representatives of those groups sharing outcomes.

3.6.6 FOCUSING ON CURRENT PRACTICE

In participatory design projects, it is common to analyse the current practice to find flaws and opportunities. However, this focus on current practice might, instead of inventing new practice, lead to translating current practice to a new situation, which often produces only half-good solutions and leaves opportunities of new technologies unexplored (Bødker & Iversen, 2002). Sometimes working from a "blank slate" is advocated. However, Brandt and Erikson (2010, p.77) argue, *"that when working with innovation in relation to existing and operating complex systems [...] changes always have their own genealogy with their connection to other ideas, insights and achievements. In this light innovation can never be radical in the sense of being totally new but will always be incremental, in the sense of reconfiguring resources that to a large extent are well known"* .

3.6.7 OVERSIMPLIFICATION OF UNDERSTANDING

Participatory design is about mutual learning between designers or researchers and stakeholders. To better understand the stakeholders, methods such as ethnography or context mapping can be employed. In the eyes of social scientists the loose application of, e.g., ethnography can only lead to a superficial understanding of the users (Spinuzzi, 2005). However, participatory design does not aim to analyse the data and represent them in abstracted way, but to apply them in a way that includes bringing the outcomes back to the participants during cooperative evaluation, analysis, and design (Spinuzzi, 2005). Consequently, this feedback-loop with the participant and their continuous involvement in the design process is an important step to prevent design based on a wrong, simplified understanding of participants.

3.6.8 FROM DESIGNING "THINGS" TO DESIGN "THINGS"

Especially the current application of participatory beyond its original areas in the public sphere poses new challenges on the designer or researcher. When participatory design moves from projects in *"organizations with clearly definable stakeholders to engaging people across organizational and community borders"* (Bannon & Ehn, 2013) the focus shifts from designing things (tools, workflows and environments) to design "Things", as Ehn (2008) calls the socio-material assemblies of people, their relations and technology that are not limited to one (e.g. organisational) context (Björgvinsson, Ehn, & Hillgren, 2012).

3.7 CHALLENGES FOR PARTICIPATORY DESIGN RESEARCH

Research and practice in participatory design have brought about a wide array of different tools, techniques and methods and their application has been wildly reported (Luck, 2007). Design research aims at gaining new insights about of participatory design and its application. Current challenges for participatory design research lie in conserving its original values on the one hand and bridging the gap to the professional, commercial world on the other hand. Furthermore, it could be an interesting challenge to explore, whether participatory design in the eyes of the participants still actually delivers the promised benefits in today's society and if these values are still relevant today.

3.7.1 LOSING VALUES

As participatory design has spread from Scandinavia to North America, *"researchers have had difficulty maintaining its methodological tenets, particularly its focus on democratic empowerment"* (Spinuzzi, 2005). This difficulty becomes also eminent in the application of participatory design to new fields in the public sphere and the private sector, where stakeholders are harder to identify and the need for empowerment and democratic practices is less obvious. As participatory design offers the means for *"user-driven design and innovation"*researchers from the participatory design field fear that it will *"end up as the latest fashion in a further modern, market-driven, commodification process"*(Bannon & Ehn, 2013).

3.7.2 CREATING A LINK WITH PROFESSIONAL DESIGN PRACTICE

Participatory Design is conducted mainly by researchers, who often come from social sciences, instead of by people who are trained as designers (it can be debatable when somebody can be called a researcher or a designer or both). As a result, little attention is paid to styling, design for experience, and design for emotion in participatory design and designers from the professional field are not likely to adopt and apply research findings because they stem from researchers from other fields.

As Lee (2008, p. 32) addresses *"[…] there are gaps between scientific design research by 'outsiders' and creative design practice by 'insiders' because of a lack of collaboration between the two groups in design".* Both groups could benefit from a closer collaboration and especially participatory design researchers from a non-design background could use cooperation with design practice to make their approaches more practice-fit and probably apply them on new design aspects as well as make them better known amongst professional designers.

3.7.3 EVALUATING THE PERSPECTIVE OF INVOLVED PARTIES

In most participatory design projects, the report about the project's success is made by the researchers themselves. *"The perspectives of other parties involved in the project are not adequately, if at all represented"* (L. Bannon, 2009). It would be interesting, and relevant, to verify whether the benefits participatory design claims to provide for its participants, such as mutual learning and commitment, are existent and actually appreciated.

3.8 DISCUSSION

A participatory design approach is promising for healthcare environment and activity design, despite the challenges it poses for the practitioner. Compared to non-participatory design approaches, it aims at having different stakeholders actively participate in a design project. This feature allows for the optimal use of the knowledge that is available within healthcare organisation and for a multi-stakeholder view on the design object. Furthermore, the shared ownership of the project between the designer researcher and the participants can contribute to a higher motivation of the stakeholders to participate in the design project, higher commitment to the developed designs as well as their implementation. Including the actual future users in a transparent development process and employing the design "toolbox" for rich user insights and participation in design can provide an approach that gives all user groups the opportunity to influence their work environment, get insight into technological possibilities, and hereby enables them to make a useful contribution.

The present research applies a participatory design approach to healthcare environment and activity design and evaluates how it performs in terms of usability.

From participatory design research perspective, it is interesting to give projects participants a larger role in the evaluation of the participatory design approach to test whether it delivers them to their own opinion the promised participant benefits. Hence, the present research evaluates, whether a participatory design approach delivers participatory design benefits with respect to mutual learning and commitment, according to the perception of the participants.

As this research aims to apply genuine participatory design including its values in the organizational context of hospitals, where stakeholders are easily identified, the above-mentioned danger of losing the original values of participatory design is not applicable this context.

Bridging the gap between participatory design and professional design practice is a relevant research area. Due to practical limitations, e.g., the costs of including professional designers in a lengthy project, this research area could not be pursued explicitly in the present research. However, as the researcher has a background in industrial design, the designer perspective is taken along in the development of the design techniques for the design case studies and in the reflection on the approach.

4 DESIGN GAMES

4 DESIGN GAMES

4.1 INTRODUCTION[1]

As described in the previous chapter, including stakeholders actively in the development of new healthcare environments and activities has three major benefits: (1) giving stakeholders the opportunity to self-determine their work, (2) tapping into stakeholder knowledge and experience, and (3) fostering commitment for change. However, it is not straightforward to involve stakeholders as co-designers in the design process, especially at the idea or concept generation stage when there is not yet a product design concept available to reflect on. Therefore, in current (non-participatory) practice stakeholders are often brought into the design process as informants in the analysis phase or only after initial design choices have already been made.

Typical methods and techniques that give users a role as informants in a design project include ethnography, market research, observations, interviews and focus groups. Observing stakeholders during their work will evoke questions about why staff chooses to do things in a particular way and other invisible "know-how". Interviews or focus group techniques (group discussions) rely for the most part on verbal communication without using visual aids. As result, they are reliant on the accurate interpretation of each other's words, which can prove difficult when discussing complex procedures that include parallel actions and several actors. Also, techniques such as observations, interviews, and focus group techniques usually only provide meaningful information about the current situation and not imagining novel future situations.

In order for stakeholders to share their practical knowledge, which is often only tacit, with the design team in an effective and efficient way, an appropriate communication medium is needed. Communication between stakeholders and designers in a multidisciplinary design team is challenging for both sides. While designers and engineers are trained to communicate and work in a multi-disciplinary environment, not all stakeholders are. Furthermore, it is difficult for the design team to find and formulate the "right" questions for prospective users so that the answers reveal useful design information, as stakeholders are typically not able to translate their current habits and routines directly into concrete user requirements or new design opportunities.

Methods and techniques for active stakeholder involvement can help

[1] *Parts of this chapter are adapted from Thalen, J. and J. Garde (2013). Capturing use: user involvement and participatory design. Advanced design methods for successful innovation. C. d. Bont, E. d. Ouden, R. Schifferstein, F. Smulders and M.C. v. d.Voort. Den Haag, Design United: 33-54, and from Garde, J.A. and M. C. van der Voort (2009). The procedure usability game: A participatory game for the development of complex medical procedures & products CIRP IPS2 Conference. R. Roy and E. Shehab. Cranfield, Cranfield University Press: 483-489.*

stakeholders express and analyse their current product use and use environment. Amongst these, design games promise to be a low-threshold and "fun" way to let stakeholders with different backgrounds explore, develop and reflect on future use situations together. Design games can take on various forms and accommodate different goals, which makes them suitable for a great variety of design problems. This thesis explores the use of a design game for healthcare environment and activity design.

Section 4.2 starts with a description of the basic elements of design games. Afterwards Section 4.3 provides a brief examination of creative group work. Creative techniques that are applicable within design games are summarized in Section 4.4. Section 4.5 discusses the key factors that need to be considered in the application of design games. Benefits and challenges of design games are addressed in Sections 4.6 and 4.7. The chapter concludes in Section 4.8 with a discussion of the use of design games for healthcare environment and activity design, and the proposal of research questions with respect to design games.

4.2 DESIGN GAMES

A design game can in the context of this research be described as a playful activity in which one or more persons are given the assignment to achieve a specified design goal, means to use in achieving this goal and rules to play by. Whereas this description might apply to most design approaches, the tools used in design games are usually more elaborate and inspired by traditional board games (e.g., role-playing, taking turns, make-believe (Vaajakallio, 2012)), as they are typically developed for non-designers to participate in the design process. They are often scenario-based *"to deliberately trigger participants' imagination as a source of design ideas"* (Vaajakallio, 2012). The difference between leisure games and design games is that the latter aim at serious outcomes that may affect the user beyond the game. In this thesis the definition given by Brandt, Messeter and Binder (2008, p.54) is adopted, which gives a more detailed definition of participatory design games:

- *"A diverse group of players a gathered around a collaborative activity guided by simple and explicit rules, assigned roles and supported by pre-defined game materials.*
- *The game materials typically point to either or both existing practices and future possibilities.*
- *The games are played within a shared temporal and spatial setting often removed from the players' everyday contexts.*
- *The purpose of the game is to establish and explore novel configurations of the game materials and the present and future practices to which these materials point.*
- *At the end of the game, the players will have produced representations of one or more possible design options."*

4.3 CREATIVE GROUP WORK

Design games are a specific form of creative group work. The strengths and weaknesses of creative group work have been the focus of experiments of behavioural scientists and design researchers. Results of behavioural scientists are often based on larger numbers of experiments with simple brainstorms consisting of writing down different ideas, rather than design games, which include tactile game objects and more complex goals, rules, and scenarios; this makes the research outcomes not directly applicable.

Yet, a few findings about creative group work can be relevant for the setup of design games such as the conditions that make group brainstorming more fruitful, the effects of giving examples, and how design concept proposals are dealt with in creative group sessions. Some studies show that when individuals pool their ideas during in brainstorm sessions they come up with more results than a group working together from the beginning (Mullen, Johnson, & Salas, 1991). However, the number of results is also dependent on the conditions of the brainstorm. Paulus, Putman, Leggett Dugosh, Dzindolet, and Coskun (2002) researched under which circumstances group brainstorms produce more, more varied, and better ideas than a "nominal" group of individuals who brainstorm individually. The negative social influences for group brainstorming they found are evaluation apprehension (being concerned about one's ideas being evaluated), anonymity (when it is not clear who had what idea), and production blocking (not being able to think about one's own contribution because others are talking).

These influences can lead to a convergence effect, low motivation, downward social comparison, and an illusion of productivity. Positive influences that improve group brainstorm outcomes are social facilitation of the process, accountability and competition, which lead to better attention of the participants, better associations, memory, idea diversity and incubation. *"When group interaction is structured so as to limit the inhibitory processes and facilitate the social and cognitive stimulation potential, groups can achieve high levels of increasing innovation and productivity in teams and organizations"* (Paulus, et al., 2002, p.320). Hence, a good structure and facilitation of the creative session is key.

Perttula, Krause, and Sipilä (2006) summarize a number of studies with respect to whether examples influence brainstorm outcomes. Their conclusion is, not surprisingly, that if subjects are given pictorial examples before brainstorming, they can get fixated on these examples and their own ideas become influenced by them. This effect was mostly occurring when the example was familiar to the subject's domain. Hence, examples must either be chosen carefully or completely avoided if possible.

Heineman (2011) addresses sequential positioning and schism as two important effects that influence how design concept proposals are handled in creative group sessions. Positioning refers to the moment in the creative session when a proposal is introduced. In case participants have already spent some time on developing one proposal, a new proposal, regardless of its quality, has less chance to receive as much attention as the proposal currently under development. Schism means that a group conversation or activity splits up in several conversations or activities with only parts of group. This seems to happen when there are more than three people present. Schisms also bring about that different design proposals are treated differently, not depending on their quality, but on the number of people giving them attention in the process and engaging in their development. Besides that, schism also leads to more complexity in the interaction, as participants can only monitor part of what is going on and it gets difficult to reach a joint understanding about the outcome of a workshop (Landgrebe, 2011). Hence, one needs to be aware that free group work does not lead to an unbiased, organized choice of proposals. If possible, unintended schisms should be limited.

4.4 APPLICABLE TOOLS AND TECHNIQUES

"The number of possible tools, techniques and applications for making, telling and enacting is limitless. The challenge is to determine which tools and techniques are most effective in what types of situation and for what types of stakeholders. Successful application of specific tools and techniques demands an in-depth understanding of the design process and the ability to provide the materials, tools and techniques that are appropriate for each phase in the process." (Brandt, Binder, & Sanders, 2013, p.175)

Before going into specific techniques for design games, it might be useful to clarify the distinction between tools, tool kits, techniques, and methods. For this purpose the definitions of Sanders et al. (2010) will be adopted. They define tools in the participatory design research context as "the material components that are used in participatory design activities", a tool kit as "a collection of tools that are used in combination to serve a specific purpose". A technique "describes how the tools and toolkits are put into action" and a method "is a combination of tools, toolkits, techniques and/or games that are strategically put together to address defined goals within the research plan". A design game is as a combination of tools and techniques. However, calling it a method might wrongly imply, that it is very descriptive and covers a complete design project. Therefore, just the description "design game", as a purposeful combination of tools and techniques will be used in this research.

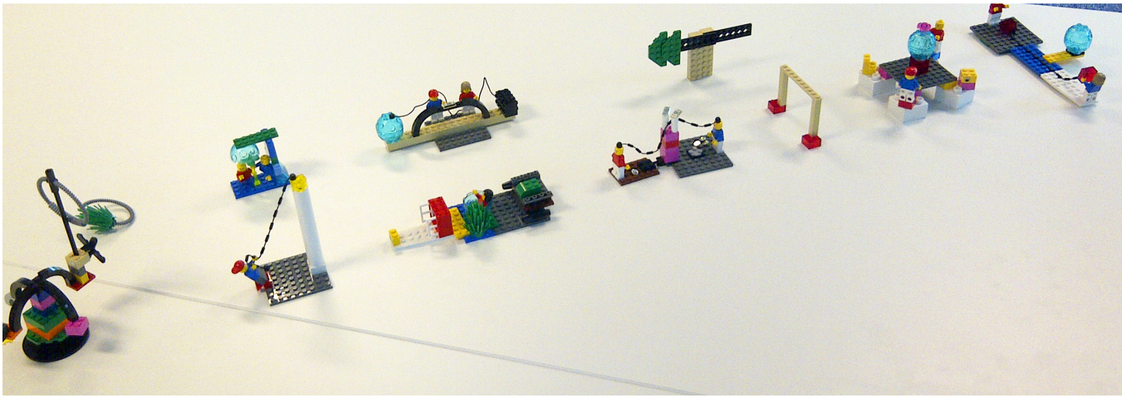
This section presents only tools techniques that can be used in design games. Tools and techniques that are intended for application outside of a design game session, e.g., probing on a ward (Gaver, Dunne, & Pacenti, 1999; Mattelmäki, 2006)

Figure 4.1: Storyboard of a scenario involving the use of a handheld device by a volleyball coach (drawn by students of the course "scenario based design" at the University of Twente)

are not addressed. The aim of the design game that is developed by this research is to access participants' current experience to generate new futures in an early design phase and to facilitate communication between end-users and the design team. Design games for these aims can employ a wide range of tools and techniques. The techniques are often practical and action oriented that encourage participants to describe and explain their actions. Recognisable artefacts like physical product mock-ups or card sets are used as tools to reduce the threshold for users to engage with the game.

4.4.1 SCENARIO CREATION AND EVALUATION

Scenarios are a commonly used technique for active user involvement (Carroll, 2000). Scenarios are rich descriptions of use situations containing one or more actors, their goals, the "product", the context of the use situation, the actions involved, and the events actors have to deal with during the actions. Scenarios, if validated by the users, provide a realistic and concrete use context which users themselves can utilize to evaluate design concepts. For inspiration or to overcome bias towards specific user groups, "pastiche" scenarios can be applied that use known fictional characters from literature or television as actors (Blythe, 2004; Dearden, Lauener, Slack, Roast, & Cassidy, 2006; Blythe & Dearden, 2009). Scenarios can be documented by written stories, by the use of storyboards (see Figure 4.1), by videos and by animations. Users can be involved in scenario techniques by creating the scenarios by themself, by consulting them to verify scenarios created by other parties, or by acting out scenarios. Acting out scenarios with a, possibly self-



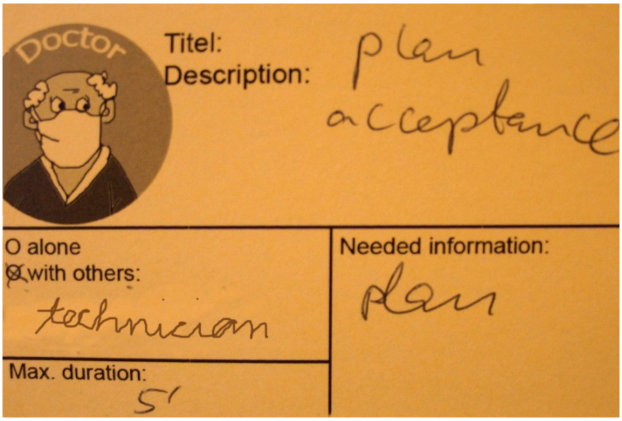
Figures 4.2 & 4.3: Card sorting session & landscape created by LEGO models.

developed, prototype of the product helps the users anticipate the consequences of their design decisions (see also the section about role-playing). Scenarios can be applied in all design phases for priming participants, accessing their current experience, and the generation of new futures.

4.4.2 CARD SORTING AND LANDSCAPING

Card sorting is an example of a practical and action oriented technique. Card sorting works with card sets that depict or describe product features, tasks or use situations. Furthermore, cards can be placeholders for digital information, as in the "video card game", where cards are linked to video snippets of typical use situations (Johansson & Linde, 2005). Groups of users or individuals are asked to organize or sort these cards in predefined or self-chosen categories (see Figure 4.2). By doing this, users provide the design team with insights into the way they organize aspects of the use situations or features of the product. The design team can then react by organizing product features in a way that match the user's preferences or experience (Nielsen & Sano, 1995).

Landscaping is a similar technique but involves sorting of tangible objects



Figures 4.4 & 4.5: Filled in task card with a representation of a specific role (doctor) & task card flow on a template background.

(see Figure 4.3). The objects can be materials from field research (e.g., objects collected during user observations) or models created from Lego or other materials representing ideas for products and abstract concepts (see, e.g., Lego serious play (www.rasmussen-and-associates.com and Halse, Brandt, Clark, and Binder, 2010a).

While both sorting techniques are originally used in the analysis phase to access participants' current experience, they can also be used for the generation of new futures in an early design phase. However, as card sorting or landscaping are abstract or metaphorical representations of products or situation, the generation of new futures can only be done by either simple sorting tasks involving, e.g., indicating feature preferences (card sorting), or by building metaphorical representations of, e.g., preferred (value) systems or experiences (landscaping).

4.4.3 TASK ANALYSIS

Task analysis techniques are used for exploring the activity (or task) flow of current use situations or to 'design' ideal use situations in the design phase (generation of new futures). Several techniques were developed for task analysis. A straightforward example is the "collaborative users' task analysis" (CUTA) (Lafrenière, 1996) which is based on the "Collaborative Analysis of Requirements and Design" CARD technique (Tudor, Muller, Dayton, & Root, 1993). CUTA uses paper cards that must be filled in for every task in a product use situation (see Figure 4.4 for an example of a task card). This helps users to sort tasks they wish to achieve. Participants then generate an activity flow using the separate task cards (see Figure 4.5). This help with recording of action sequences by making previous steps continuously visible for all participants. Additionally, task analysis supports iterative activity flow development, as it is easy to rearrange the activity flow.

4.4.4 THEATRE TECHNIQUES

Theatre techniques involve professional actors playing out use situations, and a panel of users that can react to these and change the use situations 'on the fly' (see e.g., Sato and Salvador, (1999) or Burns, Dishman, Verplank, and Lassiter (1994)). This technique can be used with large groups of participants, is low threshold, and can be applied to stimulate and steer discussion by, e.g., exaggerating specific situations or clichés. Theatre techniques can be used in all phases of the design process as well as for priming participants for accessing their current experience as well as the generating new futures. In design games, theatre techniques can be used to kick off a game.

4.4.5 ROLEPLAYING

Role-playing works by mimicking current (analysis phase) or future (design phase) use situations (Pedersen & Buur, 2000; Urnes, Weltzien, Zanussi, Engbakk, & Rafn, 2002). The use situations are played out by utilising the participants' own bodies to 'act' in theatrical manner (Figure 4.6), by using toy figures in a miniature environment tool (Figure 4.7), by using avatars in a digital virtual environment, or by applying combinations of these three techniques. A physical or digital product prototype can play a part in these mimicked use situations and might evolve throughout the various stages of development. The difference with theatre techniques is that participants themselves play out the situations.

If realistic scale, ergonomics, or aesthetics of the movements in a use situations are relevant for the design, real role-playing or very advanced virtual role playing are more useful than miniature roleplaying as scale and movements are insufficiently represented in a miniature environment. However, playing out use situations in the actual use environment holds some practical difficulties, e.g., when the environment does not yet exist or consists of many different possible places. While a virtual environment or a tangible full-scale mock-up of the environment and its interior can be used, doing so can be very costly. As a result, full-scale mock-ups of environments are mostly preserved for the later phases of the design process, when a concept design of the environment is available.

The use of a miniature environment tool offers users a lower participation threshold, while providing a defined 'setting' for the use situation in the form of, e.g., a dollhouse or map. According to Vaajakallio (2012), miniature role-playing games focus on interaction and dialogue, less on evoking empathy. Users move play figures in order to play out situations instead of playing them out by themselves. These figures can be dedicated playing figures or simple paper cut-outs (Dalsgaard, 2012) and are "*physical, symbolic representations that allow a person to move back and forth between a figured (imagined) world and the real world*" (Urnes, et al., 2002, p. 187). An additional advantage of a miniature environment is that it is easier to manipulate

Figures 4.6 & 4.7: Full-body roleplaying with simple mock-ups (by students of the course "scenario based design" at the University of Twente) & roleplaying with abstract playing figures and playing pieces representing medical appliances.

than the real world (Urnes, et al., 2002). For instance, walls can easily be adjusted, furniture moved, etc. The interaction can be started by using a rudimentary scenario, which can then be altered and detailed by the participants, or be organized by predefined information such as event lists (Iacucci, Kuutti, & Ranta, 2000).

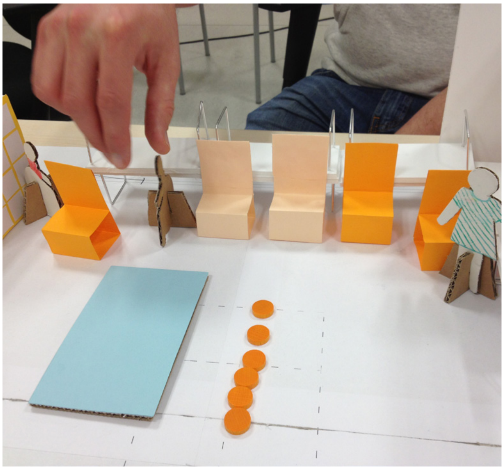
4.4.6 PROPS USE

Techniques that focus on mimicking use situations occasionally work with "props" as tools (Brandt & Grunnet, 2000). A prop can be any physical object, such as an existing product or an abstract building block. It is used in mimicking a situation as if it was a new product with specific functions. These functions are to be imagined by the prop user and can be inspired by the prop itself. Usually, a choice of several props is offered to users who then explore the chosen prop by mimicking the use situation. Applied in this way, props work as inspirational material in the exploration of possible futures in early design phases.

4.4.7 BUILDING WITH TOOLBOXES

A more focused technique, that also works with physical objects representing future products is the use of "toolboxes" (see, e.g., Sanders and William (2001) or Vaajakallio and Mattelmäki (2007)).

Toolboxes offer a choice of collage materials or building blocks. Collage



Figures 4.8 & 4.9: Building ideal classrooms with three-dimensional toolboxes (by students of the course "scenario based design" at the University of Twente).

materials can be applied to create collages of, e.g. dreams or visions. Building blocks enable users to easily build representations of products or environments that ideally support their needs (see Figure 4.8 and 4.9). A good example is the use of mock-ups of patient rooms in hospital planning by Sanders (Brandt, et al., 2013; Sanders, 2009). These techniques, as they are applied by Sanders, aim not so much at designing actual products, but at accessing the users emotional domain and dreams by letting them build their ideal "magical" devices (Sanders, 2001). They can be used for accessing users' current experience and for the development of future scenarios.

4.4.8 ESTRANGEMENT TECHNIQUES

"Getting to know "the other" is an important step in user-driven innovation. Deconstructing what is familiar is another important step. But the real power for innovation emerges as a resonance is established between the two." (Halse, Brandt, Clark, & Binder, 2010c). Getting to know the "other" can be achieved by bringing together different stakeholders to gather experiences from different fields. However, this process should also be supplemented by providing participants with knowledge about new possibilities such as new technologies. If stakeholders are caught up in the well-known, deconstruction of- or estrangement from the current situation should be encouraged. This deconstruction or estrangement is intended to stimulate participants creativity and obtain more innovative (yet maybe less readily applicable) ideas. Estrangement is intended to change people's perspectives, i.e., "cast new light on the well-known" (Brandt, et al., 2013).

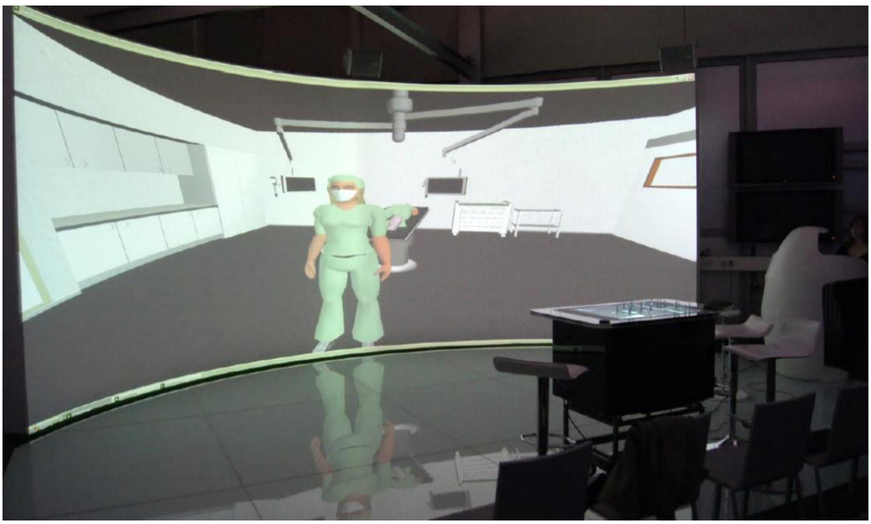
An example of an estrangement technique is the use of "critical artefacts" (see e.g., Bowen, 2007; Bowen, 2008). Critical artefacts, sometimes also called "provotypes", are prototypes of fictional products that challenge existing assumptions and trigger people to critically engage with these assumptions. An example is "Mr Germy" by Human Beans, a "bacteria impregnated baby teeter" to strengthen the immune system (Charbonnel & Vanstone, 2001). These prototypes cannot only be used as artistic statement to invite people to question conventions, but to inspire new design approaches. A less extreme technique for estrangement is leaving out one or more of the properties from the use situation in order to decrease the design boundaries and remove existing limitations from participants heads, e.g., by asking participants to design the ideal situation for the far future or a completely different organization (e.g., for an airport instead of a hospital). Estrangement is predominately useful during the early stages of the design process.

4.4.9 VIRTUAL REALITY TOOLS

In addition to low fidelity tools like board games and cards, higher fidelity tools like virtual reality (VR) tools can be used for design games. VR allows end-users to experience products and use contexts that do not (yet) exist, or to which end-users would not be normally exposed to, such as dangerous or remote locations. Traditional examples of using VR to support active user involvement in product design include driving simulators to evaluate drive support systems and the use of 3D virtual environments to immerse prospective users in a future use context (Jimeno & Puerta, 2006). Recent developments in VR hardware and software have significantly increased the accessibility of VR in terms of reduced costs, improved usability and available support. Furthermore, emerging techniques such as augmented reality and multi-touch displays enable untrained end-users to actively participate in the evaluation and generation of product concepts. The possibility to combine tangible and virtual elements in VR-tools brings advantages of the "hands-on" experience and boundary objects into these techniques.

VR-tools are most usable when initial concepts or environments are available to model, and then experience and manipulate. However, as with tangible prototypes, caution is needed with the fidelity and detail of visualisation of the models. Highly detailed models give an impression of a finished product and may lead discussions towards design details rather than innovative ideas. Also, in many cases low fidelity models are enough to discuss workflows and requirements.

Stappers (2006) stated that computer models do not very well support design skills such as *"spatial reasoning, associative thought, overview, empathic thinking, informal discussions, and serendipity"*. This is not completely applicable to VR-tools, but VR-tools are still less flexible than hands-on tools, that easily enable the manipulation and addition of game elements during the sessions. Associative thought and empathic thinking might not be limited by VR-tools, and whether informal discussion and serendipity are possible depends mostly on the whole setup of a creative session. Spatial reasoning and overview can be supported, but are limited by what has been modelled by the tool developer. Objects can be less easily rearranged or picked up and viewed from different angles. On the other hand, VR allows for viewing large, complex, and non-existing objects that cannot easily be represented with tangible objects.



Figures 4.10 & 4.11: Virtual reality design tool for the development of flexible ceiling mounted systems for operating rooms: a touch table with tangible configurable system pieces and large screen displaying the operating room with the created system (photos by student Sanne-Marye Huijing during her Industrial Design Engineering Master assignment at University of Twente)

4.5 KEY FACTORS FOR DESIGN GAME APPLICATION

A number of aspects with respect to the practical implementation of the design game must be considered before choosing the appropriate techniques and tools. This section provides an overview of these key elements that must be considered.

4.5.1 PURPOSE

A design game should have a clear purpose. However, goals cannot be formulated in terms of specific deliverables, as one cannot predict precisely what participants will come up with. Furthermore, it is helpful that participants have the option to reframe a problem to some degree. Consequently, goals are often formulated in terms of purpose statements such as "exploring a new situation", "evaluating a product concept", and "developing ideas for…" etc.

One game can be applied for different purposes in different sessions and throughout consecutive phases in a design project. When determining the purpose of a session, it is important to decide how important it is to reach consensus during the game sessions. For instance, Sanders executed a large project for the medical campus in New Orleans in which she did not ask for consensus (Sanders, 2009). Some believe that disagreement, different aims and perspectives, and even conflict are essential to innovation (Buur & Larsen, 2010). However, eventually decisions must be made and, if a design game is applied in the context of a democratic participatory design project, this requires that participants be allowed to make decisions for themselves. The key is to not enforce consensus too early during the creative process.

4.5.2 A GAME'S PLACE WITHIN A DESIGN PROJECT

Since design games can be applied for different purposes and throughout different phases in a design project, the purpose of the game and how it fits into the whole project must be considered. Depending on the design phase and the purpose of the game session, different applications for a design game are possible. Design games lend themselves according to Sanders et al. (2010) for a) "priming" participants to prepare them for entering into the area of the design problem b) access their current experience (see, e.g., "The User Game" as described by Brandt, et al. (2008)) or, c) the generation of new futures (see e.g. the "Landscape Game" as described by Brandt, et al. (2008)). For simplicity, we consider design phases as consecutive phases of analysis, design, and evaluation. Priming has to happen independently of a design phase. Accessing participants' current experience also happens in all three phases, but is most important during the analysis phase. The generation of new futures happens mainly during the design phases. In terms of the place of the game in a creative session, it is always helpful to include a warm-up phase, instead of jumping right into the game. This is especially true when participants do not know each other or are asked to talk about personal matters (Sleeswijk-Visser, et al., 2005).

4.5.3 GROUP ACTIVITIES VS. INDIVIDUAL ACTIVITIES,

Design games are mostly group games in order to benefit from the discussion between participants with different backgrounds, but can also be individual games. However, as described in Section 4.3, some studies show that in brainstorms individuals pooling their ideas come up with more results, than a group working together from the beginning (Mullen, et al., 1991).

Even though a good creative session structure and facilitation can turn this effect around, it is likely that group games benefit from an individual part in the beginning of the game to avoid that individual ideas get lost during the group discussion process. The individual part helps participants to develop their own thoughts, before being influenced and possibly distracted by what others have to tell. However, this is only advisable if participants are self-confident enough to contribute individually.

4.5.4 PARTICIPANTS

Sleeswijk-Visser et al. (2005) recommend four to six people in single group sessions for context mapping. As game sessions can apply various techniques in a number of ways, the ideal number of participants in game sessions depends on the type of game and the time available. The key is to have enough people to have group discussions, but not too many so that everybody has enough opportunity to voice his or her opinions. When selecting potential design game participants, their availability and type of compensation must be considered. Participants who are forced to take part in creative sessions on top of their practical work need to be highly motivated for the project in order to spend enough attention to their participation. The way and amount of compensation could also affect the outcomes of a design game. People who are not compensated, e.g., by participating during paid working hours, also need to be highly motivated to deliver the expected effort. However, compensating participants might attract people who are only in it for the compensation (extrinsic motivation).

4.5.5 PROPERTIES OF USE SITUATIONS AND PRODUCTS

Design games that are intended to deal with concrete use situations or products, in contrast to games that aim to develop, e.g., visions, can cover a variety of different properties. The use situation properties that could be covered are roles, responsibilities, time (chronology, duration, parallelism of events, and scheduled- and unscheduled events), space (location, distances, and size), information flows, and physical appearances of things, surroundings or people. The product properties that could be covered include functionalities, behaviours, and appearance (e.g., topology, size, colour, feel, smell, and sounds). During the development of a design game it must be decided which of these properties need to be included to solve the design problem and reach the project goals.

4.5.6 DEGREE OF FREEDOM AND GUIDING QUESTIONS.

Design games need thorough preparation beyond selecting activities, tools, and techniques. Gaining clarity about the questions that the game should answer and the degree of freedom for the participants (the size of the "solution space") is important in order to achieve relevant outcomes. This means that the designer of the game must anticipate in which direction to look for possible outcomes of the game. Furthermore, most games benefit from good guiding questions to stimulate creativity, get to specific answers, and retain focus in a game. Guiding questions refine important elements of the main question that summarize the project goals. Guiding questions are crucial and should be prepared before the start of the design game workshops.

4.5.7 CONCRETENESS VERSUS AMBIGUITY OF GAME MATERIAL

Game materials can either represent concrete properties (products, functions persons, places) of the real world, as in Ehn and Sjögrens Carpentry Shop and Utopia project (1991), or be ambiguous and allow for various interpretations as the abstract game boards in the "landscape game" described by Brandt et al. (2008). While concrete representations make it very easy for participants to relate to, ambiguous game material enables participants to bring in their own interests and allows for designing on a *"conceptual level"* without *"physical, technological or organizational constraints"* (Brandt et al., 2008, p. 62). This however requires in a design project that it allows for exploration on such a general level.

4.5.8 FACILITATION

During design game workshops there is usually a facilitator present whose tasks involves asking guiding questions, explaining the game if needed, ensuring that everybody feels at ease, taking care that every participant gets heard, keeping the group's focus on the actual problem, and keeping track of time. Facilitating a design game requires good social skills and analytical reasoning skills such as abstracting, contextualizing, reframing, and summarizing. Depending on the type of game, the design phase, the self-confidence, and the level of activity of the participants, the facilitator's role can be either active or passive and either scripted or spontaneous. The clearer the game rules and goals are, the less active can the role of the facilitator be.

4.5.9 ROLE OF THE DESIGNER AND RESEARCHER

The designer/researcher can play different roles in a design game. He/she can be either the tool and technique designer, facilitator, participant, or researcher or a combination of those roles. According to Jalote-Parmar and Badke-Schaub (2008) a prominent task for designers during creative sessions should be to bridge the communication gap between stakeholders with different backgrounds, e.g., medical specialists and technologists.

Combining some of the different roles, e.g., facilitator and participant or participant and researcher, can bring about practical and methodological problems. Being facilitator and participant at the same time can be stressful, as one has to constantly switch between a helicopter perspective and one's own perspective. Being participant and researcher at the same time is possible if one uses a participatory action research approach for the whole project with the aim to actively influence a situation. However, being participant and researcher at the same time is not possible if one executes specific experiments during game sessions, because in that case one's influence during the session could be interpreted as tampering with the experiment outcomes.

4.6 BENEFITS OF DESIGN GAMES

Involving stakeholders with a large repertoire of practical expertise in the design process can compensate for a designer's lack of knowledge about professional use situations and decrease the number of use problems in the resulting products. However, this only works if the non-designer participants are provided with the means to make a useful contribution and to bridge the gap between professions. Halse (2010) rightfully points out *"because user needs, design ideas and business opportunities are mutually constitutive, it is not enough for each expert to bring her side of the story to the others. These horizons must actively brought together in concrete terms to really take the full synergetic effect".* Design games can facilitate effective communication between designers and end-users by the use of boundary objects, by providing a concrete context for the design problem and by downplaying power relations. The concrete game context, together with tangible elements furthermore provides the means for non-designers to express their ideas and apply their practical and tacit knowledge to a design problem.

4.6.1 GATHERING RICH USER INSIGHTS

Traditional marketing tools do not always result in the desired level of user insight, since they focus predominately on quantitative data rather than in-depth qualitative data. To obtain rich qualitative data about the current use context, problems, and requirements, users can be actively involved during the design process by means of design games. Design games are helpful since they enable users to access their practical knowledge and apply tacit knowledge to the design problem.

Practical knowledge is knowledge about how things are currently done and about use problems, based on a frame of reference of experienced and memorized use situations. This knowledge can be accessed by the users to foresee problems and opportunities, which a designer, without this repertoire, cannot anticipate. Practical knowledge is especially useful to reveal current conflicts in product use or processes, foresee possible future conflicts, get insight into socially acceptable or not acceptable arrangements, and to develop new ideas for, e.g., product functions. Design games that provide concrete context in the form of scenarios or roleplaying are suitable to elicit this type of knowledge from users.

Besides eliciting practical knowledge, design games with stakeholders aim at gaining access to participants' tacit knowledge. Tacit knowledge cannot be articulated very well in words or writing, and comes only forward in the "doing" process (Polanyi, 1966). Compared to explicit knowledge, tacit knowledge provides a holistic view of, for instance, the usage or use context of a product, rather than an explicit functional definition of a particular product or activity. Design games can help with utilizing this type of knowledge in the design process by letting participants 'do' things, i.e., build and test new designs instead of just describing them.

4.6.2 TANGIBLE DESIGN OBJECTS AS BOUNDARY OBJECTS AND "THINGS TO THINK WITH"

Design games benefit from the use of physical game elements. *"When involving customers and users in a collaborative design process it is important to learn about their practices and their professional languages. [...] users/customers and designers cannot simply exchange information. All are firmly rooted in their worlds of competence, and therefore it is necessary to find ways to collaborate that can span the gap between these worlds"* (Brandt, 2004, p.118, also: Johansson, Fröst, Brandt, Binder, & Messeter, 2002). Design games can provide so-called "boundary objects" (Star & Griesemer, 1989) to span that gap. Boundary objects are (in this context tangible) objects that are common enough for all the participants from different (professional) domains to relate to. The boundary objects help to improve the communication in a group and circumvent the need to uncover and discuss the meaning the objects have to each individual. This also prevents discussions on a low level of detail, because participants do not have to agree about every detail. The boundary objects help participants to demonstrate things to each other, instead of explaining them in their individual professional language. Hence, participants can communicate with each other while each participant remains within his or her own knowledge domain.

Furthermore, showing things with the help of physical representations (e.g., puppets, building blocks, and cards) has a much lower participation threshold than drawing or using other representative techniques from the professional design domain. Also, putting hands on physical game elements enables every participant to take part in the game, influence the outcomes, and thereby gain ownership of the outcomes. Separate physical objects can be arranged and rearranged very easily, while providing a good overview for a whole group. In the same way, "post-its" are superior to writing notes on a flip-over. Finally, there is the learning theory of constructionism that says that hand-activity supports brain activities, meaning that, e.g., building things with one's hand helps to learn, structure, and make sense of the world (see, e.g., Papert, 1980).

4.6.3 DESIGN-BY-DOING: NEW LANGUAGE GAMES BETWEEN DESIGNER AND USER

Language games are a concept by Ludwig Wittgenstein, referring to language elements that are used only in a specific context or have a specific meaning in that context. The context could be, e.g., a region, or a group of professionals. The use of these specific language elements is referred to as a game, since it works according to rules which can only be learned by partaking in the language game. Ehn (1988) uses this concept to explain the difference in language games of designer and user and point to the relevance of using "design-by-doing" methods to overcome the differences.

Prototypes, mock-ups and scenarios in design games establish a common reference for communication, a reference that is understandable for participants and designers that originate from different language games, because meanings of the elements resemble each other in the different language games. In design-by-doing activities with prototypes, mock-ups and scenarios, as they are applied in design games, new language games can emerge within a group in the active practice (of e.g. a game) and when the participants begin to understand each other (Ehn, 1988, Brandt, 2005).

4.6.4 PROVIDING CONTEXT

Sleeswijk-Visser et al. (2005, p.121) note, that the term 'context' is slippery and it is not clear where it begins or ends. We adopt their description of context as referring to "*all factors that influence the experience of a product use*". Context in design games can be provided by scenarios, by tangible representations of the elements of the scenarios (e.g., playing pieces), and by predefined goals or events. This context enables participants to explore, develop, and evaluate concepts by imagining or mimicking concrete use situations.

4.6.5 RELAXATION OF POWER RELATIONS

The group of participants of design workshops can consist of people with different hierarchical standings in an organization. The presence of one's superior might inhibit participants and lead to the "superiors" being provided with the lion share of time and attention to proclaim their opinions. Design games can downplay such power-relations (Brandt, 2010), due to the playing rules and their playfulness. Rules can assign every participant to a specific role and timeslot to contribute to the game. This alters the way of interaction between participants from, say, general meetings. Design games are by definition playful and involve elements that can be perceived as fun, e.g., make-do, achievements, joking etc. The relaxed atmosphere of games supports creativity and collaboration (Vaajakallio, 2012).

4.7 CHALLENGES IN THE APPLICATION OF DESIGN GAMES

The application of design games holds a number of challenges for the practitioner:

4.7.1 TIME CONSUMPTION

Preliminary research in order to inform a game set-up, preparation of games and the organisation of game sessions can be time consuming. Even for a low-fidelity approach, the researcher or designer needs to carefully prepare the game material so that they fit the goal of the session and the characteristics of the participants. Involving users in a game session requires appropriate practical (venue and food) and organisational (scheduling and invitations) preparation. To execute game sessions, a single organizer or a small team is needed. Once defined however, a single game setup can usually be re-used for several sessions.

4.7.2 FINDING THE "RIGHT" AND WILLING PARTICIPANTS

It can be difficult to find the right participants for the participation in the design process, since what is "right'" depends on several factors including the project goal. In some cases, any participant will do, but usually open-minded participants are preferable. The range of possible participants for design games and the conditions under which they participate in the game is broad. In the selection procedure of participants three properties should be considered: (1) whether participants have real stakes in the design project, (2) whether they have sufficient practical knowledge and experience with respect to the design problem, and (3) whether they have design skills.

Participants can be stakeholders who have practical knowledge about the case and real stakes in the project. When participants have real stakes, this can influence the game outcomes, e.g., Bratteteig and Wagner (2010) describe that in one of their projects the participants with actual stakes were more focused on problem solving, whereas those with more distance were more exploratory. With respect to "designer skills", we do not refer to drawing or styling but to the ability to think associatively and to reframe problems. These skills are supposed to be well developed in professional designers, and less so in non-designer participants. Including designers as well as stakeholders from practice together enables participation in two directions; on the one hand participants participate in the designer world, on the other hands designers participate in the user world. Sleeswijk-Visser et al. (2005) have found that, in the context of context mapping, one participant in a group with good design skills can encourage the others to also access a more abstract way of thinking and exploring. However, a participant group of mainly skilled designers does not succeed in making their own experiences explicit in context mapping, because the group would be too solution minded (Pieter Jan Stappers & Sanders, 2003). Sharing experiences is not only crucial to context mapping, but also relevant step in design games that aim at attuning designs to practical experience and knowledge. Design games with this aim (in contrast to design games aiming at solutions that go beyond the current practice), therefore most likely also do not benefit from a group of mainly skilled-designers, not to mention, that healthcare is such a specialist field, that designers usually do not have relevant experiences in that field, that could be made explicit.

According to Lettl et al. (2006) there are two main barriers when aiming for so-called "radical" instead of incremental innovation. Even though healthcare environment and activity design does not always aim for radical innovation, it is useful to look into these barriers: Firstly, users might not be able to deliver valuable input because they are fixated on their current context, have problems evaluating completely new concepts, and are overwhelmed by technological complexity. Secondly, users might not want to contribute because they fear that they have to change as a result of the innovation, or that their knowledge might become obsolete. In order to overcome these barriers one adjusts the basic setup of a game session or chooses the right group of participants. With respect to the game setup, technology complexity can be partly evaded by focusing on use requirements and effects of the innovation, instead of the specifications of the technology that enables such effects. Being fixed to one's current context might indeed be a problem for user participants in design games. Specific game techniques aim at provoking participants out of their bias. In terms of choosing the right group of participants, two types of contextual factors that enable inventive user participation in the context of medical technology development were found by Lettl et al. (2006): (1) users with close access to interdisciplinary know-how and resources for research, as it can, e.g., be found in surgeons who are also part of technical universities, and (2) a high amount of intrinsic motivation.

In design projects without a predefined group of actual future product users, it can be difficult to find willing participants. In these cases the researcher probably has to decide on whether and how to compensate participants for their engagement. If participants are actual future users, they will profit simply by improving the product, and sometimes the experience of participating itself is set up to make it worthwhile, but otherwise some kind of reward might be necessary. However, when rewarding participants with gifts, participants are more likely to partake out of extrinsic motivation instead out of the willingness to develop a better future.

4.7.3 USER'S KNOWLEDGE AND ATTITUDE

Another challenge is to anticipate the users' point of departure concerning their knowledge and state of mind. It is necessary to know what they know about a project, product, or possibilities in order to create a meaningful game situation. This becomes even more crucial when participants have aversions against a brand, a product, or change in general. While it is not always possible or desirable to resolve these conflicts, being aware of them is important in order to situate and interpret game results.

4.7.4 DEGREES OF FREEDOM

Determining the degree of freedom for a generative session is an important aspect to consider. An appropriate degree of freedom for the anticipated type of product innovation (e.g., incremental innovation, platform based innovation or break-through innovation) should be maintained during the design game. However, finding the right balance is difficult, since too much freedom can lead to infeasible concepts, while too many constraints will most likely not lead to innovative concepts. The degree of freedom can be imposed by specifying or restricting the type of tools or props used, or by a skilled session moderator.

4.7.5 PROVIDING INSIGHT IN "TECHNOLOGY"

The problem of engaging "non-technical persons" is well known in including users in a design process and is generally dealt with by providing the appropriate design tools and techniques such as in design games, to participants. However, in practice game designers might feel uncertainty in determining the level of technology detail a game session should start with and design cases do not always offer the opportunity for extensive pre-studies with interviewing participants. This is e.g. the case when a project is initiated by a medical appliance company and not by a hospital itself. The reason is that companies cannot ensure compliance of medical staff to numerous user sessions. If there is only the opportunity for a single or few game sessions it becomes very important to make a good estimation of the level of technology experience, affinity with technology and frame of reference participants have. Furthermore, it also depends on the goal of a design game, to what extend the inclusion of technical detail in a game has any added value. These considerations are relevant to decide the level of "technology detail" that should be aimed at in any game session, that is to say, the extent to which technological functionalities are explicitly described.

4.7.6 LEVEL OF DETAIL

The level of detail in the game material, from virtual reality environments to mock-ups to playing pieces influences design game session outcomes. Whereas e.g., simple mock ups with few details bring up more varied issues, very detailed and finished mock-ups elicit comments with a smaller variation on a more detailed level (Brandt, 2005). It is therefore very likely that the level of detail of the game material should also be adjusted to the stage of the design process. Especially in early design phases, as is the goal in this thesis dealing with healthcare environment and activity design, very detailed game pieces are not advisable, since they may lead to too detailed discussions early on.

4.7.7 CONFIDENTIALITY

Including external participants in product development bears the danger of leaking confidential information about the company's developments and innovations to the competition. If design information is confidential, a company needs to carefully consider whether to involve users in the design process. Information leaks can be prevented by using appropriate contracts with the involved users. Alternatively, product substitutes or simplified versions of products could be used.

4.7.8 DESIGN RATIONALE

Capturing the information in design game sessions is necessary because usually not everybody included in the design process is present during the sessions. As a result the generated information must be shared afterwards with the complete design team (Sleeswijk-Visser, et al., 2005).

Generative design sessions produce a wide array of results, including models participants create, stories they tell, and the reasons that underlie specific decisions during the game process (which might or might not be explicitly mentioned). *"Just paying attention to the created artefacts alone is not recommended, because the participants' stories carry much knowledge about their experiences and the contexts of product use"* (Sleeswijk-Visser, et al., 2005, p.134), and *"what has been left out of the artifact, may be as important for guiding further understanding of the topic, as what is integrated with the created artefact"*(Vaajakallio, 2012, p.41).

Video recordings can cover everything that happens visibly and audibly during a design game session without disturbing the gameplay, but often require extensive work to identify the relevant aspects afterwards. Furthermore, many things happen in a session for reasons participants might all agree on, but these reasons are not explicitly named. This occurs very frequently due to the strong focus in design games on "doing and showing" instead of telling and reasoning. Participants can be pushed to tell these aspects by asking specific questions, so detailed descriptions of certain elements become available (Vaajakallio & Mattelmäki, 2007). However, doing this during a design session can be disruptive to the flow of the game, which is why it should preferably be done afterwards.

4.7.9 OPEN ENDED

Creative design sessions are usually open ended (Iacucci, et al., 2000). This can be uncomfortable for some people and hard to "sell" to people who are management oriented, because there is a high degree of uncertainty involved about the type of outcomes. Furthermore, outcomes are not readily available after game sessions.

4.8 DISCUSSION

A low-tech design game appears to be useful to including stakeholders in the design process of healthcare environments and activities. It can bring together different stakeholders and enable them to apply their tacit and practical knowledge to a design problem. Participating in a game can be relatively easy, and is experienced as more exciting and appealing by participants than other techniques such as focus group discussions. It creates an informal atmosphere which is productive for creative work and levels the playing field between participants (Brandt, 2006).

The goal of the present research is to find out what kind of design game is needed to give participants insight into the consequences of their design decisions and enable them to derive creative solutions for the development of healthcare environments and activities. Since Halse, Brandt, Clark, and Binder (2010b, p.9) recommend to always tailor a technique to *"suit the uniqueness of your present situation",* and the healthcare context comes with specific challenges (see Chapter 2), a dedicated game is needed for healthcare environment and activity design. A design game for this purpose must provide a holistic overview by including products, space, the activity-flow, and roles and responsibilities that are involved in the healthcare procedure as game properties. Hence, in the development of a game for healthcare environment and activity design, special attention will be paid to how *all the properties* of healthcare environments and activities, including scheduled and unscheduled use situations, can be covered in the game, and how participants can get a holistic overview of the complex use situations and a *realistic context* of a healthcare environment to simulate and evaluate ideas. As indicated in this chapter, the "choice" of participants for design games can be difficult. Therefore, the usefulness of a design game for healthcare environment and activity design will be evaluated with different participants groups in terms of stakes, practical experience and professional design skills.

5 RESEARCH APPROACH

5 RESEARCH APPROACH

5.1 INTRODUCTION

The previous chapters have indicated that designing and implementing new and improved work processes, environments, and appliances in the healthcare sector could benefit from accessing the experience and knowledge of the stakeholders involved to get a detailed understanding of the total use situation and foster the commitment of the stakeholders. This thesis proposes a dedicated design game to enable stakeholders to make a useful contribution to the design process. The need to gain access to experience and knowledge of involved stakeholders and to achieve their commitment pointed towards using a participatory design approach.

The development of the design game will be addressed in Chapter 6. Two independent design projects were performed for the second, third and fourth part. The first design project is about the redesign of the nursing work processes for a new building of a major Dutch hospital (see Chapter 7). The project, referred to as SWING, was a large participatory design project with 54 project members and over thirteen workshops that was completed over the course of two years (see Figure 5.1). Besides for confirming the usability of the developed game, this project was used to verify the usability of a participatory design approach to gain stakeholder commitment. The second design project was used to confirm the benefits of the design game in the context of a different design problem and to explore the effects on the design results of using different kinds of participants. It dealt with the design of a mobile hospital for disaster situations and was set-up with the support of Holland Medical Services, a Dutch company (see Chapter 8). It was significantly smaller in scale than SWING, involved two separate workshops and took several months to complete (see Figure 5.1).

This chapter describes the approach that was used within the present research. The research questions and how the two projects have been used to test the quality of the design game and the participatory design approach are presented in Section 5.2. Next, Section 5.3 presents the data collection and analysis process. In Section 5.4 the role of the researcher is described and in Section 5.5 ethical considerations of the research are discussed.

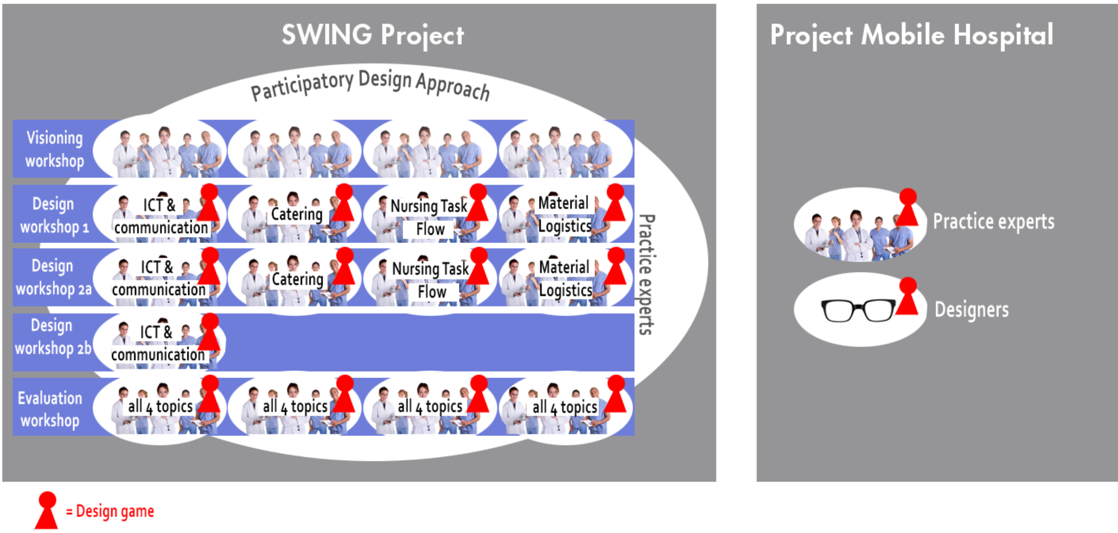


Figure 5.1: The workshop sessions in the two projects.

5.2 RESEARCH PURPOSE, QUESTIONS AND PRACTICAL APPROACH

5.2.1 RESEARCH PURPOSE

This research aims to offer support for designing healthcare environments and activities consists of four major parts:

1. the development of a design game for healthcare environment and activity design,
2. the test of the design game's overall usability and ability to develop design solutions,
3. the verification of the usability of a participatory design approach employing the design game, and its usefulness to gain stakeholder commitment.
4. the development of insight about the relevance of the design game outside of a genuine participatory design approach, with (a) participants with knowledge and expertise relevant to the use context, but no stakes, and with (b) designers who possessed design skills, but had no expertise relevant to the project.

Since the design game that has been developed, has been built and put to use, the research can be described as constructive design research (Koskinen, Zimmerman, Binder, Redström & Wensveen, 2011), where both the design game (the "product") and the lessons learned from its application are research results. Furthermore, the design game and the participatory design approach were evaluated with respect to their usability for healthcare environment and activity design. The experiences and conclusions drawn contribute to the knowledge in the fields of design games and participatory design. More specifically, this research contributes to the participatory design literature by analysing to what extent participants actually perceive the benefits the participatory design approach promises. The research furthermore also contributes to design game literature by presenting a fully developed design game as well as providing insights about the game playing behaviour and outcomes of different participant groups.

5.2.2 RESEARCH QUESTIONS AND PRACTICAL APPROACH

The development of a dedicated design game

1. What kind of design game can give participants insight into the consequences of their design decisions and enable them to derive creative solutions for the design of healthcare environments and activities?

    1a. How can *all the properties* of healthcare environments and activities, including scheduled and unscheduled use situations, be covered in the game?

    1b. How can participants get a *holistic overview* of the complex use situations?

    1c. How can participants be provided with a *realistic context* of a healthcare environment to simulate and evaluate ideas?

Evaluating the design game

The aim of design tools, techniques and methods is typically to generate a number of feasible solutions and/or ideas. Naturally, it is difficult to study creative design, because creative events or the emergence of creative ideas cannot be predicted and rating ideas according to creativity is not straightforward (Dorst & Cross, 2001). Furthermore, comparable conditions can hardly be achieved in the context of creative group sessions to evaluate design tools, techniques or methods as every group of participants develops different group dynamics. Furthermore, the sessions cannot be repeated with the same group of participants and the same topic for obvious reasons. However, comparisons can be made using the same tool, technique or methods but varying the participant group and/or the design problem. While the results cannot be used as a benchmark for other approaches, they can be used to evaluate a specific tool, technique or method and indicate under which circumstances it works best. Accordingly, the research questions regarding the evaluation of the design game are:

2. How does the developed design game perform in terms of usability under different circumstances for the design of healthcare environments and activities?

    2a. How does it perform in different design projects?

    2c. How does it perform in a participatory design context?

    2d. How does it perform with practice experts outside of a participatory design context as participants?

    2e. How does it perform with designers as participants?

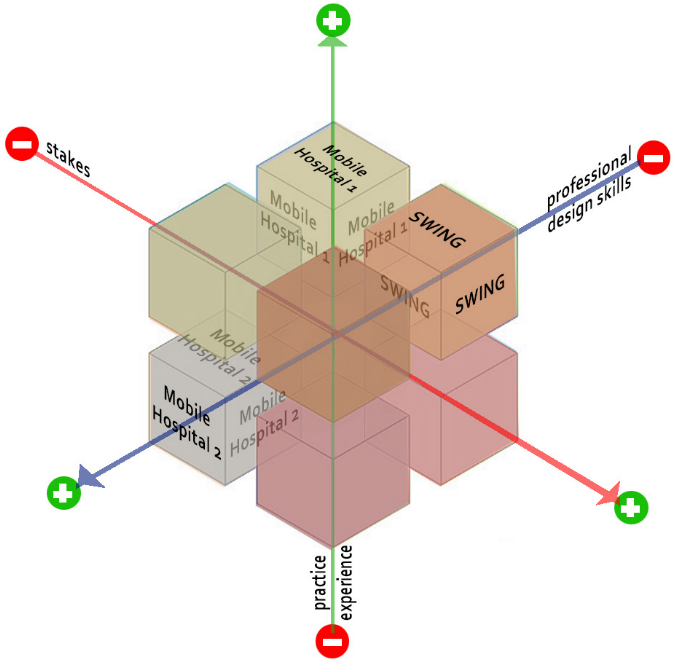


Figure 5.2: Illustration of the design projects used in this thesis based on the types of participants.

In total, the design game was used in 15 different workshops across the two design projects, covering five different design topics. Of those topics, four were part of the SWING project and one covered the mobile hospital project. The topics focused on the design of an organized routine that can be scheduled in advance as well as on ways to deal with unscheduled events. The four topics in the SWING project dealt with the setup of processes as well as the required appliances, whereas the topic in the mobile hospital project in addition covered the setup of the spatial environment. The points of departure in the workshops were different. While in project SWING the architectural design of the hospital was already completed prior to the workshops, in the mobile hospital project the hospital layout could still be changed.

For exploring the effects of the type of participants on the game outcomes, the design game was used with three different participant groups. The participant properties that are considered to influence the participants' approach of a game and the game outcomes are: whether participants have real stakes in the design project, whether they have practical knowledge and experience with respect to processes and appliances to be designed, and whether they have design skills. Hence, the game was evaluated

a) in a participatory design context with actual stakeholders, who had practical knowledge and experience with the subject matter,

b) with experts who had practical knowledge and experience with the subject matter but no stakes in the project, and

c) with designers who had no stakes and no practical experience with the subject matter, but did possess design skills (see Figure 5.2).

The combination of design skills, stakes in the project, and no practical experience, which reflects a typical situation of designers who are commissioned to a project, was not investigated. While applying the developed design game with professional designers in a commissioned project would have been interesting to evaluate, it was not feasible for this research due to time constraints. Similarly, the combination of no design skills, no practical experience, but stakes (e.g., hospital top managers) was not looked into, since the value of such participants in a design workshop is questionable due to the absence of design skills and practical experience. The other combinations are rarely appearing in practice.

Testing the usability of the design game was achieved by using a deductive and an inductive method. A deductive method was used in testing whether the method suffices the criteria of usability. An inductive method was used with respect to exploring opinions about the added value the game and its results, without a predefined construct.

Evaluating a participatory design approach based on the design game

3. How does a participatory design approach, based on the use of the developed design game, perform for the design of healthcare environments and activities with respect to usability?

4. How does a participatory design approach, based on the use of the developed design game, deliver participatory design benefits with respect to commitment to an organizational change process?

The usability of a participatory design approach that is based on the developed design game was evaluated in the SWING project. SWING was a sizeable participatory design project that that took two years to complete, involved 17 workshops (of which 13 employing the game), and had 54 project members. As a result, it allowed for a longitudinal study of the effects of the participatory design approach, which included the evaluation of the perceived usability of the approach, the project management, the set-up of different workshops, and the project members with different roles. Testing the usability of the participatory design approach was, in the same way as testing the usability of the design game, achieved by using a deductive and an inductive method.

Commitment is in this research generally describes commitment to the organizational change process, that is recognizable by participants showing the willingness to participate in SWING, the willingness to move away from the current situation and design a new one, as well as involvement with and commitment to the new building project. The commitment in the SWING project was assessed using a deductive method by asking for the added benefits of the project approach.

Project SWING was intended to be a genuine participatory design project. However, as even the best plans are susceptible to changes during implementation, it was assessed after its completion whether SWING had fulfilled that goal. As indicated in Chapter 3, the extent of participation in a participatory design project is characterized by its impact, its influence, its agency, and the benefit it generates for the individual participant Impact is described by "use of information" and "quality of information generated", influence is described by "scope of the decisions" and "number of the decisions", and agency is described by "solidarity" and "willingness of participants" in a project. In addition, the individual benefit of SWING for the participants, which was described by the variables "growth of competencies or self-efficacy", "growth of insight in the own work", "confidence about own contributions", and "pleasant project experience" was evaluated. By assessing these variables, this research tried to assess to what degree SWING can be considered a participatory design project.

5.2.3 THE CONSTRUCT OF USABILITY

The construct of usability is central to how the design game and the participatory design approach are evaluated in this research. The ISO 9241 norm is followed and usability 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"*. The definition focuses on the three criteria:

- efficiency,
- effectiveness, and
- satisfaction.

Effectiveness is the accuracy and completeness with which specified goals are achieved, efficiency refers to the resources spent in relation to the effectiveness of the achieved goals, and satisfaction relates to the comfort of the product use and acceptability of the product to the user. In this research the usability of the game and the participatory design approach were, next to analysing the design results, mainly assessed by the opinions of interviewees: The perceived effectiveness of the design game has been assessed by the contribution of the game to achieving the design goals and by the influence of the game on the number and scope of the design results. The evaluation of the game's efficiency is based on the perceived influence of the game on the quantity of design results obtained within the invested time frame. The satisfaction has been evaluated by to what extent participating in the game appealed to the participants. The effectiveness of the participatory design approach in SWING was measured via the received quality and the efficacy of the project results, and the recognizable commitment the project generated for the new building project. The efficiency was determined by the evaluation of the variables project and workshop duration, quantity of project outcomes, hidden costs, and cost-benefit ratio by interviewees. The satisfaction about the participatory design approach was measured according to the participants' satisfaction with their role in the project.

5.3 RESEARCH METHODS

5.3.1 QUALITATIVE FIELD RESEARCH

As described above, developing the "product" design game, putting it to use, and exploring how it is used and what its effects are can be described as constructive design research. Exploring the game's use and its effects is carried out as qualitative field research. Both projects were real world projects with the goal to generate design results that could be implemented. Only real world projects can generate authentic results with respect to stakes and commitment effects. Therefore no conditions were controlled during the design workshops, except the choice of participants and topics. However, the choice of topics and participants was not artificial nor was the workshop situation simplified in order to create controlled conditions. There are a number of challenges related to the present type of research. Since real-world design projects are usually time consuming, it was not feasible to do a significant number of design projects within the timespan of the present research project. Furthermore, it is difficult to measure the success of a design game, since the quality of design results can only be assessed after implementation, i.e., ex-ante verification is typically not possible. However, most research projects end before the design results get implemented or because the research project does not go into the implementation phase. While the difficulty to generate quantitative data in the evaluation of a design approach points to qualitative research, qualitative data collection and analysis has also its unique benefits. According to Gray (2009, p.164), qualitative methods provide a *"deep, intense and holistic overview"*. This research aims at finding causal relations within this specific project, it tries to *"understand phenomena within their own context-specific setting"*, studying the field setting, and the researchers role within it, understand the way people act and account for their actions (Gray, 2009, p. 164).

This research uses for the most part a qualitative research approach, but this is supplemented with quantitative methods when changes in the attitude and self-perception of the project participants are measured.

5.3.2 MIXED DATA COLLECTION

Mixed data collecting methods were applied to address the different research questions and to improve accuracy by applying different methods to the same questions. While the design of the game (research question 1) was purely based on literature research about design games and creative group work (see Chapter 4), the other research questions required the collection of original data. In both design projects, data was obtained directly from the workshops by collecting the design outcomes generated in the workshops, keeping observational notes, and making video recordings. Furthermore, during SWING interviews and questionnaires were used. There were three series of semi-structured interviews that were documented by notes and voice recordings. In addition, there were five questionnaires (digital and paper-based) that were used to collect anonymous data before, in between, and after the workshops. In the mobile hospital project an evaluation discussion about the design game was held and recorded by video.

Observations

Observations were used to determine the project setup and to explain differences between workshop sessions. Before the official start of the SWING project, the researcher joined nurses in early and late shifts on two different nursing wards to learn about their daily work, current problems, and bottlenecks in their activity flow. These observations were used to determine the project setup, the workshop topics, and the design questions for the workshop. The results from these observations are not presented in this thesis. Furthermore, the researcher participated in all workshops and steering group meetings in project SWING. All important observations were written down directly after the workshops and meetings. These results were used to generate a description of the progress and events during the workshops. The description itself was not analysed, but rather used to provide a context in which design, interview, and questionnaire outcomes were explained.

Video recordings and workshop material

In order to answer research question 2 all workshops in this research were video recorded in agreement with the participants to enable the researcher to analyse the sessions in more depth. In the mobile hospital project the designers had to evaluate the activity flow game in an open discussion directly after the workshop. Video recordings from the evaluation discussion with the design team were used to record their statements and evaluate the designers' satisfaction with the game's efficiency and effectiveness. In addition to the video recordings, all physical material created during the workshop was collected, photographed, and digitally reproduced (in case of card arrangements) or transcribed.

Interviews

The most contributing data collection method in project SWING was interviews. Interviews have been chosen because they provide rich data and the opportunity to probe participants. The interviews were used to contribute answers to research questions 2, 3 and 4. Semi-structured interviews were conducted with project participants, members of the project steering group, and domain experts (see Chapter 7) at three moments during and after the project (before the workshops session started, after the first design workshop, and after the completion of the project). The interviews took on average about one hour each. To ensure reliability, all interviews were executed by the same interviewer. Notes were taken during the interviews, and voice recordings were used as back-up to search up word-for-word expressions, if needed. Interview responses are cited by profession of the interviewees in this thesis.

The first SWING interviews took place before the start of the workshops to establish the start situation for the project. This interview was conducted with eight persons. The results from these interviews were exclusively used to prepare the project and are not be presented in this thesis.

The second series of interviews was conducted after the first design workshop, as a first moment of evaluation. Results were intended to adjust the projects direction if needed. The interview was conducted with six interviewees, and the interview questions can be found in Appendix 1.

The third series of interviews was the most extensive one and dealt with the evaluation of the design game and the participatory design approach. The sampling for this interview can be classified as stratified purposeful sampling. From each participant group interviewees were selected to be interviewed, either by interviewing the full group or by random sampling within the group. The interview was conducted with fourteen interviewees. The interview questions of the evaluation interview can be found in Appendix 2.

Questionnaires

During SWING, workshop participants were asked to fill in anonymous questionnaires. These questionnaires were designed to collect qualitative and quantitative information to address research question 4. For this purpose they contained questions to be answered on a five-item Likert scale as well as open questions. The topics of the questionnaires included the participants' perception of creativity and self-efficacy, their perception of the project's impact, their expectations with respect to the project, their organizational commitment, the current developments at their ward, and participants values that had relevance to the project. A basic set of questions was the same in every questionnaire, but presented in a different order. In addition, these repetitive questions were complemented by questions that were related to the current events in the project at the time the questionnaires were applied. The questionnaire questions can be found in Appendix 3. The questionnaires were issued at five moments during the project. Questionnaire two and five were spread digitally by providing an e-mail with a link to the digital questionnaire at the questionnaire support website “thesis tools”. The other questionnaires were handed out on paper. The goal was to have all project participants fill in the questionnaires to achieve comprehensive sampling. However, the number of workshop participants fluctuated and also decreased over the course of the project due to cancellations of participants for specific sessions and people who had to leave the project completely. Therefore, the number of complete sets of all five questionnaires filled in became too small for comprehensive sampling. Furthermore, participants were asked to use a code name or number for the questionnaires, to maintain anonymity, yet, enable us to link all five questionnaires to the same individual and provide data for an within-subject analysis. Unfortunately, most project members forgot or left out their code name or number, hence between-subject analysis had to be applied.

5.3.3 DATA ANALYSIS

Analysis of workshop data in project SWING

The workshop results from project SWING were analysed to gain information about the efficiency and effectiveness of the design game and the participatory design project. As mentioned earlier, it is difficult to decide how innovative and feasible design ideas really are, since innovativeness is a vague concept and feasibility can often only be evaluated after it has been implemented. Furthermore, the sheer quantity of output does not say much about a tool, technique or method either, as all ideas could be bad ideas. Therefore, evaluating the design game in relation to the quality of the design results it generated is based on opinions from the interviews and the discussion of the designers in the mobile hospital project.

Besides gathering opinions about the usability of the game, a comparison between results from workshops with different topics was executed, to compare the type and number of results for the different topics. The data written on game cards and flip-overs from the design workshops were coded according to the game properties they belonged to by the researcher (see Section 7.8). More specifically, the number of design ideas for each game property category were recorded. However, only ideas from the design game workshops were taken into account that were actually chosen to be pursued in the project. This approach enabled us to compare the results between different topics and different series, similar to the approach used by Perttula et al. (2006), who evaluated the outcomes of brainstorms based on the number and variety of the resulting ideas.

Furthermore, the researcher, the project commissioner, and the project manager from the hospital identified so called fundamental and innovative outcomes. The number of fundamental and innovative outcomes could then be compared between topics and between workshop series, in order to e.g. see if there was a shift from fundamental to innovative outcomes between workshop series, or specific topics led to more innovative ideas than others.

Analysis of workshop data in the mobile hospital project
In the mobile hospital project the video recordings of the two workshops were analysed not only with respect to the design outcomes, but with respect to all the actions during the workshops, even those that did not lead to outcomes. The actions (speaking and doing) in the videos were per workshop categorized according to the game properties. In addition, this research distinguished between three types of actions in every property category: (1) decisions, i.e., ideas that were chosen to be pursued, (2) discussions, and (3) shared stories. More detailed information about the coding process can be found in Chapter 8. Comparing actions for each category was done to reveal differences between the approach and results of the expert and the designer group and form conclusions about the effectiveness and efficiency of the design game in the non-participatory setup. The number of interventions from the facilitator and the number of times the project developer gave input during the workshops were also recorded. The ratio of discussions and decisions per category was used to identify controversial categories within a group.

Furthermore, the evaluation discussion in the mobile hospital project was transcribed verbatim in order to detect all relevant arguments.

Interview Analysis
The interview responses to questions aimed at evaluating usability were sorted according to the degree of consent to a specific condition and summarized. Responses to open questions were coded. The coding was executed by the researcher and was based on categories that emerged from the notes of the interviews. The categories were reduced to a small set that described the spectrum of answers sufficiently.

Questionnaire Analysis
The responses to open questions were analysed in the same way as the interview responses. The repetitive questions in the five questionnaires were analysed in a quantitative longitudinal study. Participants were asked to use a code name or number for the questionnaires to maintain anonymity but enable us to link all five questionnaires to the same individual and provide data for a within-subject analysis. Unfortunately, most project members forgot their code name/number. As a result, a unpaired analysis had to be applied by considering the respondents to the five questionnaires as five different groups. The nonparametric Kruskall-Wallis ANOVA method was used to find significant trends between questionnaire groups, as the groups data did not meet the criteria of normality.

5.4 ROLE OF THE RESEARCH AND THE RESEARCHER

The present research included a very active role for the researcher. The researcher was game designer, project manager, and researcher at the same time. Project management was added to the role of researcher and designer, as *"the closest a researcher can come to a project or a process in order to be aware of as many small important daily steps and 'information quanta' as possible, is to manage the project or process himself/herself. This involves combining the roles of researcher and manager"* (Ottoson, 2003, p.91). Even though the statement has been made in the context of participatory action research, this thesis has benefited from the fact that the researcher on top of designing the design game managed the design projects herself and facilitated all workshops. The downside was the large task load, especially for a large project as SWING. The tasks included discussing the scope of the workshops with the project steering group, preparing the workshops and workshop materials, preparing the research materials, analysing the design results for the organization and analysing other data for the research. The researcher/designer/manager will in favour of readability henceforth be addressed as "researcher", only. During the project, the researcher had contact with a large number of people with different opinions about the project and attitudes towards the new building project. This required not only analytical research skills, but also social skills, as Ottoson (2003, p.92) describes: *"Broad personal knowledge and skills are especially important when researchers act as managers, project leaders and team members, since dialogues and discussions are often spontaneous"*. The present research has not been set up as action research in the sense that it was intended to change the behaviour of people. However, the part of the research that tried to foster the project participants' commitment to the SWING project can be considered as action research (though not as participatory action research, as the project participants were not invited to take part in the analysis of the research results and in the reflection of the project context).

5.5 ETHICAL CONSIDERATIONS

All members of project SWING participated as part of their paid job. The principal advantage of participating for the participants was that they could influence their own future. In the mobile hospital project, the experts were invited to participate and share their experience with the researcher, the project developer and each other. They freely decided to participate and were "only" compensated by a tour of the Virtual Reality lab[1] of the University of Twente. Similarly, the participating designers in the mobile hospital project were invited to participate and accepted the invitation freely. Likely reasons for their participation were their general interest in the design game, the appealing topic of the project, and their solidarity with the researcher.

[1] *See "http://www.vrlab.ctw.utwente.nl" for more information about the Virtual Reality Lab.*

All project participants were informed about the goals of the projects for the commissioning organizations as well as the general research goals. Video recordings were made in agreement with the workshop participants. Interviewees were informed that interview statements and results would only be identified by professions in this thesis.

The workshops were set up in a way that did not expose potential deficiencies of participants and did not bring anyone into discredit. This was particularly judged relevant in the SWING project. For this reason no individual activities were planned during the workshops. The aim was to generate personal benefit for the participants with respect to their knowledge, self-image, and the experience of the workshops. Furthermore, participants could chose to not participate in the workshops. However, it is possible that some participants in the SWING project did not feel free to leave the project, since they were appointed by their ward managers to participate.

Including stakeholders in a design project can be misused as a mean to convince people of something that has already been decided, instead of giving them a voice in these changes. SWING, however, was not created to push any predefined concepts. Instead, the aim of SWING was to generate concepts for the work processes in the new building and to foster employee commitment to project SWING and to the whole new building project. There were no plans available for the working processes when SWING started, apart from the architectural plans of the new hospital building, which could not be changed, and some requirements regarding the catering concept. However, restrictions exist in any design problem and the restrictions in SWING were communicated to all participants from the start.

In SWING, the results of the project will have consequences for most of the participants. There will be changes in their work tasks, the unit they work for, and also changes in power relations. While this research did not have a direct influence on the fact that there will be changes, SWING tried to openly deal with the changes, make them transparent during the design workshops and facilitated developing requirements of different staff groups with respect to these changes.

In the end, the researcher made sure, that the recommendations of project SWING explicitly point out possible changes in power relations and recommendations with respect to these, the relation between ward staff and patients, and changes due the introduction of technology.

6 THE DESIGN GAME

6 THE DESIGN GAME

6.1 INTRODUCTION[1]

The design of healthcare environments and activities could benefit from a dedicated design game that properly addresses the complexities of the design problems. Such a game should bring together stakeholders with different backgrounds, skills, and hierarchical standings and provide a holistic overview of the products, the space, the task-flow, and the roles and responsibilities involved in the work activities. This chapter describes the development of such a design game, called the Healthcare Environment and Activity Design (HEAD) game. This new game includes miniature roleplaying with the aim to develop an ideal situation. The roleplaying is structured by a task flow, that has to be created as a part of the game, and gets inspirational impulses new technologies, facilitator questions and events.

The games used in the "Carpentry shop" project, the "UTOPIA" project and the "Desktop publishing" project by Ehn and Sjögren (1991) are examples of design games, that are often referred to as they are some of the early design games in Participatory Design. These games will be used as a first reference, to compare the HEAD game to, and show its characteristics. Furthermore, the "Landscape Game", as described by Brandt, et al. (2008) will be used for the same purpose, because it differs from the games from Ehn and Sjögren by the use of abstract game materials. All are examples of games, that can be used for playing *"as-if-worlds"* (Brandt et al., 2008, p.51), hence, not only to explore current practice, but to develop possible futures. First, a short description of the games will be given:

The carpentry project had the aim to *"strengthen positive aspects of carpentry workplaces such as good product quality and good workmanship and to improve the weak sides, such as bad organization and poor Physical environment"* (Ehn and Sjögren, 1991, p.242). In the project, three games were played by carpenters together with designers, "Carpentrypoly", the "layout kit" and the "Specification game". Carpentrypoly was a game with the aim to "*find out what kinds of consequences different business strategies would have for the design of technology and organization",* and what *"the impact on quality of the product and the work"* would be (p.242). The participants took on roles of carpentry shop owners *"reflecting different business ideas and strategies"* (p.243). The game was extrapolated from a leisure board game, including a game board representing a business year and a dice. Participants had to roll the dice, move game

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[1] *Content of this chapter has been adapted from "Garde, J. A. and M. C. van der Voort (2009). The procedure usability game: A participatory game for the development of complex medical procedures & products CIRP IPS2 Conference. R. Roy and E. Shehab. Cranfield, Cranfield University Press: 483-489.", from "Garde, J.A. and M.C. van der Voort (2012). Co-designing better work organization in healthcare. Advances in Human Aspects of Healthcare, CRC Press, Taylor & Francis Group: 23–32.", and from "Garde, J.A. and M.C. van der Voort (2013). The Activity-Flow Co-Design Game: Designing for scheduled and unscheduled use situations. IASDR. Tokyo".*

pieces on a board, and take "market cards", describing opportunity scenarios. Based on their role they had to make decisions with respect to their businesses to react to the opportunity scenarios. Furthermore, they had to react to fictive *"changes in the political and economic context in society"* (p.243). The second game, the "Layout kit" game was used to lay out existing shop layouts with cards with pictures of woodworking machines and accessories on a sheet with a factory lay-out with the aim to identify problems in existing shop lay-outs and develop new designs. The third game, the "Specification game" was used to structure and refine proposals or demands from the other two games in the categories "product", "technology", "organization", and "work".

In the "UTOPIA" project the "Organizational Kit" game was used to reorganize newspaper production. It consisted of adhesive cards with icons for "artefacts", "materials", and "functions". The game followed the newspaper production flow and started with making a description of the existing newspaper production flow by accordingly placing the cards. Then changes were discussed and alternatives developed, and "new functions and changed rules were introduced, *if they made sense to all participants"* (p.252). Ehn and Sjögren (1991) report, that during the game, many human actor icons were made and added to the game.

In the desktop publishing project the aim was to develop professional roles and restructure the work organization for desktop publishing in the national Swedish board for consumer policies. In the "Desktop publishing" game, Ehn and Sjögren (1991) turn towards a *"linguistic"* game which is based on negotiations between participants, because the production-flow metaphor was not applicable to the office environment. Participants took on existing as well as new professional roles. The game used paper sheets referring to general tasks, representing an interpretation of the work organization as "playground". So-called "situation cards" were used to bring breakdown events into the game. These events stimulated players with different roles to discuss and make commitments, in order to overcome the breakdown and develop strategies, to prevent similar situations in the future. The conditions for the commitments were negotiated, and both were written cards and placed on the task sheets.

Ehn and Sjögren (1991) used in the first two project many game elements that are a concrete representation of the actual world and turn to "linguistic games", which are based on verbal negotiations, to overcome the "production flow" approach in the third project. Brandt et al. (2008) argue for the combination of ambiguous game materials, such as abstract game boards in the "Landscape Game", with concrete game materials, to allow for participants to bring in their own angles and postpone a limitation by *"physical, technological and organizational constraints"* in the game (p.62). In the Landscape game, a game about future office environments, participants build a *"future landscape"* by using *"moment cards"* and *"trace cards"* and an abstract game board (p. 58). The moment cards refer to video snippets from field material and the trace cards are pictures taken from field material. Each participant picks a number of cards, that are interesting to him/her and then explain what the contents of the cards mean to him/her. This evokes discussions about various topics. Then the participants chose one out of three abstract game boards titled *"important things in the middle"*, *"everyone will sit by the window",* and *"many centres"* (p. 59). The cards become game pieces, and are arranged on the game boards. The game board is not a representation of actual space, but a template for a sorting activity such as landscaping or card sorting (see Section 4.4.2). Positions are voiced and challenged, *"many different constellations are explored"* (p. 60) and stimulate dialogue. The "visioning workshops" held in the SWING project (see Chapter 7) are probably comparable to this approach; in the visioning workshops in SWING participants were asked to bring items symbolizing visions and concerns with respect to the project in order to stimulate discussion, and were asked to place them on game boards with concentric circles, where the centre of the circles stood for the "most important" visions and concerns.

While Carpentrypoly, and the Landscape game are very open, the HEAD game is not foremost intended to explore new perspectives and leads. It is intended to deal with concrete design problems, that are expected to require a more structured approach in order to enable participants to come up with design ideas. These concrete problems are expressed by the focus points of the different workshops in the SWING- and the mobile hospital project (see Chapters 7 and 8). The HEAD game is in that sense a game for a later moment in a project, when the a dialogue on visions and concerns has already taken place, and is in that aspect more comparable to the Lay-out Kit game or the Organizational Kit. The HEAD game does not include leisure game like elements such as dices, and competition, as e.g. in the Carpentrypoly game (Ehn & Sjögren, 1991), but aims at the cooperative generation of new concepts and evoking dialogue on the way by bringing together participants with different backgrounds and by the boundaries for the solution space. Further resemblances or differences will be addressed in later on.

This chapter recalls the requirements for the HEAD game (Section 6.2), describes the two fundamental components of the game (Section 6.3) and the people involved (Section 6.4), explains choices in the game design with respect to the game characteristics (Section 6.5), presents the basic game material used (Section 6.6), the application process of the game (Section 6.7) and the use of optional game material (Section 6.8), and discusses the expected strengths and weaknesses of the game (Section 6.9).

6.2 REQUIREMENTS

A dedicated design game for designing environments and activities in healthcare should meet a number of important requirements. An investigation into the problem area in Chapter 2 has resulted six requirements that relate directly to the game. The game should:

- provide a holistic approach,
- allow for different stakeholders to participate, independent of their interests, intellectual aptitude, and skills,
- foster communication between different stakeholders,
- provide insight into consequences of design decisions,
- motivate stakeholders to participate, and
- be time efficient in view of the limited availability of medical staff.

6.3 MAIN GAME COMPONENTS

The HEAD game is applied in generative workshop sessions. In these sessions, a group of users is asked to use the game materials to develop, alter, and re-enact use scenarios in order to solve an assignment regarding a design project. The game aims to provide a holistic overview of a (future) use context and the corresponding activity task-flow. The HEAD game achieves this task with the help of (1) a miniature environment including playing figures and (2) a task-flow. The miniature environment is a physical representation of the people and places involved in the work environments/scenarios and is used for role-playing. The focus on scenario based role-playing makes the HEAD game different form the Lay-out kit game and the Organizational Kit (Ehn & Sjögren, 1991). Role-paying provides a context, in which bottlenecks and new ideas can emerge much better, than when just configuring new concepts, by changing their constellation. The general steps of the role-playing scenario are made visible in the task-flow. The task-flow keeps track of the chronology and timing of tasks with the help of task-flow cards. The relative importance of the two components differs among design projects. For some projects the chronology of tasks can be crucial (e.g., in a treatment procedure for a new appliance), while for others the different places (e.g., in the material logistics procedures on a ward) or the different users (e.g., in the design of IT for a communication and alarm system for ward staff and patients) are more important.

6.3.1 MINIATURE ENVIRONMENT

The miniature roleplaying component of the HEAD game was inspired by the miniature roleplaying game Urnes et al. (2002) employed and is similar to the "living blueprint" by Dalsgaard (2010). The miniature role-playing board game is a scaled-down representation of the environment the use situations take place. More specifically, the miniature environment of the HEAD game is a two dimensional representation of a building or location (a “map”) that is designed to be easily understood by game participants, e.g., by the use of colour, pictograms, and other visual cues. The miniature environment contains game pieces that represent characters or products, which can be moved through the environment to act out scenarios. What these pieces represent depends on the goal of the project the game is used for. Playing out scenarios in the miniature environment helps participants to imagine the future use situation in a realistic healthcare setting, because it provides a concrete context of space, people, and products.

Such a miniature environment has two advantages compared to real “full body” role-playing: Firstly, it has a lower participation threshold among users, since moving figures is less intimidating than having to play theatre. Secondly, environments comprising large buildings or even whole cities can easily be depicted in the miniature environment. While this is sufficient for most design cases, in design projects where the emphasis is on the specific movements in a use situation, a whole body roleplaying technique would be more suitable. Often miniature environment techniques include only a limited set of rules and are therefore very open (see, e.g., Urnes, et al. 2002). However, a more structured play can be applied in a miniature roleplaying game to give it more direction. In the HEAD game, the input scenario and the task flow component provide this guidance.

6.3.2 TASK-FLOW

The situations that can be acted out in the miniature environment receive guidance in the form of a task-flow that depicts the ideal scheduled activity-flow situation. In addition to the scheduled task-flow, interrupting mini scenarios/events that conflict with the ideal situation can be used to cover unscheduled events in the game. The HEAD game's use of task cards resembles the Collaborative User Task Analysis cards developed by Lafrenière (1996). The task cards can be filled in to represent specific tasks or activities and can be placed into the preferred order of execution. At the very least, the cards should contain a short description of the task, the actor who is performing the task, and the location of the task. The task cards can be filled in and arranged by the participants during the game, or can be prepared beforehand and customized by the participants during the game. Similarly, the interrupting events either can be prepared beforehand and completed by the participants, or can be filled in entirely by the participants. These events can also be represented on cards with preferably a different colour than the task cards.

The task flow analysis helps the participants to sort out which tasks they wish to accomplish in the new activity flow and in what chronological order these tasks should be executed. The developed task-flow card scheme provides a good overview of the procedure and is easy and efficient to use. In addition, it helps to properly record the developed procedure by making previous steps continuously visible to all participants. Finally, it supports an iterative design process, since rearrangement of the task-flow is easily manageable.

6.4 PEOPLE

6.4.1 PARTICIPANTS

The group of participants for the HEAD game should consist of people with relevant knowledge and experience in the area of the design problem. They preferably have different backgrounds or staff positions to bring in different perspectives. They can, but not necessarily need to be, actual stakeholders. With topics that strongly relate to supporting areas in the healthcare organization such as safety, ICT or logistics, it is advisable to include specialists from these areas, e.g., employees from the ICT department or logistics department. These specialists can provide subject-specific information that is useful for the design of new work activities. Furthermore, they can learn about the daily practical work activities of the staff members they support. The number of participants per workshop should allow for sufficient discussion between participants but avoid neglecting the contribution of any participant, due to time constraints. In addition, it is difficult from a practical perspective to seat more than eight people around a game board in a way that they all still can reach a major part of the game board.

6.4.2 FACILITATOR

The task of the game facilitator is to guide the discussion, the roleplaying, and the idea creation process during the design game workshops. More specifically, the facilitator needs to explain the game steps, take care that every participant gets the chance to participate, take care that the most relevant game steps are completed, enforce the time schedule, ask the guiding questions (and dynamically adapt them if needed), and keep the discussions close to the topic under consideration. Apart from these supporting skills, the facilitator should also be well versed in the problem area at hand in order to distinguish essential from unessential issues and direct attention to the former. However, a facilitator should not be rooted too deeply in the current practice or the on-going project, because that might lead to a bias towards current ways of doing it. The importance of the facilitator has been minimized in the HEAD game, by providing a step-by step game and the use of mostly self-explanatory game material. The game allows for the facilitator to take a role as facilitator only, as well as to take a double role as facilitator and participant and actively suggest ideas.

6.5 GAME CHARACTERISTICS

The HEAD game is based on a number of underlying game characteristics that are essential for achieving the aspired game requirements. Here the characteristics and their rationales will be discussed.

6.5.1 GROUP GAME

Design games can be group games (with or without individual activities next to group activities) or individual games. Since the HEAD game is intended to bring together the expertise of all the stakeholders who are involved in a healthcare environment or activity, a group game setup was chosen. Due to the variety in the participants group with respect to hierarchical standing and skills, it was decided not to include individual activities to avoid the possibility of making participants feel uncomfortable exposed. The game does however promote individual actions and everybody's participation by giving participants specific roles in the game.

6.5.2 COMBINING MINIATURE ROLE PLAYING AND STRUCTURED TASK-FLOW DEVELOPMENT

Healthcare environment and activity design problems consist of two main dimensions: (1) the environment including people, products, facilities, and information, and (2) the flow of activities that should be facilitated by the environment. The HEAD game covers both aspects by a combination of a miniature role-playing environment and a task-flow component. The miniature environment supports imagining a complex use situation and provides an overview of the location of people, products, and facilities. The task flow component supports capturing a procedure or activity flow in a structured and detailed way.

6.5.3 SCENARIO-BASED ELICITATION OF USE REQUIREMENTS

A product can be described by its technical specifications such as size, functions, materials, and/or weight. These specifications can be based on safety, pricing, and/or available production facilities. However, these specifications do not have much meaning for the user unless they are placed in the context of a use situation. For instance, the size of a smart phone becomes meaningful to the user when he imagines carrying it in his trouser pocket. The requirement that the phone should fit into trouser pockets is more valuable to the designer, than if the user would define specific sizes for the phone. In the latter case, it would not be clear why the user had specified exactly these dimensions, and the consequences of altering the dimensions are unclear. Consequently, the HEAD game is based on scenarios and targets eliciting use-oriented requirements for products and facilities. These use requirements can best emerge in the concrete context of use scenarios. Only when goals, persons, products, and the context of the use situation are clear, it is possible to specify use requirements. For example, the use requirement that the smart phone should fit into trouser pockets becomes apparent when a situation is imagined in which the user wants to transport the phone, but needs both hands for other activities such as paying for a ticket at a counter. The scenarios are also one of the aspects, that make the HEAD game different from the Lay-out Kit game (Ehn & Sjögren, 1991), that is not guided by scenarios of procedures.

6.5.4 INPUT SCENARIO

Having a small set of scenarios prepared before the start of the design workshops is a good way to provide guidance for the participants. The scenarios can be described either very generally, e.g., only mentioning a type of surgery or more specifically, e.g., describing a detailed patient case and events during a surgery. The optimal level of detail of the input scenario depends on (1) how much guidance the participants are expected to need and (2) the development stage of the design problem in focus. While a more detailed description will deliver more guidance and typically more specific design results, it will probably limit the creativity of the participants and hence the innovativeness of the design results.

6.5.5 LOW-FI GAME

Design games come in three varieties: (1) virtual design games that are played on a computer with simulated components, (2) low fidelity ("analogue") games that are played only with tangible real world elements, and (3) a combination of the previous two. The HEAD game is a low fidelity game with tangible elements and activities including moving real game pieces, writing, and rearranging and pasting tangible task cards. This makes the game more accessible for people who do not have much experience with digital games. Furthermore, it makes the game easy to transport and set-up, which may not be the case for advanced virtual reality appliances. Comparing the time and costs involved in the preparation of the low-fi game materials and digital games in general is difficult, since it is highly depended on the situational factors. However, it is clear that the preparation of digital games requires skills that are more specialized. An advantage of digital games is that a higher degree of realism and detail in representations of products or environments can be achieved. However, as the HEAD game aims at developing functionality in the early phase of a design project, not at appearance, there is less need for a high level of detail and realism. On the contrary, such a representation might give the false impression that a product or environment is already finished and drive user discussions towards product details (see also Chapter 4).

6.5.6 TANGIBLE OBJECTS

The HEAD game contains tangible game objects that can be used as "tools to think with" and as boundary objects to promote communication between different stakeholders. The game pieces ("pivots") are *"physical, symbolic representations that allow(s) a person to move back and forth between a figured (imagined) world and the real world"* (Urnes, et al., 2002, p.187). It has been stated in constructionist learning theory that learning can happen most effectively when people are actively creating things in the real world (Papert, 1980). Designing a new procedure is a process of making changes and learning what the effects are. Therefore, doing this with physical game pieces is most likely to support the learning process.

A game with tangible objects also has the capability to bring together people from different backgrounds. The game pieces work as "boundary objects" (Star & Griesemer, 1989), because the physical game elements make it easy to exchange information (Urnes, et al., 2002) and oversee the situation. They help overcome boundaries between the stakeholders, who might be used to different professional languages.

As mentioned before in the context of digital versus tangible design games, the level of detail in a game and the game pieces can influence the outcomes of the game. The more detailed the game pieces or mock-ups are, the more defined their functionality seems to be and the more participants may believe that the details represent the real future situation and stick to that. As the developed game focuses on functionalities and behaviours and less on appearance, the representations are kept as generic as possible. Furthermore, to prevent the participants from taking the game not seriously, an abstract design of the game pieces might be preferable to a detailed design that can be associated with small children's toys. In addition, using "dedicated" game material, instead of "off the shelf" dolls demonstrates care and effort by the game organizer.

6.5.7 MINIMAL FACILITATOR ROLE

In order to reduce the dependence on a good facilitator during the workshops, the game material of the HEAD game provides as much guidance for the participants as possible. Most elements are self-explanatory, such as the task cards. Furthermore, the HEAD game follows a sequential step-by step plan, and each participant has a well-defined role to play in the HEAD game. All these elements reduce the tasks of the facilitator to keeping the discussions on topic and time keeping.

6.5.8 GUIDING QUESTIONS

Since the design problems in the healthcare area are usually complex, it is advisable to split them up into several smaller problems to be solved one by one. In order to do that within the setting of the HEAD game, it is helpful to break down the design problem into a number of guiding questions to be used during the design workshops to help the participants. While this process seems to be obvious, the proper use of guiding questions can make or break the workshop's results. If the questions are well prepared and dynamically used during the game, the game develops a flow in which the next step always seems obvious to the participants. However, this approach is a delicate balancing act between control and leaving sufficient room for creative freedom during the game play.

6.5.9 FLEXIBLE DEGREES OF FREEDOM

For every game element, a degree of freedom should be determined (Törpel, 2006). The degree of freedom of a game element determines to what extent the game element influences the participants' game behaviour and ideas. In the case of the HEAD game, the game creator needs to consider the degrees of freedom for game elements such as the input scenarios, the guiding questions, game pieces, and the game board. Determining the degree of freedom consists of finding the right balance between keeping the risk of influencing game participants' gameplay and design solutions to a minimum and providing enough guidance for participants to come up with solutions for the design problem. This task is difficult and differs from case to case, since the capabilities of the participants are crucial factors. Principally, the HEAD game allows for different degrees of freedom. It can accommodate a highly structured approach, where the game and design problem is broken up into many small steps/assignments, and an open approach, where one poses only general questions, and leaves it up to the participants to freely tackle the design problem.

6.5.10 ITERATIVE DESIGN PROCESS AROUND A CENTRAL ACTIVITY FLOW

The HEAD game is intended to start with the development of an ideal activity flow (within the given constraints), and to then proceed with filling in the requirements for products and facilities based on this activity flow. However, new technology or products might also offer opportunities and inspiration for changes in the activity flow that could not have been achieved without the knowledge of these novelties. Hence, the design process in the game needs to be iterative and go back and forth:, e.g., starting with the ideal activity flow to develop requirements for technology based on the activity flow, and then the other way round, develop new activities based on the opportunities that e.g., new technologies offer. In this design process, the activity flow forms the backbone for structuring the game. The activity flow is generated (1) from the perspective of a single role (e.g., a fictive patient or nurse) or (2) with the aim to fulfil a task of a higher order (e.g., a specific treatment). In the first case, activities of all other roles are explored from the viewpoint of the chosen role; in the second case only the activities of the roles contribute to the task are explored.

6.5.11 COVERED PROPERTIES

The HEAD game covers the most important aspects of healthcare environments and activity flows, to support the holistic view of the design problem:

- people and their roles (game pieces),
- tools and appliances (game pieces),
- activities and their timing (ordering of the task cards and roleplaying),
- scheduled events (task-flow),
- unscheduled events (event cards), and
- space and location of people, products and material (game board).

Information flow and responsibilities can be addressed by additional game material. Duration of tasks can be added as additional information to the task cards. Distances, and appearance of products, people and interior are not taken into consideration in the basic game setup, because they are not essential for designing an ideal activity-flow and finding use requirements. Furthermore, leaving them out has the advantage that the miniature environment does not need to be precisely to scale. Each of the above properties can either be included as a constraint (point of departure) or be manipulated by the participants and become outcomes of the game.

6.5.12 GAME RULES

Participants do not take turns in the game, but are assigned the roles of different actors in the scenario and are asked to play out the actions of this actor with a corresponding gaming figure and optionally personalized task cards in the game Such a task division seems especially advisable, if there are lower/higher ranking or shy/overpowering people in the same group, since it helps to ensure that everybody can provide input. Roles are assigned based on one's actual profession to allow for maximal involvement. If there are participants, who do not have active roles in the task flow (e.g., people from the ICT department) participants take on roles, based on their affinity or preference. If there are more roles in the game than participants, participants take on double roles.

Otherwise, anything that helps solving the design problem within the given boundaries is allowed. There is no competition in the game between the participants. The only goal is to work towards a good solution as a team.

6.6 BASIC GAME MATERIAL

The proposed HEAD game consists of a set of fundamental game materials that can be used for every project in which the game is applied. This section contains a description the basic game materials. The use of optional game materials is discussed in a later section.

Figure 6.1: A game board for the fictive case of the design of a weight-loss app, depicting a stylized city map.

Figure 6.2: A game board for the SWING project, depicting a plan of the new wards (see also Chapter 7).

6.6.1 GAME BOARD

The game board is designed to be the central element of the HEAD game. It forms the environment for the miniature role-playing. The layout of the game board either can be prepared in advance or be constructed by the users during the workshop as part of the design results. A predefined game board should be given, if the activities and product use will take place in a specific building or when the building itself can be generic. However, participants can also be asked to "build" the ideal premises, an activity that helps the participants to go beyond their own hospital context. See Figure 6.1, 6.2, and 6.3 for examples of game boards. The game boards are concrete representations of the real world, that is similar to the sheets with the factory lay-

Figure 6.3: A game board for the SWING project, depicting a plan of the new wards (see also Chapter 7).

out in the Layout-kit game (Ehn & Sjögren, 1991). The concrete representation has been chosen over abstract game boards, as the game boards form the scene for the miniature role playing, and not a template for an activity including sorting or metaphorical landscaping with game materials as in the Landscape Game (Brandt, et al., 2008). In the miniature role-playing positions of locations in relation to each other and their distances are relevant properties to consider.

6.6.2 TASK CARDS

The layout of the task cards the players need to fill in as part of the task-flow analysis is based on the activity oriented CUTA technique (Lafrenière, 1996). Each card documents the type of the task, by whom the task is performed, and where it should be performed. This information can be complemented by information required for the task, cooperation with other actors, and the duration of the task. An example of a task card is shown in Figure 6.4. Task cards can also be labelled by different roles used in the design game, such as placing a representational picture of the player's character on it. This approach allows every participant to have his or her own set of task cards. The cards should to be arranged in chronological order to form an overview of the task-flow and allow for efficient rearrangements. The task-flow is preferably placed on a flip-over in an upright position next to the game table so that it is visible to everybody, but does not interfere with the game board on the table. Positioning the task-flow in an upright position requires that the task cards stick to the surface. This can be achieved by using a non-permanent glue, which has the additional advantage of enabling repeated repositioning of the cards.

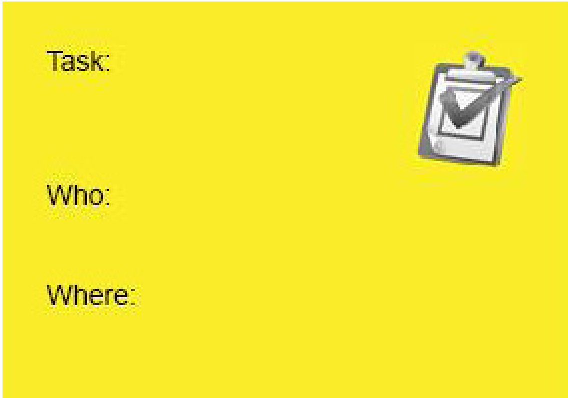


Figure 6.4: Example of a task card with a simple layout.

6.6.3 GAME PIECES

In-between filling in the task cards, the game participants play out the defined procedure on the game board with playing pieces, representing staff members, appliances, tools, and materials. There should be pieces for existing products as well as unassigned game pieces to represent new products that are needed to perform the new procedure. The game pieces should be recognizable, but not contain too much detail as explained in Section 6.5.6. They do not need to be precisely scaled to the game board.

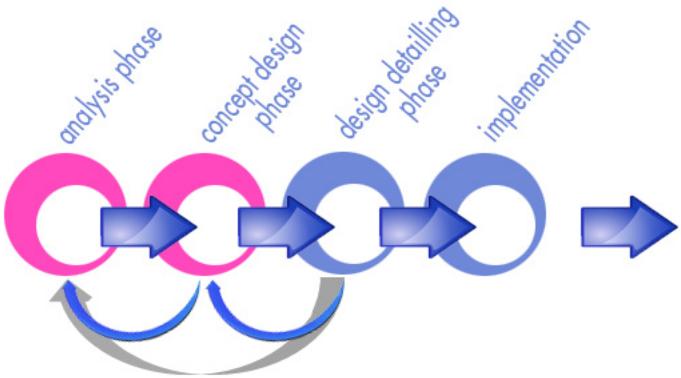
6.6.4 PRODUCT/TOOL CARDS

The HEAD game gives participants the opportunity to assign product characteristics to the required products and to document these with the help of product/tool cards. The game participants fill in these cards as soon as a product is used in the gameplay.

6.6.5 EVENT CARDS

After participants have developed a complete treatment procedure with the help of the task-flow and product/tool cards, "events cards" are introduced. Participants are confronted with events that might conflict with the procedure they have conceptualized. These event cards resemble the "situation cared" in the desktop publishing project (Ehn & Sjögren, 1991). The participants are asked to discuss the impact that these unscheduled events have on their procedure and adapt the procedure to deal with the events if needed. The events either can be picked at random, or participants can pick one event card from the stack that has the biggest impact on the developed procedure. Playing event cards is expected to force participants to (1) reflect once more on the developed procedure and product requirements and (2) verify its robustness under different circumstances.

Figure 6.5:
Application of the
design game in
the design process
(lighter grey circles)



6.7 PREPARATION, EXECUTION, AND ANALYSIS OF THE GAME

6.7.1 POSITIONING IN THE DESIGN PROCESS

The HEAD game does not cover a complete design process. Instead, it should be part of a larger design process that includes more activities. The game is intended for application in the early phase of the design process. This part is commonly referred to as the analysis and the concept design phase (see Figure 6.5). During the analysis phase, the design problem is explored with respect to possible stakeholders, variables, relation between variables, and directions for possible solutions. Since developing the HEAD game and selecting the participants requires some understanding of the case, an information gathering process should precede an application of the design game. The information gathering can be achieved by techniques such as observations, interviews, visioning workshops, or context mapping. After exploring the design problem in the analysis phase, ideas for solutions can be developed in the concept design phase. In practice, both phases usually overlap, since the analysis phase may lead to new opportunities for ideas and new ideas can lead to a need for further analysis. The application of the game in the first two design phases should be followed by a design-detailing phase and an implementation phase.

6.7.2 PREPARATION

The preparation of a game session involves the following steps:

1. ***Participant selection.*** The initial task is to find out who the users are in the healthcare environments and activity flows which must be designed. If there are more suitable candidates than spots, it must be decided upon a tactic to select participants for the sessions or participants must be divided over several workshops. The selection procedure may be based on who volunteers first or on specific user characteristics. Apart from the users involved, a list of all stakeholders should be made and it should be decided who of these should be interviewed and who should take part in the generative sessions.
2. ***Preliminary research.*** This step involves observing and interviewing users and stakeholders about the use situation, environment, and current and expected problems.
3. ***Project delineation.*** Next, one should define the project boundaries, the questions that need to be answered and the aims, based on the preliminary research. Furthermore, one should determine the use scenario that will be the point of departure for the generative session.
4. ***Scheduling game session with participants.*** This step calls for the planning of the workshop sessions and inviting the selected participants (the future users) and possibly one or two "specialists" that are familiar with technical aspects of the design problem but are no direct users themselves.
5. ***Setting up of attending team.*** In a following step, the attending team for each workshop should be determined. The team needs a facilitator, a person keeping notes, and a video/audio equipment operator. One person can take on several of these functions.
6. ***Preparation of the game material.*** The final step in the preparation phase involves producing the task-cards, the game board, the game pieces (people, furniture, appliances, and blanks), event cards, and any additional cards/tools.

6.7.3 EXECUTION

A HEAD game session is designed to generally take about 3 to 3.5 hours to complete and consists of six consecutive steps:

1. ***Opening.*** The game workshop should start with an introduction of the attending team, an explanation of the goals of the session, a description of the use scenario, and an explanation of the agenda. If participants do not know each other, they should introduce themselves at this point. Furthermore, having an additional activity to *"break the ice"* in order to help the participants to feel comfortable talking about personal matters with people they might not know can be helpful (Sleeswijk-Visser, et al., 2005). For the game, the participants take on professional roles as in the Desktop publishing project (Ehn & Sjögren,

1991), that are relevant to the procedures under consideration. These can be their own roles or, if not all professional roles are available in the participants, additional roles different from their own profession.

2. ***Creation of the game board.*** In a following step, the participants should be asked to produce a game board with a number of building materials (e.g., a blank map, coloured stickers of different shapes, and pens), as long as the game board for the use scenario is not already predetermined. In case the game board is given, the participants should take a good look at it and ask any clarifying questions.
3. ***Playing out current task-flow.*** Next, participants should be asked to explore the work environment by playing out a current use situation on the game board. If the game board represents a new building, participants should be asked to play out existing procedures with the game figures. This technique is expected to allow participants to visualize future task-flows and by comparing them to the current ones, participants can identify potential problems as well as design solutions. Starting with the current task-flow is a very useful technique to prevent impracticable design solutions, as Jalote-Parmar and Badke-Schaub state with respect to the surgical workspace; *"visualizing the changes that will occur in the future workflow while linking them to the current workflow can avoid solutions that do not fit [...]"*(Jalote-Parmar & Badke-Schaub, 2008, p.354). If there is no current task flow, because a completely new activity needs to be determined, this step can be skipped.
4. ***Step by step determination of a new scenario.*** At this point, participants should be asked to solve the problems found in the previous step. In order to achieve this, participants can make changes to the task-flow, the material, and/or products they want to use. All materials and products should be represented by physical game figures. In case the pre-made material is not enough, participants can introduce new materials, using blank game pieces and "property cards" on which requirements for the products or materials are described. The ideal task-flow is prepared with the help of the task cards and possibly the use of new rules and the assignment of responsibilities among game figures. All changes must be validated by repeatedly playing out use situations on the game board. It is expected, that in most cases, the design problem must be divided into smaller portions and addressed separately by the participants in order to be playable. The facilitator can support this process by asking the guiding questions he/she has prepared. The group should iterate the game design process until they are satisfied with the design result or run out of time (see Figure 6.6)

Figure 6.6: Participants playing the HEAD game on the game board, in the background a task flow with yellow task cards (Worls Usability Day, "Design for Usability" Symposium Utrecht, 2012)

5. ***Introduction of event cards.*** The final gaming step involves confronting the participants with events cards. These cards contain difficult situations for the specific use situation and must be dealt with in the context of the developed environment and task-flow. The events are intended to stress test the developed design solutions for their flexibility and feasibility. In case the design solutions fail these tests, the participants must change the designs accordingly.
6. ***Conclusion.*** Each HEAD game session should conclude with a brief review of the session's results, informing the participants about any further steps in the project, and an appreciation for the group's participation.

6.7.4 ANALYSIS

The results of the HEAD game are requirements, concepts, and task-flows. The physical material produced during the workshop can capture all three. However, minutes and video recordings of the workshop sessions can be valuable sources of information as well. Consequently, for the analysis of the game results it is recommended to collect both direct and indirect workshop results.

6.8 OPTIONAL GAME MATERIAL

The HEAD game offers a basic setup that is expected to be sufficient for the majority of design problems. However, there might be a need to give specific properties of the healthcare environment, such as product properties, responsibilities, or rules, more attention in a game session than the standard setup offers. In order to address these specific properties, the HEAD game can be extended with a number of additional game elements that are briefly described in this section.

6.8.1 BUILDING WITH TOOLBOXES

In order to let participants develop rudimentary product concepts or identify important product properties, "tool boxes" can be used during the game. Toolboxes are a collection of 2- and 3 dimensional objects that can be modified and glued together to form a representation of an ideal product. During the HEAD game, toolboxes can be used to build additional playing figures or products. These tool boxes can be used either when the participants come across the need for new products by themselves or they can explicitly be asked to do it for specific tasks, if a specific product is in the focus of the game. This technique can be used to make a product idea more concrete with respect to its topology and components, if it can be expected, that this supports the design process. The product can then be tested and rebuilt during the game. Consider the following example: When dealing with products for hospital housekeeping, the participants could be asked to assemble a scale model of an ideal cleaning trolley with different functionalities from a set of generic building blocks. During the continued gameplay, they might come across problems or opportunities, which require a redesign of this trolley with respect to which materials are the most accessible on the trolley.

6.8.2 MOCK-UPS

For smaller accessories that must be used in the task-flow, e.g., handheld devices, it could be useful to provide a number of real-size mock-ups of different devices in order to enable participants to explore their size and feeling and have the participants develop preferences during the game. Suppose, for instance, that nurses explore the possibilities of using a digital device to access and alter patient data during their shift. In that case, a number of different smart phones and smart tablets could offer an incentive to discuss the ideal size and functionalities of the device.

6.8.3 PERSONA CARDS

For some design problems, e.g., in healthcare service design, one must deal with a great number of different people and problems. The people cannot all be included in the game as participants. In such situations it can prove beneficial to provide a set of "persona cards", i.e., cards that describe specific personas (Cooper, 1999), in order to have the participants develop creative and systematic ways to deal with e.g. different clients, staff members or other chance encounters that demand attention. Consider, for example, the problem of developing emergency room procedures. For such a problem a well-defined set of persona cards, representing patients with specific needs, can be used.

6.8.4 RESPONSIBILITY HATS

In some task-flows, it is crucial to know who has which responsibilities. For such problems, the focus of the game participants should be on the assignment of these responsibilities to the different persons (or even technology) involved. A useful tool for this purpose are "responsibility hats", taking the form of small hats or rings that can be placed on playing figures. For example, when developing a system for food ordering and distribution in a hospital, it is important to know who is responsible for bringing the food, controlling the patients' diet adherence, and prescribing specific diets. These responsibilities can be effectively and efficiently incorporated into the HEAD game by responsibility hats.

6.8.5 ADDITIONAL CARD SETS

Next to the previously discussed task-, product/tool, and event cards, it might be helpful for some design problems to develop additional, case-specific cards. These additional cards can then be filled in and placed next to the task-flow overview. Examples of additional cards include "rule cards" in the context of defining hospital visiting rules and dedicated tool cards for the different trolleys nurses use.

6.9 EXPECTED STRENGTHS AND WEAKNESSES OF THE HEAD GAME

This section will explicate how the proposed design of the HEAD game meets the requirements set out in Section 6.2 to serve its aim. However the choices made in the game design process have led to a few necessary weaknesses as well.

The HEAD game fulfils the definition of design games of Brandt et al. (2008), It is meant to gather a diverse group of healthcare stakeholders in the activity of developing and evaluating scenarios with pre-defined game materials such as the miniature role playing environment and the task cards, guided by very few, simple rules. The game materials point to either or both existing practices and future possibilities; they contain playing pieces of existing staff and appliances, but also blank pieces, which can be given meaning by the participants and become future concepts. The game starts with playing the current task flow (if existent), to turn then towards developing a future task flow. The HEAD game is played in workshop sessions of several hours, ideally at a location removed from participants work context. The purpose is to develop novel ideas and requirements for, spaces, appliances and tools and new practices for healthcare workflows. The game results in representations of the new design, established by the task flow, the product-tool- and other cards, and the stories that go with them.

6.9.1 EXPECTED WEAKNESSES

- Preparing all the game materials and guiding questions for the HEAD game may be more time-consuming than other idea-generating techniques such as simple brainstorming/interview sessions, since it requires extensive research about the (current) use context in addition to the creation of the gaming material. While generally true, the sophistication of the HEAD game is expected to produce superior design results compared to these less advanced approaches.
- Furthermore, the HEAD game is intended for several relevant stakeholders to participate in a gaming session. For larger projects, several sessions might be needed. Organizing all this could be difficult and time consuming.
- The type and number of outcomes of the HEAD game are hard to predict. However, that is a common characteristic of the type of complex design problems the HEAD game is designed to tackle.
- Some participants might not take the child/recreational-like gaming setup seriously. However, it is expected that, if participants can be stimulated to start playing, the advantages of the game will outweigh a potential initial hesitation.

6.9.2 EXPECTED STRENGTHS

Reviewing the requirements for the new game, the HEAD game is expected to fulfil these due to characteristic strengths of the game:

Holistic approach

- The game includes all people and their roles, tools and appliances, space, and activity flow in the game material.
- The game board in combination with the task flow is expected to allow participants to get a good overview of lengthy and complex multi-step procedures that possibly take place at different locations.
- The game aims to cover (dynamic) scheduled use situations in the task flow and (dynamic) unscheduled use situations in the event cards.

Enabling participation of different stakeholders in the design process

- The game allows different stakeholders to participate, because the game set-up with tangible objects is expected to not require specific skills or knowledge.

Foster communication between different stakeholders

- The game provides game pieces that can work as tangible boundary objects to enable communication between different stakeholders to discuss what a change in one user's domain of responsibility means for the domains of others.

Insight into consequences of decisions

- The game facilitates the exploration of possible futures in the context of the realistic use situation of the input scenario and the miniature environment. This combination is expected to help participants to anticipate the new procedure or activity flow situation and the consequences that changes to the procedure or other game properties will have, and to enable them to make informed decisions.

Stakeholder motivation

- The game is expected to be more pleasant to participants than general group meetings or brainstorming techniques.
- It is intended to enable stakeholder inclusion in an early design phase, and hereby makes them full member of the design team from the beginning.

Time efficiency

- The game is designed to takes up to 3.5 hours, which is expected to be very efficient for participant involvement and in the view of the expected outcomes of the game.

To evaluate, whether the developed game is indeed usable for the design of healthcare environments and activities, it has been applied in two cases. These are described in the following two chapters.

7 PROJECT SWING

7 PROJECT SWING

7.1 INTRODUCTION

Medisch Spectrum Twente (MST) hospital will migrate from the currently used two hospital buildings to a single new building with a completely different layout in 2016. This brings about changes that will heavily influence the work practice of the nursing staff. In particular, the migration of MST hospital to the new building entails five important changes that will affect the work practices of the nursing staff (Garde & van der Voort, 2012, p.329):

- *"In the new building there will only be single-person rooms, while in the current building there are one-, two-, and four-person rooms.*
- *Medical specialties will not have a pre-defined number of beds in the new wards but will be assigned beds according to demand; hence, their ward unit size and the amount of staff will fluctuate.*
- *The hospital management has the ambition to create a paper-free hospital, including digital patient records.*
- *The visitor policy will change. Today the hospital works with visiting hours, but single-person rooms offer the possibility to allow visitors to be around 24/7 and for family to stay overnight.*
- *The catering will change from a single central kitchen that serves at predefined times to a kitchen on every floor that can serve food continuously and to order."*

The consequences of these changes are that nurses, ward assistants, nutrition assistants, and ward secretaries have to adapt the way they work to the new situation. As a result, the ward staff needs to review their shift organization, their material and appliances use, their ways of communication with other staff and with patients, and how they keep track of patient information.

Project SWING[1] was initiated to explore the possibilities and restrictions of these changes and design a new nursing work practice for the general wards. It was conducted as a participatory design project in the sense that the actual stakeholders were used as participants. Central to SWING was the use of the HEAD game to elicit design results and facilitate the participatory design approach. The project took 2 years to complete, had 54 project members (45 participating staff, 7 steering committee, and 2 project management), and included in total 17 different workshops, of which 13 utilized the HEAD game.

The goals of the SWING project from a research perspective have been twofold:

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1 *SWING is an acronym for the Dutch "Samen Werkprocesssen Inrichten for het Nieuwe Gebouw", which essentially translates to "jointly designing work processes for the new building".*

1. Testing how the developed design game performs in terms of usability to design solutions for different design problems in a real world healthcare design context.
2. Assessing the usability and benefits of a participatory design approach and in particular testing whether by carefully implementing the game in a participatory design project approach convincing staff commitment can be achieved.

SWING generated design results and research results. These two are presented separately: Section 7.2 to Section 7.4 of this chapter describe the SWING project and the design results generated in the workshops. Section 7.2 starts with the project goals and scope of SWING as seen by MST, a brief description of the nursing work practice, an overview of the project team and the different project phases, and finally a description of the anchoring of the project and of the visioning workshops. Next, Section 7.3 gives a thorough description of the utilization of the HEAD game in the different workshops and Section 7.4 provides a description of the different design results and a summary of the recommendations from the project for MST. Moving on to the research part, Section 7.5 describes how SWING has contributed to research, starting with a description of the data collection and the research methods, before discussing the research results. In Section 7.6, the question whether SWING was really a participatory design project is analysed. The value of the HEAD game and the participatory design approach for the healthcare organization are discussed in Sections 7.7 and 7.8. The chapter ends with a discussion in Section 7.9.

7.2 PROJECT DESCRIPTION

This section gives a summary of the main elements of the SWING project as they are described in the MST project plan, including the project goals, a description of the nursing work practice, the project team, the project phases, and the communication strategy with regard to the participants.

7.2.1 PROJECT SCOPE AND GOALS

The primary goal of project SWING for MST hospital was to explore and design the future nursing work practice on the wards including walking routes and the application of new technologies for patient monitoring, communication, administration and "home" automation, focusing on the effects of the fluctuating ward size. The secondary goal was to test whether a participatory design approach can become part of future (design) projects of MST hospital. It was hoped that the nurses obtain a better notion of the possibilities for the working practice in the new hospital building by participating in designing the future working practice and that SWING would bring about involvement and participation of the nurses for the new building to create commitment for the building plans and pave the way for a more effective implementation of the new working practice. Shortly after the establishment of the project plan, the project steering committee agreed upon four central topics for SWING, which together cover the topic of nursing work practice: (1) nursing activity flow and visitors, (2) ICT and communication, (3) material logistics, and (4) catering. The topics were independently discussed in separate workshops to ensure the whole topic of nursing work practice was covered. During the project, more specific focus points were defined for every topic and workshop. These focus points are described in Section 7.3.

It was made clear that SWING should only focus on the nursing work practice on the general wards in the new MST building, and not, for example, policlinics and treatment rooms. The project aimed to include a short analysis of today's nursing practice situation, the design of new working practices with regard to walking routes and the use of new technologies, and the evaluation of these practices employing scenarios and models. The implementation phase of the practices was beyond the scope of the SWING project. MST committed to allowing at least two staff members from every ward (45 of the 54 project members were from the wards) to participate in four workshops and to do limited preparation between workshops with an estimated 780 man-hours for the whole group. In addition, 44 man-hours were provided for steering committee meetings and interviews with staff members. MST agreed to provide all the required facilities (meeting rooms and drinks) and materials for the workshops.

7.2.2 POINT OF DEPARTURE

Project SWING started in 2011, when the new building was still faraway in the future for everybody who was not directly involved in the building planning process. However, the architectural plans and drawings were already finished when project SWING was initiated. During the development of the drawings, the building management team had been talking with representatives of the different departments and wards to develop appropriate designs for the different hospital units. However, talks with SWING participants revealed that few of them had knowledge of these discussions or had participated in them. The fact that MST, as one of the first hospitals in the Netherlands, would provide only single-person rooms created concerns amongst the staff; in particular, concerns about social isolation of patients, lesser overview and control of the patients, and longer walking distances. In order to let nurses evaluate the single-patient room design, the management had a complete test version of a patient room with en-suite bathroom created in the old hospital. However, this single test room could not provide adequate overview of the implications of a complete ward with forty single-person rooms, as planned for the new hospital.

When SWING started, digitalization of patient records had already begun in MST but was far from complete. Several wards were still using paper records that had to be carried around. Technologies such as wireless data access, smart phones or RFID were not- or scarcely employed to support the nursing work. In terms of catering, one central kitchen provided the catering for the patients and delivered meals to the wards at fixed times. Next, nutrition assistants distributed these meals. When a patient could not eat at this specific moment, due to, e.g., a treatment, the meal had to be reheated later. The material logistics on the wards was a mix of storage rooms and a number of different trolleys, which were replenished at regular intervals. There were trolleys for materials, medication, fresh linen, garbage and dirty linen. Medication and sterile disposables were stocked in storage rooms. Some of the trolleys were daily placed in the hallways during the periods the nurses needed them, for example, in the morning when patients were cared for after the night. The medication trolley was taken along by the nurse administering the medication.

7.2.3 NURSING WORK PRACTICE

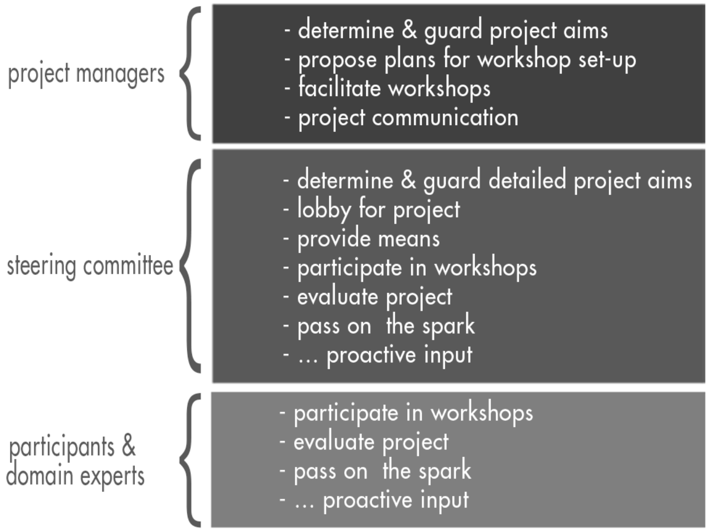
Here the essential features of nursing work practice are briefly reviewed. The work practice of nursing is a combination of various tasks:

- caring for the patient's physical (washing, bandaging, feeding etc.) and mental (informing and conversational talks) well-being,
- checking various bodily functions and patient properties,
- administrative tasks with respect to the patient records,
- managing (sorting, preparing and providing) the medication,
- transporting patients,
- dealing with the patients' visitors,
- ward rounds,
- transfer between shifts, and
- breaks.

Furthermore, nursing tasks relate closely to- or sometimes involve tasks with respect to the patient catering, the material logistics on the wards, and the cleaning.

A standard morning shift at MST could consist of the sequence: (1) reading patient records in the staff room and transfer between night- and morning shift staff, (2) providing medication, washing patients, checks, making the beds, cleaning the pantry and refilling materials, (3) ward rounds, (4) coffee break, (5) ward staff meeting, (6) providing medication, (7) lunch, (8) resting hour on the ward, working on patient data administration, (9) visiting hour, informing patients and family about examinations, results etc. and (10) transfer between morning and afternoon shift. These tasks are typically scheduled tasks, but the nursing work also involves a large number of unscheduled tasks, which present themselves during the day and range from patient requests such as toilet assistance to reanimation

Figure 7.1: Overview of roles and tasks in project SWING.



assistance. According to a calculation by Klaasen (2011) nurses in MST currently walk about 1500 to 3000 meters per shift. When project SWING started, MST had not yet an up-to-date central nursing vision for the new building.

7.2.4 TEAM

From their experience, Clemensen et al. provide a number of useful practical tips for applying participatory design in Healthcare: Researchers in the project should come from both, *"clinical and technical background"*, the participants should be *"representing all stakeholders"*, the researchers should *"not try to anticipate the precise [project] result"*, should *"engage actively"* in the creative sessions to be a *"role model"* for the participants (2007, p.129). Project SWING consisted of two project managers, a steering committee, 45 participants, and representatives from facilitating services – the "domain experts" (see Figure 7.1). The project managers were part of the steering committee. The participants, the domain experts, and the majority of the steering committee members participated in the workshops.

Participants

The participants were the biggest group in the project and also the group that was supposed to come up with new design ideas about the nursing practice in the new building. SWING had 45 project participants from all wards of MST. Participants were expected to attend workshop meetings and participate in the design of the nursing processes and technology concepts, pass on the "spark" from the workshops to their co-workers, and provide proactive input regarding the project (see Figure 7.1).

For research purposes, the participants filled in questionnaires and reflective surveys. In addition, five participants took part in evaluation interviews after the project. The composition of the group of the project participants was chosen to be representative of the general wards. The managers from all wards were asked to send two representatives. In addition, it was ensured that all different functions of the ward staff were represented. The participants included 33 nurses, one nurse practitioner, three nutrition assistants, one nursing specialist, one physiotherapist, two ward secretaries, one secretary/nutrition assistant, one project member of the Thorax Centrum project (a project for the renewal of the Thorax Centrum which is part of MST), one ward manager, and one mediator from the facility management unit. The final group included 11% males, which was lower than the ratio for the complete staff of MST with 24% males (see Jaarverantwoording Medisch Spectrum Twente, 2011). The project steering committee decided not to include doctors in the participant group because SWING's focus was on the nursing processes and the main role of doctors in these processes is limited to the ward rounds.

According to Bødker et al.(2004, p. 106) the ideal project participants should *"posess a good overview of the work domain concerned, enjoy broad respect and confidence among their co-workers, be committed to the project and be neither technology freaks nor technophobes."* However in project SWING, the selection of participants was handed over to the ward managers, there was no specific selection procedure. Ward managers selcted whom they thought to be suited for the project or accepted those who volunteerded. This is reflected in the statements of the participants in a questionnaire that was taken before the first workshop (QQ39), and in which participants were asked why they participated in the project: There were 41 respondents, and first reaction of the majority of participants was, that they were asked to participate (8 times). The second most frequent answer was "interest in imagining the future situation and in being involved" (7 responses), third, that "the own experience is valuable for the project" (5 responses), fourth, that the participants "want to be informed and up-to date about the new buidling project" and that "SWING is an area of interest for their function" (each 4 responses), and the fifth were "the importance of including staff", "for a good result, and because "it is an interesting project (each 3 responses).

Participants were also asked to name positive and negative aspects of earlyer projects, if they had taken part in any (QQ40, 41). The intention was to find out, if the participants had made bad or good experiences in earlyer projects, that might influence their motivation for -, or evaluation of SWING. 30 of the respondents 41 filled in comments about earlyer projects. The top three positive experiences related to synergy (8 reactions), "being able to contribute your own opinion" (4 responses), and "commitment" or "learing" (each 3 responses). Top three negative experiences were “the implementation not going well or not taking place at all” (7 responses), “inefficiency of the project” (6 responses), and “incompetence of participants” (3 responses).

Project managers
The researcher managed the project in cooperation with an employee of MST. Their main tasks were to determine and guard the project aims, propose plans for the workshop set-up, and facilitate the workshops (see Figure 7.1). With regard to the task division, the researcher made proposals about the workshop set-up and the questions that should be the subject of the workshops. These proposals were discussed with the MST manager before they were presented to the steering committee. The MST project manager provided relevant input and feedback with respect to the proposals. The planning of the workshop rooms and facilities and the MST internal project communication were mainly handled by the MST partner.

Steering committee
In line with the practice described by Bødker et al. ((2004), Participatory IT design), a steering committee was set up. The main purpose of the steering committee was to provide information for the project and to manage the detailed project aims and direction (see Figure 7.1). The other tasks of the steering committee were to lobby for the project, provide the means for the workshop, participate in the workshops, evaluate the project, pass on the “spark” and give proactive input to SWING. The committee was composed of people with knowledge about nursing processes, the building project, and ICT. More specifically, the committee consisted of the MST building project manager, the SWING project manager partner from MST, two ward team managers, a nursing care specialist, an ICT and medical technology advisor, a member of the nursing advisory council, the Hospital Business Unit Manager who commissioned the SWING project, and the researcher.

Domain experts
A number of domain experts were invited to participate in specific workshops to provide relevant background information about the workshop topics and to stimulate a dialogue between the ward staff and facilitating services (see Figure 7.1). The invited experts included the head of hospital logistics, a representative of the pharmacy, several staff members from the ICT and Medical Technology department, the head of the MST facility management and his staff manager, and a manager from the hotel and catering industry. Next to providing input regarding the workshops, the domain experts also took part in the project evaluation and provided proactive input to the project.

Figure 7.2: Overview of the six phases in project SWING.

7.2.5 PROJECT PHASES

SWING consisted of a preliminary investigation phase, visioning workshops, two design workshop series, evaluation workshops, and a wrap-up phase (see Figure 7.2). The two design workshops were the most important part of the project from a research perspective and employed the HEAD game. The design workshops SWING had four different focus topics: (1) nursing activity flow and visitors, (2) ICT and communication, (3) material logistics, and (4) catering.

Preliminary investigation

The nursing work practice at MST of two nurses was followed and observed on different wards for three shifts by the researcher to obtain better insight in the current work practice. This insight is an essential point of departure for participatory design projects. Bødker et al. (2004) recommend that within a participatory design project, one third of the project time is spent on gathering, analysing end presenting present work practices. In addition to the observations, interviews with ten key persons for the building project were carried out to generate an overview of the state of the building project. Most of the people who were actively included in this preliminary investigation phase became SWING participants (one of the two nurses who were observed during their work and eight of the interviewees).

Visioning workshops

The objectives of the visioning workshops were twofold: (1) inform the participants about the project goals and procedure and (2) discuss concerns and develop a shared vision for the project. The whole group (45 persons) was divided up into four groups to keep the workshops manageable and to allow enough time for every participant to contribute. All four workshops had the same set-up and took one and a half hour each. The information about the project goals and procedure was given by a short presentation by the researcher. This presentation also contained the latest

Figures 7.3 - 7.8: Presentation about the building project at the visioning workshop by the researcher (top left); nurse bringing shampoo and comb to emphasize her concern and vision for the care of patients' personal hygiene (top right); participant writing down concerns on a flip-over (middle left); an object designed by a participant to represent her vision for the nursing care on the wards with lots of cotton wool to represent pampering the patient (the Dutch expression for pampering is “laying someone in cotton wool”) (middle right); circles with objects representing worries (e.g., plastic bag representing “suffocating” when staying at the reception without windows) (bottom left) and visions (e.g., a picture of a computer representing the different software packages at the hospital being compatible) (bottom right).

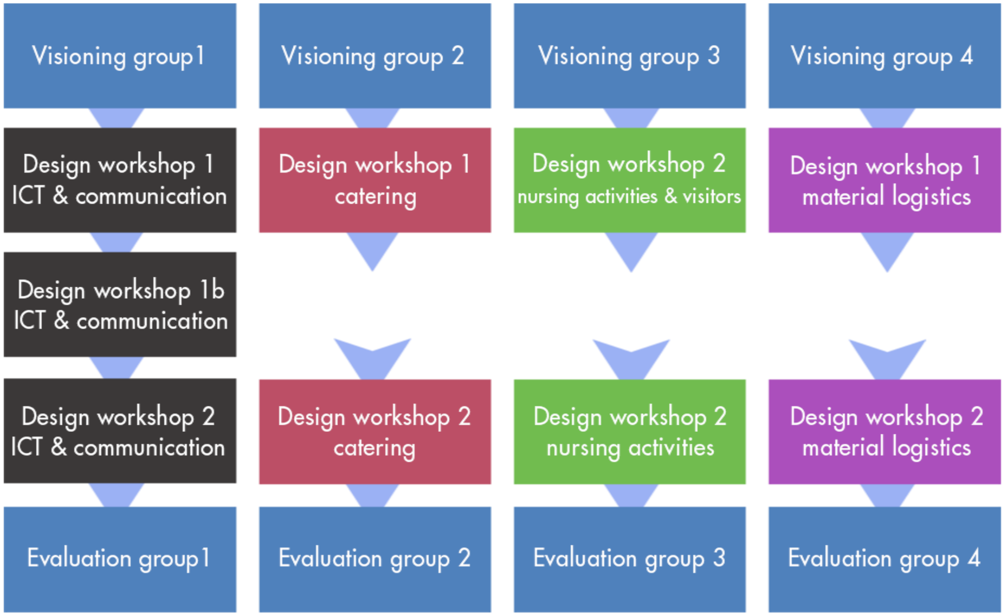


Figure 7.9 Overview of the workshops in the different project phases of SWING.

plans for the new building, which were news for the majority of project participants at that time. Since some resistance from the participants with respect to the new building project was anticipated, it was decided that all participants were given the opportunity to express their concerns. By sharing all concerns upfront, the design workshops could focus on defining future work practices. Each workshop participant was asked to bring two items, one representing a concern and the other one a vision involving the new building. During the workshop, every participant was asked to introduce him- or herself briefly, present the two items, and tell the stories that belonged to them (see Figures 7.3 -7.8). Next all items together with post-it's describing the story in catchwords were placed on designated circles for concerns and visions. The intention was to prioritize the items, but unfortunately, this could not be realized due to time constraints.

Design workshops series 1 and 2

The design workshops were at the heart of SWING and made use of the HEAD game. The whole problem field was divided into four different topics to allow for an in-depth exploration (see Figure 7.9). The four topics for the first design workshop were (1) nursing activity flow and visitors, (2) ICT and communication, (3) material logistics, and (4) catering. More details regarding the content of each topic can be found in Section 7.3.

Two series of design workshops (38 and 36 participants) were scheduled that consisted of four workshops for each topic for a total of eight design workshops. Hence, one quarter of the participants took part in each topic workshop. As this was a group of about ten people most of the time, the group was divided in two during the topic workshops. Each workshop took approximately three hours. However, since the planned tasks for the topic ICT and communication were not completed within the three-hour workshop, an additional session on this topic was scheduled. The second workshop series had the same four topics except that the visiting concept was developed to satisfaction in the first series and hence the first topic was changed to "nursing activity flow". The composition of the workshop groups slightly changed throughout the project due to problems to find common dates and people joining or leaving the project.

The design process in SWING was both sequential and parallel. Sequential, because the first design workshop series built on the results, i.e., the visions and concerns, of the visioning workshops, the second design workshop series detailed the concepts that had been designed in series 1, and the evaluation workshops were used to bring together and evaluate the results of the second workshop series. Parallel, because the workshops with different topics in the same series were given in the same period and did (except for the generated task flows) not build upon each other, but upon workshops from the previous sessions.

Evaluation workshops

The evaluation workshops (27 participants) followed the same procedure for all four groups, took three hours each, and aimed at making final design decisions and evaluating the designed concepts. For these workshops, a dedicated version of the HEAD game with a virtual reality tool (VR-tool) was used, as described in Section 7.3.4. The tool enabled participants to play accelerated nursing scenarios within the new situation and hereby evaluate the concepts that had been designed during the design workshops.

7.2.6 COMMUNICATION STRATEGY: ANCHORING

The communication strategy towards the participants in a participatory design project is a crucial element of the project management, as stressed by Bødker, et al. (2004, p. 71): *"The principle of genuine user participation – and the view of a design project as a mutual learning process - involves project group participants gaining good, common understanding of the results produced by the design project. [...] management, staff members, and those who will be implementing the design project's vision will not all be directly involved in the project. The project group may then run the risk of developing what may at times amount to "insider reasoning" informing the study's result."* In the participatory design literature this is often referred to as *"anchoring"* which is defined as *"Informing a target group about the design project's goals, visions, and plans. [...]"* (Bødker, et al., 2004, p.70) to receive feedback about and backing for the proposals.

In SWING the anchoring within the group of workshop participants was realized in two ways: (1) the information generated during the workshops was made available for the participants by e-mail and on a private website, allowing for comments (see Figure 7.10) and (2) the material (e.g., the task-cards) that had been generated during the sessions were re-used in successive workshops when possible.

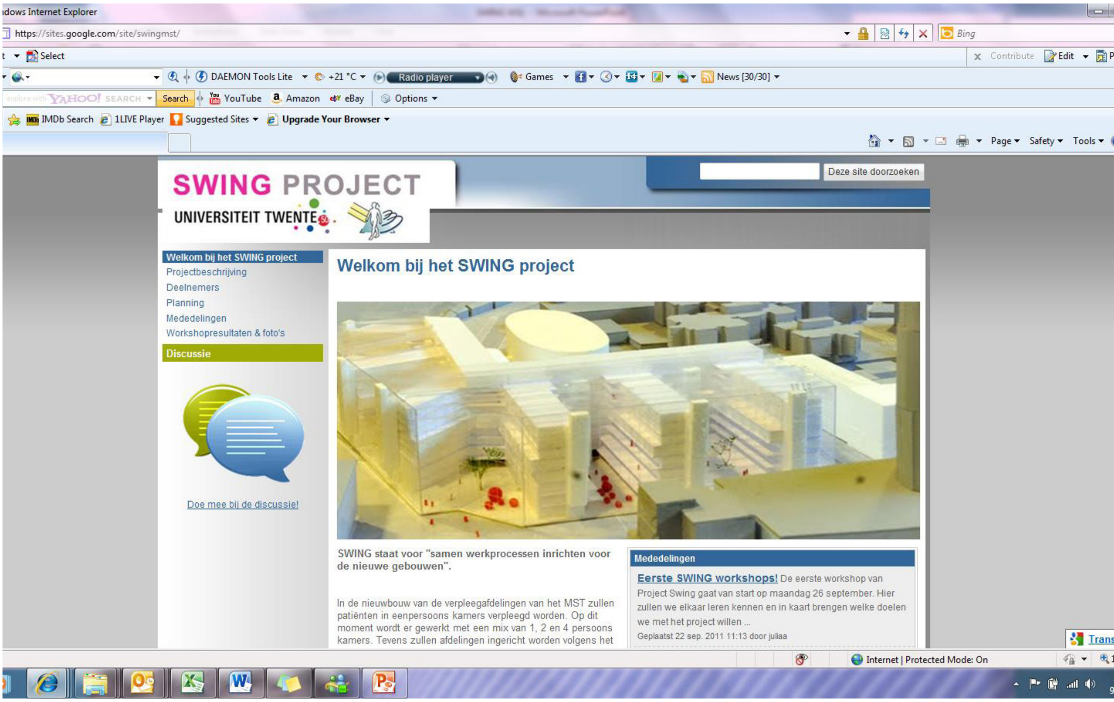


Figure 7.10: Screenshot of the SWING private website.

The project anchoring outside of the group of people who participated in the workshops was ensured by reports, online information, and presentations. Project reports informed the steering committee and the project commissioner about the conditions and results of the workshops. Furthermore, information about the project was made available in- and outside the organization via a MST intranet- and an Internet website (Nieuw ziekenhuis moet "SWINGen", 2012), a magazine about the building project (MST bouwt! Ontwikkelingen nieuwbouw Medisch Spectrum Twente, 2012) and presentations. The MST project manager and the researcher did three presentations during the project: one for the patient interest group, one in a lunch meeting for the MST staff, and one as part of a meeting for nurses of MST. Feedback from these presentations was taken into account in the project.

7.3 HEAD GAME CUSTOMIZATION AND WORKSHOPS

The SWING project consisted of ten different applications of the HEAD game, each requiring a specific game customization: nine different workshops on the 4 topics, plus the evaluation workshops. This section describes the HEAD game customizations and the design of the game for every type of workshop. The basic elements of the HEAD game have been described in Chapter 6. Here the workshops from the first design workshop series are described in detail, while the second design workshops are summarized in tables, because they are similar.

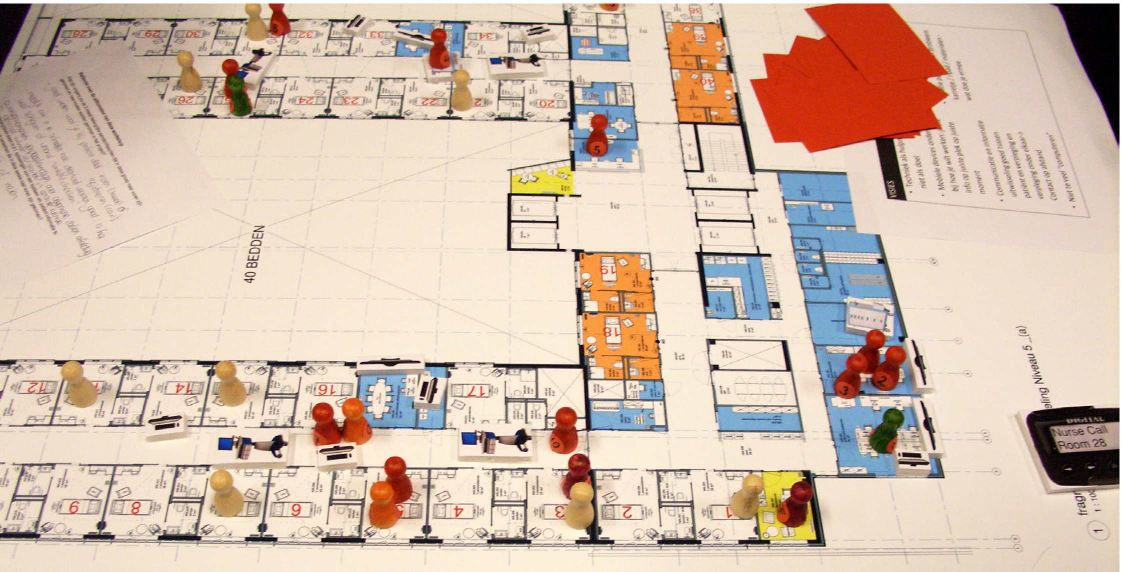


Figure 7.11: Game board of the new ward with playing pieces representing staff members and computer trolleys.

7.3.1 GAME BOARD, GAME PIECES, AND TASK CARDS

Three parts of the HEAD game were the same for all topics and workshops in project SWING: the game board, the game pieces, and the activity flow cards. Since SWING dealt with nursing procedures on the wards in the new building, a map representing a ward in the new building was used as game board. The game pieces were coloured pawns representing the staff that works on a ward and poster board cutouts with printed pictures of different trolleys and other moveable items (see Figure 7.11).

In accordance with the focus on nursing practices, the nursing activity flow guides the HEAD game in the SWING project. The task cards contained the fields "task", "by whom", and "where" (see Figure 7.12). A field for the duration of the tasks and for the needed information was omitted to keep the task cards as plain as possible and to make them usable for all topics. In every workshop flip-overs, pens, and blank playing pieces were available.

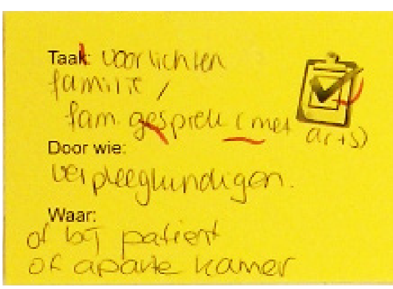


Figure 7.12: Task card with fields for "task" (Taak), "by whom" (Door wie), and "where" (Waar).

Within SWING, nine general properties of the nursing process were identified:

1. people and their roles,
2. tools and appliances (products, software and infrastructure),
3. the activity flow including time (when, chronology, duration, parallelism of events),
4. scheduled events,
5. unscheduled events,
6. space and location where tasks are executed or events happen (location, distances and size),
7. the information flow,
8. rules and regulations, and
9. responsibilities.

The properties seven, eight, and nine are additional to the six basic properties.

While each topic had its own focus points and most relevant properties, there was some overlap between them since they related to elements of nursing work. The results of the first workshop treating the topic of "nursing activity flow" was used as the point of departure in subsequent workshops. Due to different focus points of the four topics, a dedicated design of event cards, cases, guiding questions and additional material was needed to address the four workshop topics. The session set-up was adapted to the qualities of the topics, depending on whether scheduled or unscheduled events were the focus. Below the focus points of every workshop, the relevant nursing process properties, the session set-up, the employed dedicated game elements, and the guiding questions are described. Guiding questions are questions the facilitator used during the game to steer the game process and make certain that all relevant aspects of the topic are discussed. The project managers and the steering committee (see Section 7.2.4) developed these guiding questions.

7.3.2 FIRST DESIGN WORKSHOP SERIES

First ICT and communication workshop

The topic ICT and communication deals with the ways of communication, information recording, and consultation with or without information technology tools and the software, hardware, and infrastructure these tools consist of. The goal of the workshop was to first determine an optimal workflow for the new building and then derive product requirements for ICT products and systems, using the new workflow. The technical framework that had already been defined for the new building was used as a point of departure for the game. The framework said that in the new hospital building there would be a wireless network for data transfer, telephone, and Radio Frequency Identification (RFID) tags. As result, all digital information can be made wireless available anywhere in the building and there is the option to trace goods and people. The patients can access facilities such as internet,

Figure 7.13: Workshop about ICT and communication with mock-ups of Ipads, IPhones, and pagers.

TV, and hospital intranet by a “smart TV”.

The topic relates to three important elements of the nursing processes: (1) the reading and recording of patient and other data, (2) all communication between staff and between staff and patients such as phone calls, making digital appointments, reanimation alarm, and (3) the monitoring of patients. Of the previously mentioned nine properties of the nursing process, the focus point for the first design workshop was the optimal location for consulting and editing digital patient records (e.g., does a nurse fill in patient information at the patient room or at the staff room) and the optimal tools needed for the task. These relate to the properties (1), the staff and their roles, (2) the tools and appliances products, software and infrastructure), (3) and (4) the (scheduled) activity flow, containing time (when, chronology, duration, parallelism of events), and (6) the space where tasks are executed or events happen (location, distances and size).

Dedicated game elements that were added to the game elements that were used for the ICT and communication design workshop included mock-ups of communication tools, tool requirement cards, and problematic event cards. The real size mock-ups depicted communication tools such as telephones, smartphones, smart tablets, pagers, etc. They were added to provide inspiration, e.g., with respect to appliance sizes (see Figure 7.13). The tool requirement cards could be linked to specific tools and be used to describe needed requirements. The red event cards described problematic events related to the topic that could occur, e.g., *“during the delivery of bad news in the family room, patient information needs to be consulted”*.

All workshops started with a coffee moment and the completion of questionnaires for research purposes that are addressed in later sections (see Step 1 in Table 7.1). The first workshop started with a brief introductory presentation about the workshop topic and a presentation by a staff member of the ICT department about

Table 7.1: ICT & communication 1 session steps and guiding question.

ICT & COMMUNICATION 1	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee and questionnaire	• What are the reasons for the choice of tools?
2. Introduction presentation	
3. Presentation ICT about opportunities ICT	
4. Playing current situation for one nurse	
5. Filling in tasks on task cards	
6. Creating chronological activity flow	
7. Marking tasks for which patient information needs to be consulted or edited with a red dot	
8. Filling in locations on task cards	
9. Discussion about tools	
10. Placement of tools that are not portable on game board	
11. Keeping portable tools within arm's reach	
12. Filling in tool requirements, if needed	
13. Playing new scenario, adjust chosen tools and activity flow, if needed	
14. Playing problematic events, adjust chosen tools and activity flow, if needed	
15. Filling in reflection	

the technical possibilities in the new hospital, including some practical examples of the use of ICT for patients and staff in other hospitals (Step 2 and 3). Next, the participants played out the current activity flow of the morning nursing shift on the game board, which was a plan of the ward, with playing figures and noted possible problems (Step 4). The exemplary session transcript with video stills 1, "Ward rounds", shows an example of how participants are triggered to discuss problems in the current procedure. The subsequent steps dealt with the development of new scenarios, the heart of the design game. First participants were asked to adapt the activity flow of the morning shift to the new building situation by playing it out with playing figures and creating a new task card flow for the morning shift (Step 5 and 6). Afterwards, they were asked to mark the tasks for which patient information needed to be consulted or edited with a red dot on the task card flow (Step 7, see Figure 7.14), determine the ideal location for executing the task (8), decide

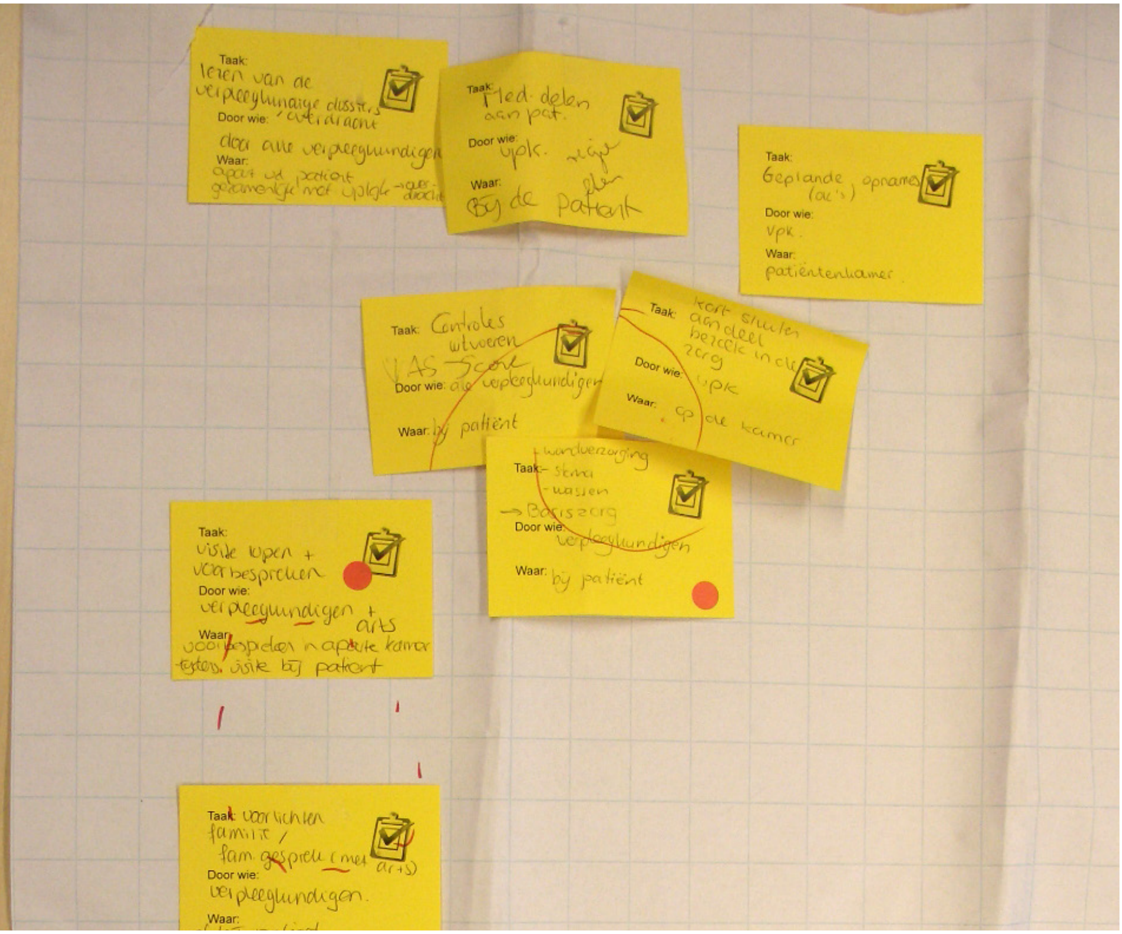


Figure 7.14: Activity flow with red dot stickers from ICT and communication extra workshop.

on the best way to consult and edit patient data with the help of the different real size mock-ups of smart products (Steps 9, 10, and 11), add product requirements to the tools (Step 12), and repeatedly mimic elements of the morning shift on the game board (Step 13). The exemplary session transcript with video stills 2, "click!" describes how a nurse proposes a new ICT tool, based on a task in the task flow. Furthermore, the exemplary session transcript with video stills 3, "Put everything in the telephone" shows how the mock-ups elicit a discussion about ICT tools. Next, the event cards introduced interrupting events as a means to stress test the flexibility and feasibility of the chosen design solutions (Step 14). The workshop ended with participants writing down their reflections on the most relevant outcomes of the workshop (Step 15).

In all workshops, the facilitator used guiding questions to support the participants. The guiding question for the first workshop was used to find out the motivation for the choice of tools, if they were not given by the participants on their own. While the workshop procedure is presented in sequential fashion, in reality it consisted of numerous iterations, overlaps, and interventions by the facilitator to keep the basic order intact.

EXEMPLARY SESSION TRANSCRIPT WITH VIDEO STILLS 1: "WARD ROUNDS"

Design workshop 1, topic "ICT & communication". The game participants in this group are two nurses, a secretary, a physiotherapist, and the facilitator: Participants play the ward rounds (a task in the task flow they have created) on the game board. This triggers them to share experiences about problems with organizing the ward rounds with the doctors. The playing figures representing various staff roles are placed in different positions on the game board, the task flow is on the flip over in the back (not visible in the photos):

Participant 4 (picks up playing pieces representing nurses, see video still above): *"With the ward rounds, there is one doing the ward rounds with the doctor, another one follows up, she is doing everything now…"*

Participant 5: *"And the other one …"*

Participant 4: *"And this one is sitting in the coffee room."*

Participants 5,6 and 7: *"Yes."*

Participant 5 (points to the playing figures, see video still above): *"At our ward, the ward round is not finished before one, and then we start over again, because the doctor has had a consultation with the assistants!"*

Participant 4 & 6: *"Yes, that is the same at our ward!"*

EXEMPLARY SESSION TRANSCRIPT WITH VIDEO STILLS 2: "CLICK!"

Design workshop 1, topic "ICT & communication". The game participants in this group are two nurses, a secretary, a physiotherapist and the facilitator: Participant 4 imagines an additional function to the "bread car" during playing the task "providing the patients with breakfast" and explains how it works:
Participant 4 (draws rectangle in the air with her fingers): "*…you could have a screen on the bread car.*"
Participant 5: *"Yes."*

Participant 4 (mimes ticking on a touchscreen with a finger, see video still): *"On this you could see for every room, you, "click", can open the liquid balance, I set down a cup of water, "click", I type in "a cup of water", and that there is directly visible, what kind of diet someone has, that would be ideal for the nutrition assistants!"*
Participant 5 agrees: *"Yes!"*
Next, a "product tool card" is filled in, saying, that the bread car should have a touch screen to access patients diet and insert the food and liquid intake.

Extra ICT and communication workshop

Since it turned out that the ICT and communication topic was too extensive to be completely addressed in one workshop, it was decided that a second workshop was needed. The focus in the second workshop was on communication issues related to unscheduled events rather than predefined routine tasks. In particular, the goal of the second workshop was to design the ideal smart call-, alarm- and communication system on the wards and the kind of ICT tools (facilities, products, software, etc.) needed to realize this system. The activity flow designed in the first workshop was used as the point of departure and the crucial properties of the nursing process were the unplanned events (property 5) of the previously mentioned seven basic properties), the tools needed (property 2), and the information flow (additional property 7). The dedicated game elements consisted of mock-ups of communication tools, the tool requirement cards, "call cards" describing different types of calls/

EXEMPLARY SESSION TRANSCRIPT WITH VIDEO STILLS 3: "PUT EVERYTHING IN THE TELEPHONE"

Design workshop 1, topic "ICT & communication": A participant reflects on mock-ups of pagers, I-pads and smart phones which are spread over the table:

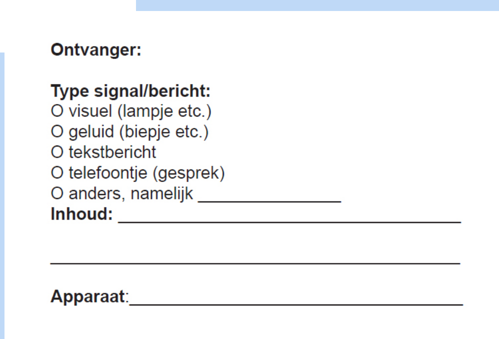
Participant 5 (points at the mock-up of an I-pad, see video still above): *"And with an Ipad, that also isn't convenient to walk with. I would propose to put everything in the telephone, the alarm system as well!"*

Later they will agree that a device size somewhere in-between Ipad and smart phone, that can fit in the nurses' uniform pockets would be ideal.

Afdelingssituatie
ochtend
Vpk 1: deelt medicijnen op kamers1-4
Vpk 2: wast patiënt kamer 6
Vpk 3: loopt visite kamer 12
Vpk 4: kamer 14
Vpk 5: verschoont bed kamer 17
Vpk 6: zet patiënt op po, kamer 23
Vpk 7: op zoek naar patiënt kamer 26
Vpk 8: spoelkeuken
Vpk 9: WC
Vpk 10: kamer 37

secretaresse: balie
artsassistent: loopt visite
teamhoofd: teamhoofdenkamer
onderst. medew. voeding: deelt eten uit

Figure 7.15 and 7.16: ward situation card (top) and information card (bottom).



Ontvanger:

Type signal/bericht:
O visuel (lampje etc.)
O geluid (biepje etc.)
O tekstbericht
O telefoontje (gesprek)
O anders, namelijk ______________
Inhoud: ________________________________

____

Apparaat:________________________________

alarms, and "ward situation cards" describing a scenario of the position and task of different staff members on the ward (see Figure 7.15). During the game random combinations of both card types were drawn to discuss the ideal way of dealing with the described scenario consisting of a call (call card) and ward situation (ward situation card). An example of a call card was *"patient Miller from Room 4 calls because he hears the patient in the room next to him crying"* and an example for a ward situation card *"Nurse 1 who is responsible for Room 1, 2, 3, and 4 is busy to change the bandages of the patient in Room 1; Nurse 2 who is responsible for rooms 5, 7, 9, and 10 is on her way to the operating room to pick up a patient"*. For each scenario, the participants were asked to find the best way to deal with it and then record the proposed solutions on information cards (see Figure and 7.16). The last two steps were repeated until no new scenarios came up and participants could not imagine any additional situations on their own. The workshop ended with the participants giving their reflections. See Table 7.2 for an overview of the workshop procedure.

First Catering workshop

With the new MST building there will be a new catering concept. Whereas in the old building meals are prepared in a central kitchen and delivered to the wards at fixed moments, in the new building there will be a restaurant on every floor that can respond dynamically to the needs and wishes of the patients in terms of meal composition and serving time. The nutrition assistants of SWING joined the catering workshop. This workshop addressed the catering issues of ordering and

Table 7.2: ICT and communication extra session steps and guiding questions.

ICT & COMMUNICATION 1B (EXTRA)	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee 2. Discussion about additional tools/ choosing additional tools 3. Pulling call/alarm situation card 4. Pulling ward situation card 5. Decision about who needs to be informed and how 6. Filling in information card 7. Adjustment of chosen tools and activity flow if needed 8. Repetition of 2-6 until cards are run out 9. Filling in reflection	• Should the patient be enabled to call the nurse anytime? • Which calls go directly to the nurse, which go via e.g., a secretary?

Figure 7.17: Playing pieces with "responsibility hats" (rings with labels, left), and control task cards (right).

distributing of meals, recording of patients' in- and outtakes of fluids and food, feeding of incapacitated patients, food-related hospitality towards visitors, and the tools needed in these processes for data processing and food transport. The processes inside the kitchen such as managing orders and cooking were beyond the scope of SWING.

The focus points of the first catering design workshop were: (1) the conditions for ordering meals in compliance with treatment plans and daily schedules, (2) the tasks of the nutrition assistant under the new catering concept, and (3) the division of tasks amongst nutrition assistants and other staff members. These issues related primarily to the properties of the activity flow of the nutrition assistants (property 3 of the previously mentioned seven basic properties), rules and regulations with respect to ordering meals (additional property 8), and the responsibilities in the catering process (additional property 9). Dedicated game elements for this workshop topic consisted of "responsibility hats", persona cards (fictional patient descriptions), problematic event cards, control task cards, and an "ICT system field" on the game board (for responsibility hats and control task cards see Figure 7.17). Responsibility hats were little rings that depicted responsibilities such as "bringing meals" or "feeding patients" and could be placed on playing figures representing different staff functions to assign responsibilities. Persona cards described patients with problematic diet profiles. These were intended to stimulate the design of rules and mechanisms to deal with difficult patients. The problematic event cards had a similar function, but described more dramatic events that players had to deal with. The control task cards could be used to define tasks such as "nutrition assistants checks whether patients have eaten the ordered meals". The ICT system field was a sheet, placed on the game board in order to create a physical representation of the ICT system and a place to assign tasks to in the process of allocating tasks to

Table 7.3: Catering session steps and guiding questions.

CATERING 1	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee and questionnaire 2. Introduction presentation 3. Presentation by facility management about new catering concept 4. Playing current situation for one nutrition assistant 5. Assignment of responsibilities for bringing food/helping patients with eating/nutrition plans/ nutritional state of patients by adding responsibility hats to playing pawns representing different staff functions 6. Pulling persona card 7. Filling in control task card for persona if needed 8. Deciding whether control function should be allocated with staff or ICT system by placing control card at staff function pawn or ICT system field 9. Repeat 6-8 10. Playing problematic events, adjustment of chosen control mechanisms if needed 11. Filling in reflection	• Will there controlled what patients ate? • Will there be a control, whether patient ate at all? • When will patients be allowed to order food? • Who does the controlling? • How can shared meals be facilitated?

humans or the ICT system (e.g., a software for meal ordering that prevents ordering sweets for patients with diabetes). As usual, the workshops ended with participants recording their impressions after all personas and event cards were played. See Table 7.3 for an overview of the workshop procedure.

First Nursing activity flow and visitors workshop

The nursing activity flow deals with the timing, order, location, and distribution of scheduled and unscheduled tasks that nurses need to carry out during their workday. The goal of the workshop was to design the nursing activity flow and furthermore clarify visiting rules and visitor facilities. The point of departure for the visiting concept was that the visiting hours are abandoned in favor of welcoming visitors 24/7 and that one family member of a patient could sleep in the patient room on a camp bed. Furthermore, other family members could be facilitated in a designated family room. The focus points of the workshop then were (1) the planning of nursing tasks on a ward with only single person rooms (property 3, the activity flow), (2) the consequences of family and other visitors being present at day and night on the activity flow, and (3) the facilities (property 2) and rules (additional property 8) needed and distribution of responsibilities for handling the visitors (additional property 8).

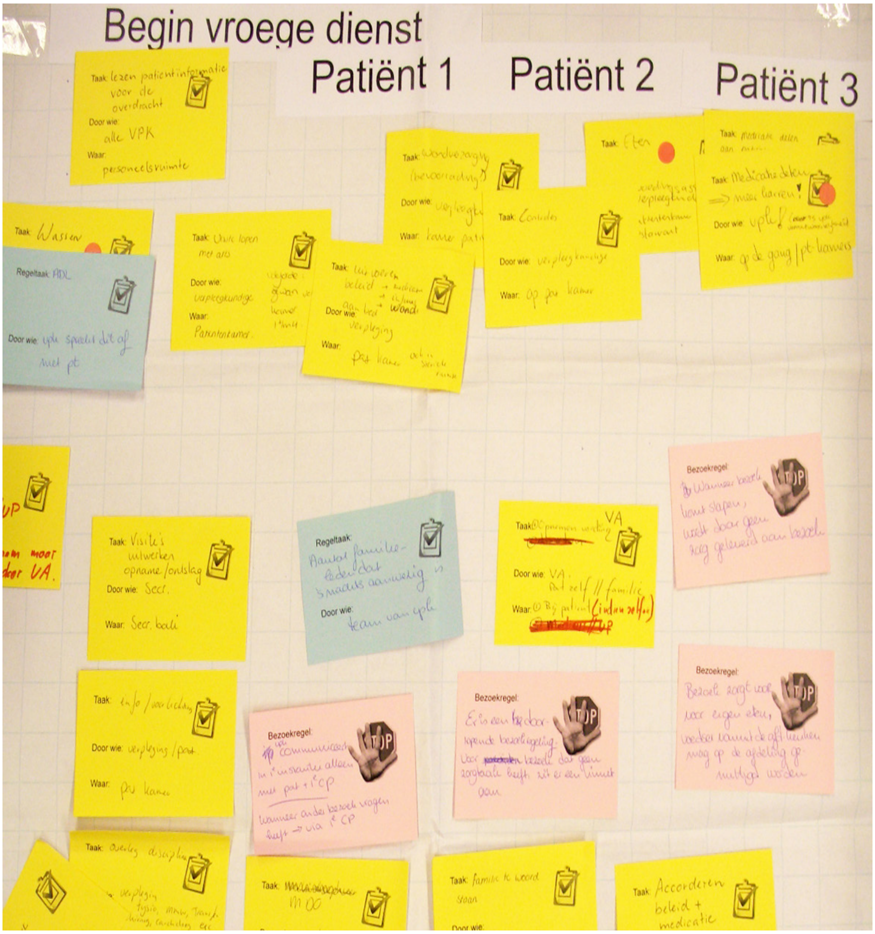


Figure 7.18: Activity flow (yellow) with rule cards (red) and regulation task cards (blue).

Dedicated game elements in this workshop were cards to write down rules, cards to write down regulatory tasks, and visiting event cards (see Figure 7.18).

After the usual initial steps, the participants played out the old activity flow of the morning shift on the game board representing the new ward and noted any problems. Next, participants were asked to solve these problems and adapt the nursing activity flow to working at a ward with single person rooms. Special attention was given to the question whether patients should be handled sequentially (e.g., washing, dressing, feeding first patient and then move to second patient, etc.) or concurrently (e.g., first wash all patients, then dress all patients, then feed all patients etc.). As usual, the activity flows were visualized by mimicking them on the game board and filling in task cards to form an activity flow. Afterwards, participants were asked during which of the tasks family presence would be acceptable (e.g., feeding) and during which tasks not (e.g., washing). Tasks where no visitors should be allowed were marked with a red dot. As a next step, a discussion was initiated by the facilitator about whether there should be "written" visiting rules about these situations or if it should be the responsibility of staff members to manage these situations case by case. Participants were asked to fill in and place different colored

Table 7.4: Nursing activity flow and visitors session steps and guiding question.

NURSING ACTIVITY & VISITORS 1	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee and questionnaire 2. Introduction presentation 3. Playing current situation for 1 nurse 4. Filling in tasks cards for tasks with patient contact 5. Discussion how tasks should be bundled per patient 6. Creating chronological nursing activity flow including several patients 7. Playing activity flow 8. Marking of task cards during which visitors should not be allowed in the patient room with red dots 9. Discussion whether there should be visiting rules or regulatory task for the marked tasks 10. Filling in rule or regulatory task card 11. Discussion about visitor facilities and choosing/making playing pieces for the facilities 12. Pull card with visiting event 13. Discussion whether event needs rule or regulatory task 14. Repeat 12-13 until cards run out 15. Filling in reflection	• Should we maintain the limited visiting hours?

cards next to the activity flow, representing any rules and responsibilities. Next, the participants were asked to think about facilities that were needed for the visitors (e.g., a room stocking camp beds, extra coffee facilities, a sign at the door showing whether tasks are going on inside that require privacy). Subsequently, a number of critical event cards dealing with visitors were drawn at random to provoke further discussions on the previous design results. An example of such an event card read: "Patient Tiekstra is very sick and needs to rest, but she also has a large family. Family members are often present and take over part of the care for Mrs. Tiekstra. It is apparent that the situation is rather stressful for Mrs. Tiekstra." The workshops again ended with participants writing down their reflections after all event cards were played. See Table 7.4 for an overview of the workshop procedure.

First Material Logistics workshop

According to the logistics concept for the new building, materials will be delivered to a storage area on the ward that is separated from the patient rooms and the pharmacy will prepare medications for each patient on demand and deliver them

Figure 7.19: Game board with material cards (red) and trolley playing pieces (blue).

directly to the patient rooms. The further distribution of medication, disposables, appliances, linen, and garbage on the ward itself was not yet determined and hence became topic of the design workshop. More specifically, the focus points for the material logistics workshop were: (1) the decision whether to use trolleys for transport and storage of materials on the wards, (2) the use of trolleys (or alternative solutions) for all nursing work, the set of functionalities required of them, and their restocking, and (3) the materials that must be placed in the trolleys or elsewhere on the ward. Material logistics outside the ward was beyond the scope of SWING. For this topic the relevant properties were the nursing activity flow as a point of departure (property 3), the tools needed to transport items (e.g., trolleys, property 2), and the responsibilities (e.g., who should restock, additional property 9).

Dedicated game elements included material cards and problematic events cards. The material cards could be used to define specific storage places (e.g., patient room or trolley) and describe the contents of these storages (see Figure 7.19). There were no guiding questions for this session.

The workshop followed the same basic sequence of steps. After the usual introductory steps, the participants played out the current situation of the morning shift for one nurse in order to identify opportunities and bottlenecks regarding the current activity flow and the new building. The exemplary session transcript with video stills 4, "Illogical", gives an example of the discovery of such a bottle neck. The results were compared to the results on the activity flow from previous workshops. Next, tasks that required materials or appliances were highlighted with

Table 7.5: Material logistics 1 session steps.

MATERIAL LOGISTICS 1	
WORKSHOP STEPS	
1.	Coffee and questionnaire
2.	Introduction presentation
3.	Playing current situation for one nurse
4.	Discussing and adapting activity flow that was created in sessions about ICT and nursing tasks & visitors
5.	Indicating tasks that require materials with red dot stickers
6.	Design a first approach for material storages on the ward (rooms and trolleys)
7.	Filling in storage cards per storage room/trolley
8.	Playing activity flow and filling storage cards with a list of needed materials
9.	Playing problematic events, adjust storages and activity flow needed
10.	Filling in reflection

red stickers on the respective task cards. Afterwards, the participants were asked to find the best places to store the different types of materials and the best way to distribute them over the ward. This task was accomplished by filling in storage cards representing trolleys, bags, storage rooms, etc. In addition, each of these storages could be stocked by filling in lists of needed materials on every storage card. As usual, the final step consisted of playing event cards and filling in the reflection forms. Table 7.5 gives an overview of the different steps of the workshop.

7.3.3 SECOND DESIGN WORKSHOP SERIES

General set-up

The goal of the second design workshop series was to analyse the different issues in more detail, building on the results of the first workshop series. For this purpose, the project managers and steering group used a higher number of study- or guiding questions than in the first workshop series. Every workshop in the second workshop series started with a coffee moment, a questionnaire (see Appendix 3), an introductory presentation about the workshop topic, and an introductory presentation of the virtual reality tool. The virtual reality tool was designed to be used in evaluation workshops to provide a better overview of the future building situation. The virtual reality tool is described in Section 7.3.4. Furthermore, in every workshop brainstorming techniques were used to widen the participants' perspectives. More specifically, reverse brainstorms and brainwriting were employed. Reverse brainstorm is a technique where participants are asked to first come up with ideas to worsen a particular situation in order to then turn those ideas around to find ideas that improve the situation. With the brainwriting technique participants received inspiration sheets and were asked to write down ideas in pairs to improve the nursing work or patient experience on the wards. The inspiration sheets showed examples for processes and hospitality from different areas, e.g., low-

EXEMPLARY SESSION TRANSCRIPT WITH VIDEO STILLS 4: "ILLOGICAL"

Design workshop 1, topic "material logistics". The visible game participants are three nurses, a project member from the Thorax centrum, and the facilitator. They play the current practice for picking up materials for wound care on the game board of the new ward, in order to identify problems. The long distance between the sterile storage and the patient room in the new hospital causes such problems.

Facilitator: *"And the wound care materials?"*

Participant 2: *"The wound care - that is normally on a trolley., at our ward"*

Participants 2 and 3: *"…in the sterile storage."*

Participant 3 points to the sterile storage on the game board (see video still above): *"Here."* The facilitator moves playing figure representing a nurse towards the storage.

Participant 1: *"But you could do that differently…"*

Facilitator asks: *"And then you take that, and you think "I need two bandages for that patient"…"*

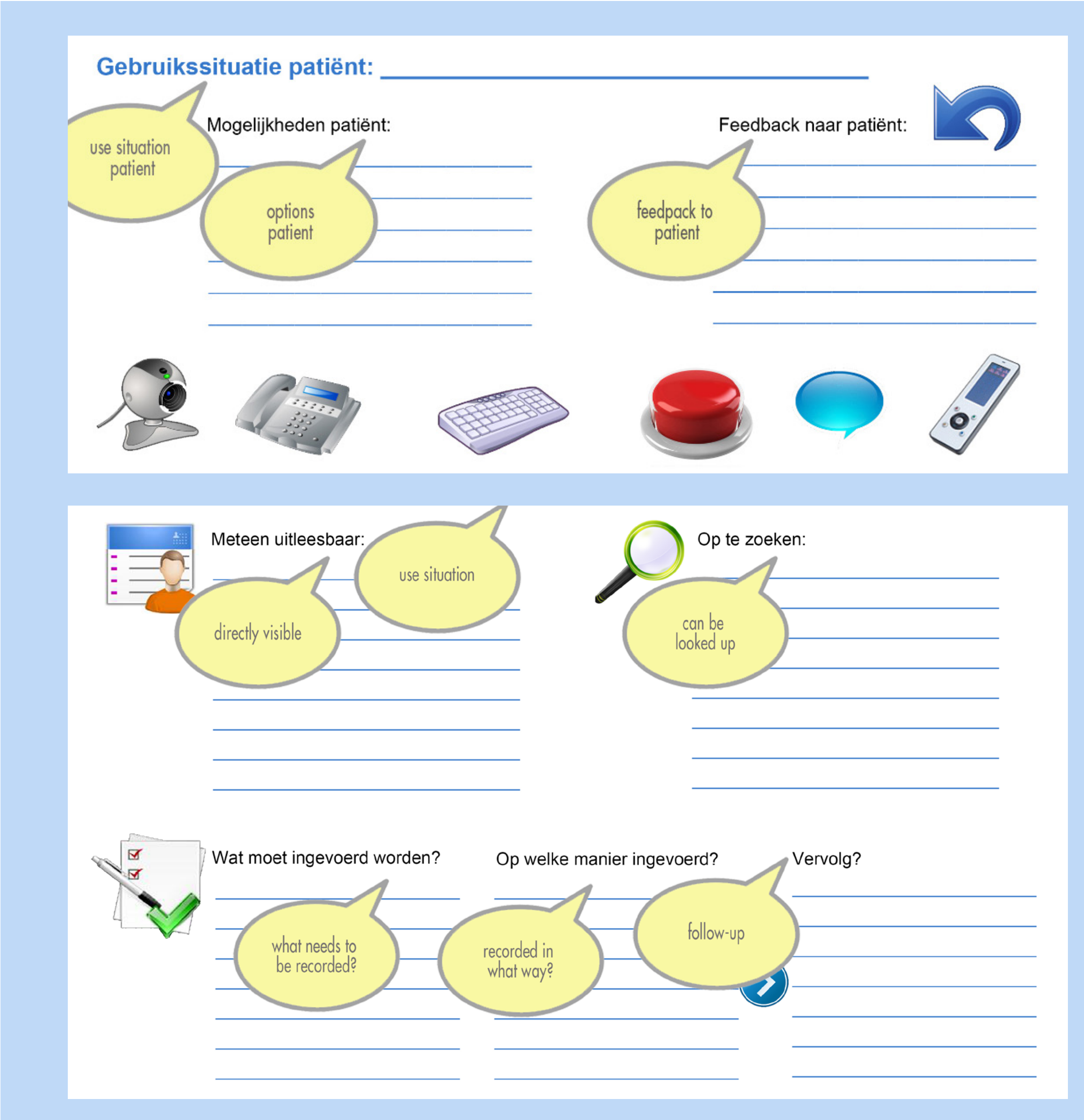
Participant 3: *"Yes…"*

Facilitator: *"and one gauze…"*

Participant 3 (a bit irritated) : *"Yes."*

Facilitator moves playing piece representing the nurse from the sterile storage via the hallway to the a patient room (see video still above): *"…and then you walk all the way over here?"*

Participant 1: *"That is quite illogical!"*



Figures 7.21: Information consulting or editing card.

budget hotels or airports. After that they had to pass the ideas on to the next duo and follow up on the ideas they were given. Unfortunately, the reverse brainstorm technique was not used after the first workshop (nursing activity flow workshop), since it did not deliver the desired results and was very time consuming; it only led to complaining about current problems, instead of stimulating ideas. However, the brainwriting technique was more successful and was used in every workshop of the second design workshop series. Each workshop concluded with each participant writing down his or her reflection of the workshop.

Second ICT and communication workshop

The second workshop on ICT and communication focused on the patient side of the ICT system and a detailing of the system the nurses will eventually use in the new

Table 7.6: Steps of the second ICT and communication workshop.

ICT & COMMUNICATION 2	
WORKSHOP STEPS	
1.	Coffee and questionnaire
2.	Introduction presentation
3.	Introduction VR-tool
4.	Brainwriting
5.	Discussion about in which situations patients and family could use the alarm and communication system, filling in alarm/call situation cards for every situation
6.	Fill in with what kind of hardware the patient should do the call on situation card
7.	Filling in what should be the feedback to the patient/ family
8.	Discussion about how to deal with different levels of capability in patients
9.	Filling in information consultation/editing cards with what kind of information should be available at the daily information consultation or editing moments
10.	Discussion about what information needs to be available in unexpected (not planned) situations, filling in additional cards
11.	Writing down, which information can be filled in by the usage of text, box ticking etc.
12.	Filling in what kind of follow-up actions are needed
13.	Discussion about the need for automatic reminders or warnings (make notes on flip-over)
14.	Role-play of scenario: what would happen, if nurse receives a telephone call while washing a patient, to start discussion about the use of a head-set
15.	Discussion about what kind of "do not disturb" or other modes are there besides during medication distribution (make notes on flip-over)
16.	Sharing outcomes with both groups
17.	Filling in reflection

building. In particular, the focus points were:

1. How can the patient use the alarm and communication system? What are his use options?
2. What kind of options to consult and edit information should the electronic patient dossier offer at what moments?
3. Should the nurses work with a headset?
4. What kind of "do not disturb" or other modes are there besides during medication distribution?

The questions relate to the activity flow, tools, and information flow properties.

Two dedicated game elements were designed to answer the questions: alarm and call situation and information consulting or editing cards (see Figures 7.20 and 7.21). The former aims at how patients can deal with calls or alarms they want to make, the latter deals with what information nurses would like to consult and how they would like to edit it. See Table 7.6 for an overview of the workshop procedure.

Table 7.7: Steps and guiding questions of the second catering workshop.

CATERING 2	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee and questionnaire 2. Introduction presentation 3. Introduction VR-tool 4. Brainwriting 5. Creation of nutrition assistant activity flow, marking tasks that can be planned beforehand with a red dot 6. Discussion about additional ICT tools (besides smart pad) 7. Filling in information cards with the information the assistant needs for every task, adding them to the activity flow 8. Discussion about additional tools 9. Filling in reflection	• How can the division and execution of tasks take place, which cannot be planned? • Does someone coordinate the nutrition assistants? • To what extent should there be feedback to patients and nurses about the planning (waiting times) of the catering team?

Second catering workshop

The second catering workshop zoomed in on one of the design question of the first workshop, namely, the issues of ordering and distribution of meals. The difference between the workshops was that this time a higher emphasis on the information flow was placed.

Dedicated game materials comprised information cards that were used to write down information that the nutrition assistant and/or nurses need at specific moments in the activity flow (see Figure 7.22). See Table 7.7 for an overview of the workshop procedure.

Second nursing activity flow workshop

The goal of the second nursing activity flow workshop was to divide the previously derived activity flow into smaller, more detailed steps and to find ways to decrease walking distances and task accumulation in the morning. Dedicated game elements included stickers in the form of hearts that were to be used to identify "core" tasks of nurses (see Figure 7.23. See Table 7.8 for an overview of the workshop procedure. Notice the increased number of guiding questions compared to the first workshop.

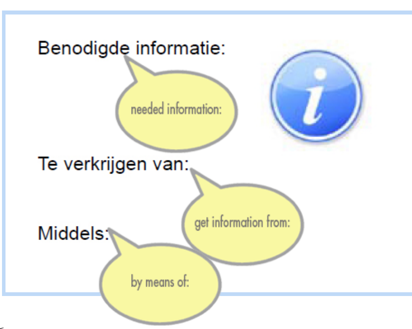


Figure 7.22: Information card.

Table 7.8: Steps and guiding questions of the second nursing activity flow workshop.

NURSING ACTIVITY 2	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee and questionnaire	• Can we divide or plan the shifts differently?
2. Introduction presentation	• Which tasks could go from nurses to other staff?
3. Introduction VR-tool	• Which tasks must anyhow happen in the morning?
4. Reverse brainstorm	• Which tasks can we split up?
5. Hotel brainwriting	• Which tasks can we do differently to speed them up?
6. Adaption of activity flow according to ideas from brainstorm and brainwriting	• Will we carry out the tasks serial or parallel?
7. Adaption of activity flow according to guiding questions of facilitator, marking core tasks that must be done by nurses with heart stickers	
8. Filling in reflection	

Figure 7.23: Activity flow from the nursing activity flow workshop with heart stickers.

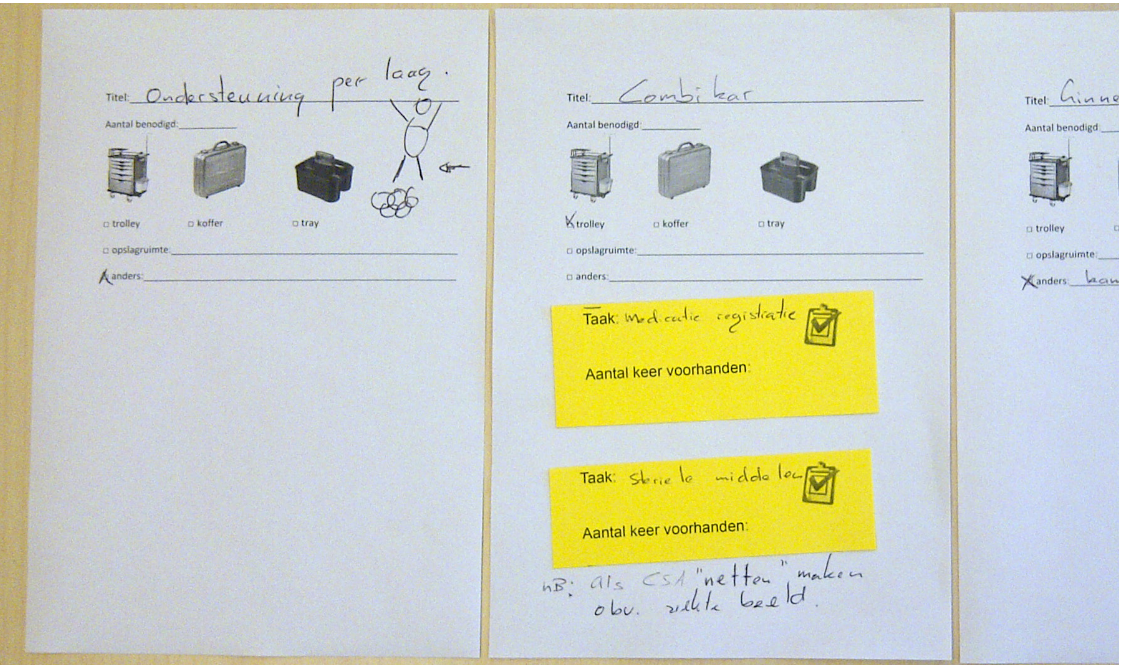


Figure 7.24: Storage cards with mini task cards.

Second material logistics workshop

The second workshop on material logistics had similar contents but focused more on the details of the location of tools and the activity flow property. More specifically, the focus points were

1. Adaptation of the number and content of the trolleys to the new activity flow.
2. The extent to which the use of trolleys implies a change in the activity flow.
3. The type of unexpected tasks that demand additional trolleys or other solutions for material storage and transport.
4. The amounts of materials that need to be stored in the trolleys.
5. The amounts of materials that need to be stored in the stock room as a reserve.

Dedicated game materials that were designed to answer the focus points included storage cards and mini task cards (see Figure 7.24). The storage cards were similar to the material cards used in the first material logistics workshop. However, the storage cards contained more options and were used in combination with task cards. Instead of recording, which materials should be stored in which place, participants were asked to fill in mini task cards and place these on the storage cards to indicate which tasks the storage should accommodate. This way unnecessarily detailed discussions witnessed in the first workshop were avoided. Another advantage of the mini-tool cards was that they could easily be moved across different storage cards, which was not possible previously. See Table 7.9 for an overview of the workshop procedure.

Table 7.9: Steps and guiding question of the second material logistics workshop.

MATERIAL LOGISTICS 2	
WORKSHOP STEPS	**GUIDING QUESTION**
1. Coffee and questionnaire 2. Introduction presentation 3. Introduction VR-tool 4. Brainwriting 5. Adaption of activity flow 6. Discussion about for which tasks materials from the trolleys are needed 7. Filling-in a stock card per trolley 8. Filling in small task cards en place them on the trolleys, that should provide the materials needed for these cards 9. Discussion about the number of trolleys per type 10. Play activity flow 11. Discussion about trolleys for materials that are needed in unexpected (not planned) situations 12. Filling in for how many executions of a task there should be materials in a trolley on the trolley stock cards 13. Filling in on trolley stock cards, when they should be refilled 14. Discussion about type and number of reserve materials in stockroom 15. Filling in reflection	• Should the trolleys be filled per room(s), tasks or materials?

7.3.4 EVALUATION WORKSHOPS WITH VIRTUAL REALITY TOOL

The objective of the evaluation workshops was to finalize the definitive concept for the new nursing practice including the activity flow, rules, responsibilities, ICT and tools. Since all concepts from the previous workshops were to be integrated and evaluated, all properties of the nursing process were relevant. The evaluation workshops made use of a virtual reality tool (VR-tool) similar to the "room layout configurator" and the "operating theatre design" cases described by Thalen and van der Voort (2012).

The VR-tool was a digital version of the game board used in the previous design workshops and offered three main functionalities (see Figure 7.25 and 7.26). Firstly, the tool consisted of a touchscreen table that showed a representation of the map of the new ward linked to a large vertical screen. Moving playing figures on the touchscreen displayed on the large screen the first-person view of the person represented by the playing figure when walking through the hospital ward. A three-dimensional digital model of the ward enabled this feature. Secondly, the tool

Table 7.10: Evaluation session steps.

EVALUATION	
WORKSHOP STEPS	
1.	Coffee & questionnaire
2.	Discussion of activity flows from previous sessions, design of final activity flow
3.	Discussion about tools, ICT options, rules and regulations based on cards representing options designed in previous workshops
4.	Introduction VR tool scenario game
5.	Assigning the player roles: one person is the nurse, the other participants represent staff patients and family, and have to confront the nurse with various requests
6.	Noting requests and way of bringing over this request on event cards
7.	Playing the activity flow scenario including tools, ICT, rules and regulations for one nurse with the VR-tool, while the nurse is trying to fulfil her planned tasks, the other players can hit a buzzer and utter a request, she must react to, the events and task cards are placed on a timeline
8.	Discussion of observed bottlenecks, chances and surprising insights
9.	Filling in reflection

recorded the distances a person would have to walk in the real world whenever a figure was moved across the digital ward during playing situations. Thirdly, the tool came with a clock that went from 7:30 to 16:00 o'clock (the morning shift) within just one hour. This feature was used during the evaluation session to allow participants to play a whole shift through within the confines of a three-hour workshop.

Dedicated game elements were result cards that were used to summarize design decisions from previous workshops, the activity flow that had been derived from the design workshops, event cards, and a poster depicting a timeline. The workshop started with a discussion of previous results with the help of the result cards and choosing between different solutions that had been designed in parallel. Afterwards, the VR-tool scenario game was introduced and participants were assigned different roles. One participant was assigned the leading role of a nurse, while the others took roles such as nurse colleagues, patients, and secretaries. The nurse then played a full morning shift in accelerated speed with the VR-tool, using the newly designed activity flow and applying the concepts that had been developed for tools, communication, information flow, etc. The task of the other participants was to interrupt the nurse with a buzzer and confront her with events from the event cards and events they had prepared themselves. The nurse had to deal with these events appropriately. All tasks and events were placed on a timeline (see Figure 7.27). The exemplary session transcript with video still 6 "How do I get my cracker", describes one episode from the evaluation workshop, in which an event and the reaction of the "nurse" lead to the discovery of a bottleneck in the current concept. The session ended with a discussion of observations regarding the potential bottlenecks and new insights and filling in a final reflection document. See Table 7.10 for an overview of the workshop procedure.

Figure 7.25 and 7.26: The VR-tool with big screen and touchscreen table with game board.

Figure 7.27: Timeline with task cards and events from the scenario play.

EXEMPLARY SESSION TRANSCRIPT WITH VIDEO STILL 5: "HOW DO I GET MY CRACKER?"

Evaluation workshop, playing the morning shift with the VR-tool. The participants are two nurses, a staff member of the ICT department, a nursing care specialist, the researcher, the MST project manager, and a manger from the catering industry. An episode between the nurse and a patient, the participants representing other roles are watching the episode.

Participant 8 (playing the role of the nurse, moving the playing figure representing a nurse, see video still above): *"I go to room seven "Good Morning Madam!"*

Participant 9 (playing the role of the patient, taking one more look at his event cards", see video still above): *"Good morning."*

Participant 8 (playing the role of the nurse)*:"Did you sleep well?"*

Participant 9 (playing the role of the patient)*:"No, actually not."*

[Everybody laughs.]

Participant 8 (playing the role of the nurse): *"You did not sleep well?"*
Participant 9 (playing the role of the patient)*:"No, I am feeling sick."*
Participant 8 (playing the role of the nurse)*:"Oh, that is unpleasant. You haven't eaten yet?"*
Participant 9 (playing the role of the patient): *"No I haven't eaten yet."*
Participant 8 (playing the role of the nurse): *"Oh, that is unpleasant. Let me help you first with washing, then I help you to sit upright…"*
Participant 9 (playing the role of the patient): *"Well, I really do not feel like it. I am really sick."*
[…]
Participant 9 (playing the role of the patient): *"Ehm, I think that I would like a cracker, and I would like it now."*
Participant 8 (playing the role of the nurse): *"That's ok. Then you can start with that, and I will go to someone else first, and then I will check on you and the we slowly start with washing."*
Participant 9 (playing the role of the patient)*:"Yes."*
Participant 8 (playing the role of the nurse)*:"We ask a colleague then, and we do it with two nurses, and then we can finish it quickly."*
two nurses, and then we can finish it quickly."
Participant 9 (playing the role of the patient): *"Yes."*
Participant 8 (playing the role of the nurse): *"And then you will be -what did I say -at eleven you will be picked up by the ambulance, as you maybe already know."*
Participant 9 (playing the role of the patient)*:"But how do I get my cracker?"*
A discussion starts, because the situation had revealed, that it was still unclear, how nurses can place orders for food aside the usual meals and how the food then gets from the kitchen to the patient.

7.3.5 SOME NOTES ON THE ACTUAL PROJECT DEVELOPMENT

For a better understanding of the outcomes of the design and research results, a description of a number of developments during the course of the project will be provided:

Project developments

The project was initially planned to take one year, but due to difficulties in scheduling meetings, it took nearly two years. In order to ensure continuity between the workshops, it was decided to that all workshops were to be completed within one year. The timeline of the project is depicted in Figure 7.28. During the year, the project changed its focus from the concept of the fluctuating ward size towards the reduction of walking distances. This was due to the growing understanding that the scheduling of nurses on a fluctuating ward and the room assignment can be better addressed by a mathematical optimization approach (Operation Research approach) than a design game approach driven by practical experience.

During the steering group meeting it was decided to not include doctors in SWING due to the project's focus on the nursing activity flow and the difficulties that were expected with convincing doctors to cooperate properly. This decision had the consequence that new concepts for the ward rounds with the doctors could not be validated. Unfortunately, the time between the two design workshop series was rather long due to practical constraints. This interruption led to the fact that the participants forgot many of the points of departure and results from first workshop series. Another unfortunate necessity was that the group composition changed slightly between the two series. As a result, some participants were assigned to a different topic in the second series than in the first. Furthermore, not all participants had prepared properly for the workshops.

It was monitored whether participants were influenced by pleasant or unpleasant developments on the wards during the project that might find expression in their motivation or evaluation of SWING . They were asked to indicate wether there were positive (QQ31, questionnaire 1-5) or negative (QQ32, questionnaire 1) developments at the wards. The responses to both questions stayed close to "neither agree, nor disagree", during the whole project. In conclusion, there was no significant overall tendency, that influenced the whole population.

Difficult project start

During the first workshop, the visioning workshop, many participants were confronted with specific plans for the new building including the fluctuating ward size concept and the set-up of the wards for the first time. In addition, they learned that the plan to have only single-person rooms had been finalized. These plans were presented by the researcher and provoked a number of critical and in one session even cynical comments. In particular, participants criticized that they were not part

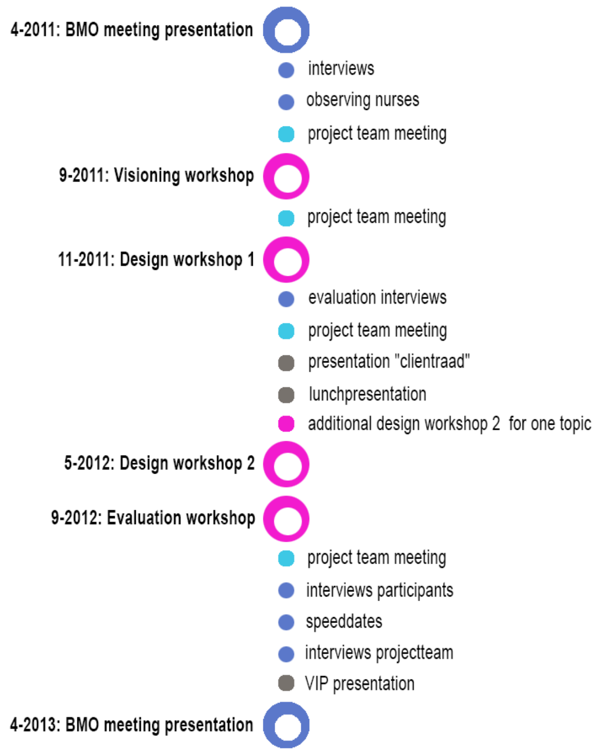


Figure 7.28: Project SWING timeline

of the process until now and that they were likely only allowed to decide about some minor issues. It was stressed that project SWING on the contrary provided the opportunity to give input and to contribute to some major questions that had not been answered yet. A small number of participants voiced concerns about their own ability to design solutions. The tense atmosphere of the visioning workshop produced many concerns with respect to the further course of the project on the side of the project managers. The participants voiced two types of concerns. Firstly, there were concerns about the new building, the social isolation of patients, the longer walking routes, and less available time for patients due to the longer routes. Secondly, many participants worried that SWING came too late to have an impact, that it might stick too much to today's situation, and that SWING was not based on a clear strategic vision provided by MST.

Attitude change

During the design workshops participants were less vocal regarding their concerns about the new building project than during with the visioning workshops. The participants gave the impression that they came to terms with some of the controversial issues regarding the new hospital concept. While some changed their perspective and viewed the initial problems as opportunities, some merely accepted the downsides, e.g., of increased walking distances, and made the best of the situation. However, some participants still voiced their concerns. In particular, participants repeatedly emphasized that every medical specialism is too unique to develop a general concept that fits all wards. The design workshops themselves were in general well received by the participants, but only after some initial consternation about the seemingly childish set-up. The presence of domain experts from ICT and medical technology and the facility management helped in this regard and was greatly appreciated by the participants. The different workshop topics were received with variable interest by the participants. Whereas the topic of material logistic was received with a neutral attitude, the topic of the catering was of great interest but had to be approached carefully since it directly affected the functions of several staff members.

Stimulating creativity

Because participants showed that they were able and willing to contribute during the workshops, it was decided to take them one step further in the second design workshop series and stimulate their creativity. In particular, it was decided to hold the second workshop series at the "Virtual Reality Lab "[2] at the University of Twente. It was hoped that placing the participants in a new, stimulating environment away from their work would help them to come up with ideas that were different from the current situation. In addition, the first part of the second workshops for each topic included brainwriting sessions, where participants were asked to work in pairs and write down ideas for improvement of the hospital. For inspiration, they were given examples from practice in low budget hotels, five star hotels, and airports. Bringing participants outside of the hospital worked in the sense that they were less distracted and had more time available for the workshops. While the ideas produced during the brainwriting sessions were not directly applicable to the workshop topics, the process was successful in broadening the participants' perspective since the second design workshop series produced important improvements on the different topics.

Overall, many project members were observed to have a hard time to deal with the uncertainties and iterations in the SWING project, which are common to design processes. During the workshops participants at one time complained about their lack of knowledge of the future with comments like *"I cannot tell you, how everything is going to be, because I do not know how this and that is going to be"*, while at other time they complained that too much had already been decided in advance.

2 *See "http://www.vrlab.ctw.utwente.nl".*

7.4 DESIGN RESULTS

This section summarizes the design results for the four SWING topics (nursing activity flow, ICT and communication, material logistics, and catering). The ideas for reducing the walking routes are addressed separately, because they touch on all four topics. An analysis of the outcomes per session and with respect to the relevant properties per topic can be found in Section 7.8.6. All results are derived from the in the workshops generated materials (filled-in cards & notes) and agreed upon in the evaluation workshops. Recommendations were formulated in the steering committee based on the results.

7.4.1 NURSING TASKS FLOW AND VISITORS

Project SWING made evident that MST is currently lacking an up-to date and widely supported vision on nursing. However, since defining a nursing vision for the whole organization was beyond the scope of SWING, the focus was placed on identifying opportunities to work more efficiently in order to reduce the work pressure during the morning peak and shorten the walking distances of the nurses walk. The design workshops produced the following ideas to improve the nursing activity flow and dealing with visitors:

Delegating. In a number of cases the washing and feeding of patients can, in agreement with the responsible nurse, be delegated to the patients' families. Furthermore, in specific cases washing, basic care, and checks can be delegated to the nurse assistant.

Buddy system. Every nurse should have a nurse (the "buddy") who is his/her given work partner and steady back up.

Coordinating nurse. Every ward should have a coordinating nurse. This nurse adds an organizational layer between ward manager and nurses. Her main task would be scheduling which nurse takes care of which patient, based on the current state of the patients. The coordinating nurse should only take over patient care in emergencies.

"Huddle". In order to briefly go over relevant news or problems and offer an opportunity to ask for assistance if tasks pile up, one or two "huddles" (as in the sports context) should be introduced to the nursing shift. All ward staff gathers for a short moment, e.g., in the beginning of the shift and communicates relevant issues face to face.

Admission, intake, and discharge. To make planning easier, fixed time slots for the admissions should be scheduled. This is possible due to the planned set-up of an acute admission and observation ward. The medical history of patients and relevant data (anamnesis) from earlier hospital admissions should be available digitally and patients should have the option to fill in their anamnesis in advance, either online or at the evening before a planned hospital admission by phone.

Hospitality. The existing online patient portal should be used to let patients indicate specific requests with respect to e.g., diet or beds. Furthermore, it should be used to give patients information about their prospective stay including instruction movies. The nurses should be given the additional task of managing visiting hours and overnight stays of family members in the best interest of the patients. For visitors who do not stay overnight, visiting hours should be extended, but not be continuous. Overnight stays of family members in the patient rooms should be organized in consultation with the responsible nurse.

Additional opportunities to save time and shorten walking distances. Using disposable washcloths (washing without water) and disposable bedpans that are stored in patient rooms is recommended.

7.4.2 ICT AND COMMUNICATION

The design results from the ICT workshops involve the communication between staff members and between staff and patients, the call and alarm system, the way data are accessed, presented, and altered, and the monitoring of patients. The presented solutions deal for the most part with appliances and software. Some results from the workshops include the identification of bottlenecks with respect to social aspects of the communication technologies. The point of departure for this topic was that the digital patient records are wireless accessible everywhere in the new building for those who have admission rights.

Smart tablet. Currently the documentation of patient data and information is very time intensive, because there are many separate moments during the day when information must be documented. This inefficiency can be improved by digitalization and combining documentation moments. The participants suggested that the staff should use smart tablets for communication and information management. The smart tablets could also be used to locate colleagues with the help of “GPS” if their assistance is needed. However, staff should not get the impression that the tracking system is being misused to monitor their every move. The tablets must be small enough to easily fit into the uniform pockets, but large enough to conveniently display patient files. In combination with the tablet, a headset should be used for making calls. The device should be operable with voice recognition to enable staff to make calls with “dirty” hands. Furthermore, the device should have a ”do not disturb” function that puts calls through to the buddy nurse, if the nurse is preoccupied or on a break. The tablet should be able to take photos of, e.g., wounds, and add these efficiently to the patient record.

Furthermore, it would be helpful if the tablet could automatically record results from measurement appliances (e.g., blood pressure and blood sugar levels). Since the tablet cannot be taken into the isolation room, there should be a substitute system with the same set of functionalities in place.

Digital records and software. The nurses should have a personal "dashboard" on their tablet that informs them about changes in the patient records, e.g., via pop-ups. Via a start-up screen on the dashboard, the nurse should be asked to confirm the list of patients she is responsible for at the beginning of her shift. For the transfer between shifts, the most recent reports, the reason for admission, disabilities, last actions, and an overview of appointments should be visible. The nutrition assistants should have their own dashboard with access to the nutritional information of the patient records.

Patient calls and emergency calls. A smart system should link patient calls to the nurses who have been assigned to take care for the patients. On the nurses tablet should be an alarm button that can be easily reached. The use of this button should call the two closest nurses on the ward. As a result, a nurse knows that she always needs to take action when she receives an emergency call. The participants were not sure whether the emergency buttons that will be placed in the patient rooms to conform to the legal regulations should be linked to the smart wireless alarm system or whether two parallel systems should be introduced. However, two parallel systems might bring about safety risks.

Ward dashboard. Each ward should have a large screen displaying a dashboard with a map of the ward that shows the status of all patient rooms. The screen should be place at the reception or in the staff room, but should not be accessible by patients and visitors.

ICT patient side. Before SWING started, MST decided to place smart TVs in each patient room. These TVs can be used for accessing internet and entertainment applications. During the workshops, there was much criticism about the positioning of the TV in the patient rooms. The TV should ideally have an interface for ordering food and for the displaying the schedule of the day for every patient. The patients should have the following devices at their disposal: a keyboard, a remote control, and a communication device with one or a few buttons to make contact with the responsible nurse and nutrition assistant. This device needs to be wireless and wearable. Furthermore, there should be an option to accommodate patients who cannot call by using other means such as a blowing device. The patient should have the choice to either make food related calls or care related calls.

Patient monitoring. Patients with a high risk of falling should be equipped with a fall detector. Furthermore, restless patients should have a sensor that alarms the nurses, whenever the patient moves out of bed. Due to patient privacy and because of the type of patients on a general ward, video connections with the patient rooms are not needed. Exceptions apply to confused or unstable patients.

New technology and behaviour. While no design results, the participants showed great concern with regard to the influence of the new technology on the perception of nurses and social behaviour. For example, nurses need to be aware that some patients and family members might think that nurses who always wear headsets and are always available are not in the position to give undivided attention to the individual patient.

7.4.3 MATERIAL LOGISTICS ON THE WARD

In the beginning of SWING, it was decided that the stock of materials in the patient rooms needs to be reduced due to the costs of throwing away unused material after short periods as prescribed by the hygiene policy. The starting point for SWING with respect to medication was that prescribed medication would be placed daily in lockable boxes in the patient rooms by the pharmacy staff.

Storage and trolleys. The participants concluded that it is necessary to place a small stock of materials that must be easily accessible in each patient room. Further materials are stored in trolleys and storage rooms. At wards with a high level of material usage, every nurse should have her own trolley that is stocked only with materials needed for the patients she is responsible for. Each trolley should be equipped with measurement devices needed for the daily checks (e.g., clinical thermometers). A smart system could be used to keep information about the material stock up-to date and order new materials automatically. Furthermore, the nurses should together with the logistics department inspect the closets in the storage rooms, since the current ones are not arranged ergonomically.

Task or condition specific material sets. Standardized material sets should be composed for the care of specific conditions. Protocols for the composition of the material sets are needed and should be updated regularly. Furthermore, there should also always be single materials available for non-standard cases.

Linen. Besides sterile materials, textiles such as towels should be delivered directly to the rooms. If the ward assistant refills the textiles in the rooms daily, there is no need to continuously place an additional trolley with linen in the hallway, as it is currently done. In case the linen stock in a patient room is used up, the nurse should have the option to request a restocking on demand. For every ward, there should be five combined dirty linen/garbage trolleys. It would be useful to equip the trolleys with a chip reader to trace how much linen goes out of the ward. Preferably, the trolleys allow for rigid bins to prevent fumbling with sacs.

Appliances. If the nurse needs a medical appliance, she should be able to trace the location of the appliances on her smart tablet.

7.4.4 CATERING CONCEPT

In the new hospital, there will be a restaurant on every floor to provide the patient catering. This new arrangement allows patients to order the food they want at the time they want. The design results for the catering topic in SWING mainly concern regulations and responsibilities.

Ordering food. The patient can digitally indicate his preferences (before admission). Furthermore, he can order daily using the smart TV. The software offers all the food options that are in line with the patients' treatment plan. As part of the admission, the nutrition assistant should take a coffee moment with the patient and explain how to order food and plan the meal times for the next days. The nutrition assistant can see the patients order history on her smart tablet. If patients do not order any food, the nutrition assistant needs to visit the patients. Whatever patients eat in the hospital restaurants next to their meals (that are according their treatment plans) should not be controlled, because patients are supposed to take responsibility for their own actions. However, a healthy food choice should be stimulated by the assortment and presentation of products in the restaurants. It might be practical to have a concept similar to the current "bread car" which offers an assortment of bread, sandwich fillings, and diary for the breakfast and the lunch. The advantages of the bread car are that it is easy to use and client friendly.

Food and medication. Some drugs must be taken at a specific time before, during, or after a meal and diabetes patients need to eat at specific times. Therefore, it is nearly impossible to let these patients order food at any time. This is also not advisable with respect to the efficiency of the logistics and working processes. Therefore, the participants advise to restrict the times during which patients can order food. If every patient indicates the times he would like to eat in advance, medication and appointments can be arranged accordingly.

Competences and responsibilities. The nutrition assistant helps the patients with ordering food. She serves the food, controls the intake, if necessary, and advises the patient with respect to nutrition. For this tasks thorough knowledge about nutrition in combination with specific conditions and treatments is needed. Therefore, the nutrition assistants should be linked to specific wards to acquire the knowledge needed. Besides knowledge about nutrition, experience with the abilities and restraints of the kitchen is important. Helping with eating is a responsibility of the nurse. She can delegate this task to the nutrition assistant for patients who do not suffer from problems with swallowing. If there is a risk that the patient suffers from such problems, the speech therapist must give a recommendation regarding eating.

Floor restaurants. Wards with patients who are limited in their mobility should be located closer to the patient restaurants. Furthermore, wards with bedridden patients should be placed close to the kitchen to reduce the walking distance for the nutrition assistants.

7.4.5 WALKING DISTANCES AND ROUTES

The following list is a summary of the results that should contribute to shortening the distances nurses walk in the new building in comparison to maintaining the current workflow:

- The use of smart tablets with headsets for communication and to locate the closest colleagues accurately via GPS will make searching for help obsolete.
- Telephone communication with patients will enable nurses to ask patients what they need before walking towards them and take along any required materials.
- Due to the "huddle", the buddy system, and the communication tools there will be more agreement about tasks, which prevents walking back and forth due to vagueness.
- On wards that use large amounts of materials, placing the individual material trolley close to the door of the patient room will make walking to a trolley in the middle of the hallway or to the storage redundant.
- The combination of dedicated material sets and a basic storage in the patient rooms will reduce the number of times nurses need to walk to the storage.
- Placing measuring appliances on the trolleys and being able to locate other appliances via GPS will limit searching for and picking up of appliances.

Furthermore, a number of ideas that had been developed outside of SWING will add to the reduction of walking distances. The delivery of medication to each patient room saves nurses a number of steps since they only need to take the medication from the locked box in the patient room. Furthermore, the acute admissions and observation ward will also take over a number of tasks of the nurses with respect to the admittance of acute patients.

7.4.6 INSIGHTS AND RECOMMENDATIONS FOR MST

Apart from the design results, the workshops generated a number of insights and recommendations for MST that are briefly described here.

Insights

- Project SWING has not only generated a rich amount of information to improve the work processes in the new building, but it succeeded to include project members actively in the process and enable them to imagine future ways of working, in particular generating a basic design of the ICT system. While the different design games did not lead to revolutionary concepts, they enabled participants to let go of their initial resistance and look at the work processes from a greater distance. The project created a culture amongst participants in which people critically look at current working procedures and are open for improvement and innovation.
- It turned out to be very valuable to include the ICT department and the Facility Management in the workshops.
- Unfortunately, visits at other hospitals could not be realized during SWING. After SWING visits could be made to look at key concepts identified during the design workshops that are already implemented in other hospitals, e.g., with respect to the smart tablets and material logistics.
- During the workshops, it became clear that every ward of MST had their unique way of working. Things that are normal on one ward are a completely new way of looking at processes for another ward. The participant learned from each other and got ideas how to improve the workflow even in the old building.
- Due to the lack of a clear vision with respect to nursing at MST, there was sometimes a lack of direction in the discussions, especially during the sessions about nursing tasks. A relevant question is, whether MST wants to hold on to a vision of integrated care (delegating as few tasks as possible), or aim for a higher level of efficiency, which puts delegating tasks central.

Recommendations for patient related nursing tasks

- At the time of writing, a new vision on patient care for MST has nearly been completed in a different project. The results should be used to formulate a vision on nursing, which should be done in cooperation with the nursing advice council (Verpleegkundige Advies Raad), Department of Quality and Safety (Stafdienst Kwaliteit en Veiligheid), and the involved staff from the Best Practice Units.
- The role of the nurses will change as a result of the changing roles of visitors and family when using single person rooms. Hospitality, but also a more and more self-determined audience will play a bigger role. As a result, there is a

need for clear rules and agreements about how to deal with different situations.

- The process for organizing after-care should be improved by employing a lean project approach.
- The tasks of ward assistants should be made uniform and their tasks should be analysed to determine how the ward assistants could help the nurses with the general daily tasks. The vision on nursing should be used as point of departure.
- At the time of writing, there have been no doctors actively included in the design of working procedures for the wards in the new building. However, the results from SWING should be discussed with a representative group of doctors. Special attention should be given to the ward rounds.
- The work processes in SWING have been designed from the perspective of nurses and a number of other disciplines. While the interest of the patient has been kept in mind and there has been a dialogue with the patient organization about the project results, no patients have actively been involved in the project. The design results should be analysed together with a representative group of patients (or patient representatives).

Recommendations for ICT and communication

In the area of ICT and communication, there are still many aspects that need further detailing. A work group should be established that can make a connection between working practice and technical solutions. The work group should make a prioritized list of action points that need to be finished before moving to the new building. The following aspects should be considered:

- A concept for the use of smart tablets and the communication/alarm system for the general wards and the whole MST should be realized. Testing and implementing this concept should happen gradually.
- A pilot project for the headsets should be started to evaluate expectations and concerns in practice.
- In the final design of the ICT system, the aspects of social behaviour and transparency of system should be considered.
- A prospective risk analysis (PRIA) for working with two parallel alarm systems should be executed.
- The location and flexibility of the positioning of the smart TV with respect to visibility of the screen should be reconsidered.
- Staff who will work with the new ICT system should receive proper training.
- The relevant applications should be fully operational on a tablet.
- It is advisable to make a connection between the other ICT/communication projects in the follow-up of SWING, including projects involving digital status keeping, patient portal, nutrition system, and projects in the field of privacy and information protection.

Recommendations for the catering concept

The establishment of a work group with participants from the facility management, the catering company, nutrition assistants, and dieticians would be helpful. The work group should work on the catering concept focusing on the following aspects:

- The work group members should be familiarized with the work processes of the other members by observing them during work.
- The catering concept should be standardized as much as possible since at the time of writing there are significant differences between catering at the wards.
- The work group should take into account the option to plan meals (due to medication), maintaining the competencies of the nutrition assistants, isolation rooms, and hygiene regulations.
- A decentralised catering solution for the wards that has the same advantages as the bread car should be considered.
- The walking routes and distances involved with the delivery of meals should be mapped out in order to determine which items should be stored in the central kitchens and which ones in the decentralised pantries.
- It should be ensured that the ICT for the nutrition (ordering meals, the food menu options, etc.) fit with the existing working processes.
- The work group should determine how the catering service towards visitors on the wards needs to be organized.

Recommendations for material logistics

At the time of writing, there are already a number of projects about material logistics and medication distribution in place, including a black belt project involving storage management, a linen project, the pilot project for the tracking and tracing of materials via RFIDs, and a project about continuing the use of home medication in the hospital. While some of the results from SWING are already taken into account in these projects, a few recommendations are summarized here:

- The ward staff should be included as early as possible in the project about medication distribution that has been set up in connection with the Santeon hospitals (hospital cooperation). A point of attention during the SWING workshops was how nurses could quickly acquire new medication, when the prescribed medication was lost, e.g., because pills fall to the ground. This issue should be part of the project.
- A work group should be created to further design the trolley concept and test extensively what works for each ward. The group should consist of nurses, members from the logistics department of the facility services, experts for sterile medical aids, and members from the department infection prevention. The group should also explore the option to make dedicated material sets for specific conditions or tasks.

- A project should be initiated that analyses what the minimum number of appliances that are needed on the wards should be and in which places these appliances should be stored.
- The concept for bed cleaning should be developed further and be based on the input from nurses from each ward.
- The role the ward assistant should have in refilling materials at the patient rooms should be explored.
- Nurses together with members of the logistics department should redesign the division of the storage closets in the storage rooms.

7.5 RESEARCH APPROACH

7.5.1 RESEARCH QUESTIONS

From a research perspective, project SWING was designed to answer research questions 2a, 2c, 3, and 4 as previously described in Chapter 5:

2. How does the developed design game perform in terms of usability under different circumstances for the design of healthcare environments and activities? (See Section 7.8)

   2a. How does it perform in different design cases?

   2c. How does it perform in a participatory design context?

3. How does a participatory design approach, based on the use of the developed design game, perform for the design of healthcare environments and activities with respect to usability? (See Section 7.8).

The usability of the game and the participatory design approach was evaluated by utilizing the three criteria that define usability according to the ISO 9241 norm as a measuring instrument: effectiveness, efficiency, and satisfaction.

4. How does a participatory design approach, based on the use of the developed design game, deliver participatory design benefits with respect to commitment to an organizational change process? (See Section 7.8)

Commitment to the organizational change process covers recognizable effects with respect to participants showing the willingness to participate in SWING, the willingness to move away from the current situation and design a new one, as well as involvement with and commitment to the new building project. Commitment-related benefits of the participatory design approach were assessed as part of an open evaluation of the benefits of the approach. Furthermore, it was briefly assessed whether possible commitment to the change process also has an effect on the commitment of project members to the organisation in general (MST).

Prior to addressing the third and fourth research question, it will be assessed to what extent project SWING actually meets the criteria of a participatory design project with respect to democratic partnership (see Section 7.6).

7.5.2 RESEARCH METHODS

As discussed in Chapter 5, the research questions were addressed predominately with qualitative field research methods. In particular, the methods included observations, three semi-structured interviews, five questionnaires, and an analysis of the design results of the workshops.

Observations

Observations were used to determine the project setup and to explain differences between workshop sessions. Before the official start of the SWING project, the researcher joined nurses in early and late shifts on two different nursing wards to learn about their daily work, current problems, and bottlenecks in their workflow. These observations were used to determine the project setup, the workshop topics, and the design questions for the workshop. The results from these observations are not presented in this thesis. Furthermore, the researcher participated in all workshops and steering group meetings in project SWING. All important observations were written down directly after the workshops and meetings. These results were used to generate a description of the progress and events during the workshops. The description itself was not analysed, but rather used to provide a context in which design, interview, and questionnaire results were explained.

Interviews

Semi-structured interviews were conducted with project participants, members of the project steering group, and domain experts (see Section 7.2.4) at three moments during and after the project (before the workshops started, after the first design workshop, and after the completion of the project). The interviews took on average about one hour each. During the interviews, notes were taken and voice recordings were made to clarify any unclear or incomplete notes.

The first SWING interviews took place before the start of the workshops to get an impression about the status of the building project and establish the start situation for the new project. These interviews were conducted with three members of the steering group (the building project manager, the SWING project manager partner from MST and a ward team manager) and five domain experts (the head of MST hospital logistics, the head and the staff manager of the MST facility management, the head of the ICT & medical technology department and the head of the MST hospital pharmacy). The results from these interviews were exclusively used to prepare the project and are not presented in this thesis.

The second interview was conducted after the first design workshop (see Section 7.3.2), as a first moment of evaluation. Results were used to adjust the projects direction where needed. The interview was conducted with four steering committee members (the building project manager, the SWING project manager partner from MST, a ward team manager and an ICT & medical technology advisor) and two domain experts (the staff manager of the MST facility management and a team leader from the ICT & medical technology department). The interview questions can be found in Appendix 1. All interviewees of the second interview had participated in the first design workshop.

The third interview was the most extensive one and dealt with the evaluation of the design game and the participatory design approach. In particular, the interviews were used to obtain insight into how the interviewees perceived the efficiency and effectiveness of the project and the game and if they were satisfied with the project course and the use of the game. Furthermore, the benefits for the individual participants and the impact, influence, and agency of project SWING were assessed. The sampling for this interview can be classified as stratified purposeful sampling. From each participant group interviewees were selected to be interviewed, either by interviewing the full group or by random sampling within the group. The interview was conducted with fourteen interviewees; five project participants (three nurses, one nutrition assistant and one secretary), seven members of the steering committee (the building project manager, the SWING project manager partner from MST, a ward team manager, a nursing care specialist, an ICT & medical technology advisor, a nurse who is member of the nursing advisory council and the Hospital Unit Manager who commissioned the SWING project) and two domain experts (the head of hospital logistics, and a manager from the hotel and catering industry). The interview questions of the evaluation interview can be found in Appendix 2.

Questionnaires

During the project, workshop participants were asked to fill in anonymous questionnaires. These questionnaires were designed to collect qualitative and quantitative information to address participants' perception of creativity and self-efficacy, their perception of the project's impact, their expectations with respect to the project, their organizational commitment, the current developments at their ward, and values with respect to the project to provide information to answer the research questions. For this purpose they contained questions to be answered on a five-item Likert scale ("completely disagree" (1), "disagree" (2), "neither agree, nor disagree" (3), "agree" (4), or "completely agree" (5)) as well as open questions. A basic set of questions was the same in every questionnaire, but presented in a

different order to keep respondents attentive to the content of the questions. In addition, these repetitive questions were complemented by questions that were related to the current events in the project at the time the questionnaires were applied. The questionnaire questions can be found in Appendix 3.
The questionnaires were issued at five moments during the project:

1. directly before the start of the workshops (42 responses),
2. after the visioning workshop, directly before the first design workshop (29 responses),
3. directly before the second design workshop (20 responses),
4. directly before the evaluation workshop (23 responses), and
5. after the project (16 responses).

Questionnaire 2 and 5 were spread digitally, by providing an e-mail with a link to the digital questionnaire at "thesis tools". The other questionnaires were handed out on paper. The goal was to have all project participants fill in the questionnaires to achieve comprehensive sampling. However, the number of workshop participants fluctuated and also decreased over the course of the project due to cancellations of participants for specific sessions and people who had to leave the project completely. As a result, the number of complete sets of all five questionnaires became too small for comprehensive sampling. Furthermore, participants were asked to use a code name or number for the questionnaires to maintain anonymity but still allow linking all five questionnaires to the same individual and provide data for a within-subject analysis. Unfortunately, most project members forgot or left out their code name/number, requiring the application of between-subject analysis.

Design results analysis

The workshop results per session were analysed to gain information about the efficiency, and effectiveness of the project and the game with respect to the different topics. The data written on game cards and flip-overs from the design workshops were coded according to a number of categories based on the game properties by the researcher.

The number of results per category was compared between workshop series and between topics. Furthermore, as every topic had specific focus points (see workshop descriptions in Sections 7.3.2 & 7.3.3), it was controlled, whether the number of results in the categories responding to these focus points were higher than in other categories.

7.6 SWING AS A PARTICIPATORY DESIGN PROJECT

Before the value of the participatory design approach of project SWING could be evaluated, it was assessed, to what extent SWING was participatory. Even though it was set-up according to the terms of participatory design, SWING might have evolved away from the intended direction. Furthermore, it was assessed if SWING delivered benefits to the individual participant with respect to e.g., learning, grow of competences, or generally a pleasant project experience, as partcipartory design literature propagates.

In Chapter 3 impact, influence, and agency were identified as the properties to describe the extent of participation in a participatory design project (Segalowitz, 2012). Impact is defined by the two variables "use of information" and "quality of information generated" in a project. Influence is defined by the two variables "scope of the decisions" and "number of the decisions" in a project. Agency is defined by the two variables "solidarity" and "willingness of participants" in a project. The individual benefit will be defined by the variables "growth of competencies or self-efficacy", "growth of insight in the own work", "confidence about own contributions", and "pleasant project experience".

Participants were asked during the evaluation interview and in the questionnaires whether project SWING had in their opinion these qualities (see Figure 7.29).

However, before directly asking questions about the qualities that are defined to characterize participatory design projects, it was assessed what insights interviewees developed about the ideal conditions for a participatory design project and if they perceived staff involvement as relevant. To assess interviewees insights, they were asked what the conditions are to succeed for a project like SWING and what the important aspects are to enable participants to make a useful contribution. With respect to the relevance of staff involvement, it was directly asked whether project team members believe that staff participation in projects like SWING is relevant. This aspect was assessed because project members could evaluate a design project as providing benefits for themselves and the organization, but could still think that the staff involvement was not essential for the project. Hence, the project would be evaluated as a design project that was useful and pleasant for the staff, but that does not show the need for participatory design.

In the following sections the results are presented by indicating for every statement the number of interviewees out of the total number who stated it with a fraction to the right as a footnote, e.g., "2/5 participants" meaning "two out of five participants". All results from the questionnaires and the interviews, which relate to the asked questions, are presented. Please note that not in all cases all interviewees gave responses that answered the questions.

Figure 7.29: Overview of the assessed items that are addressed in this chapter.

7.6.1 INSIGHTS ABOUT THE CONDITIONS FOR PARTICIPATORY DESIGN

Interviewees were asked in the evaluation interview about the conditions to make a project like SWING a success (IQ20). The interviewees never received detailed information about participatory design. During the evaluation interview they mentioned aspects related to the team composition, the project management, and the workshops. When asked about the key conditions that would enable participants to make a useful contribution to a project like SWING (IQ21), the interviewees mentioned items belonging to the same categories. Hence, these categories became the three main categories for the coding framework for the topic.

1. *team composition*
   - *inclusion*
   - *qualities of participants*
   - *profile of participants*
   - *individuals*

2. *project management*
   - *employees are facilitated to participate*
   - *commitment*
   - *clear goal*
   - *timing and planning*
   - *making project known and raising awareness*
   - *leader from organization*
   - *boundaries*

3. *workshops*
   - *outside hospital*
   - *atmosphere*
   - *techniques & visualisation*

Team composition

The interviewees named typical qualities of participatory design with respect to the team composition: the importance to "include many people" or "everybody",[1] and more specifically including specialists,[2] multidisciplinary groups[3] and that all relevant people are represented[4]. Other conditions with respect to the team composition that were mentioned relate generally to the qualities of the people who participate, to their profile, or to the participation of specific individuals.[5] The named qualities were very general and included "the right person to participate". One more specifically defined quality was having experience in ones field of work.[6] With respect to the ideal profiles of team members, interviewees indicated, that persons from outside the organization[7] and specialists who have knowledge of

[1] IQ20: 3/5 participants, 1/2 steering committee members
[2] IQ20: 1/5 participants, 1/7 steering committee member
[3] IQ20: 2/7 steering committee members
[4] IQ20: 1/2 domain experts
[5] IQ20: 3/5 participants
[6] IQ21: 1/5 participants
[7] IQ20: 1/5 participant, 1/7 steering committee members
[8] IQ21: 1/5 participants

current processes[8] were needed. The resarcher,[9] the hospital project manager partner,[10] the manager who commissioned project SWING,[11] and the building project manager[12] were listed as needed individuals. All aspects indicated with respect to team composition directly relate to the fundamental idea behind participatory design – including the people who will have to work in the new situation.

[9] IQ20: 2/7steering committee members
[10] IQ20: 1/5 participants, 1/7 steering committee members
[11] IQ20: 1/7 steering group members
[12] IQ20: 1/7 steering committee members

Project management

With respect to project management, three interviewees named an aspect, which is a relevant condition to enable participatory design to happen: that employees are facilitated to participate.[1] This was specified by some interviewees as that participants must receive the time (working hours) for the project.[2] Several indicated aspects relate indirectly to project impact: commitment or support from the management[3] and all organizational layers[4], making the project explicitly known with the board of management[5] and working continuously on awareness-raising why the project is done[6] could be linked to improving the chances that the in the project generated information will be used by the organization. Other aspects relate to the conditions for a successful projects in general, and not specifically to participatory projects: a clear goal or point of departure[7], a good timing[8] and planning far in advance[9] a leader from the organization,[10] and inclusion of the project bureau to provide boundaries[11]. Furthermore, one participant indicated, that it would have been important to take a look at other hospitals.[12]

[1] IQ20: 1/5 participants, 2/7 steering committee members
[2] IQ21, 1/5 participants, 6/7 steering committee members
[3] IQ20: 4/7 steering committee members, IQ21: 1/5 participants
[4] IQ20: 1/7 steering committee members
[5,6] IQ20: 1/7steering committee members
[7] IQ20: 1/5 participants, 1/7 steering committee member, 1/2 domain experts, IQ21: 1/5 participants
[8] IQ20: 2/7 steering committee members
[9] IQ21: 1/7 steering committee members
[10] IQ20: 1/7steering committee members
[11] IQ21: 1/7 steering committee members
[12] IQ21: 1/5 participants

Workshops

With respect to the workshops, it was indicated that it was better to organize the sessions outside the hospital[1]. Furthermore, factors with respect to the atmosphere were indicated: that there needs to be a stimulating climate[2] and a nice working environment[3], and that a culture needs to be created where one's opinion is important[4] and participants can feel free[5] and "comfortable to tell what you want to".[6] Three interviewees referred to the workshop techniques[7] and one to the visualisation[8] techniques during the workshops. The location and atmosphere of workshops are conditions for successful participatory design projects that only indirectly influence impact, influence, agency and personal benefit of a project.

[1] IQ20: 1/5 participants, 1/7 steering committee members, IQ21: 1/7 steering committee members
[2] IQ21: 1/2 domain expert
[3] IQ21: 1/7 steering committee members
[4] IQ20: 1/7 steering committee members, IQ21: 1/7 steering committee member
[5] IQ20: one domain expert1/2)
[6] IQ21: 2/5 participants, 1/2 domain experts
[7] IQ21: 2/7 steering committee members, 1/2 domain experts
[8] IQ21:1/5 participants

Interpretation

Despite the fact that the interviewees did not indicate any new - or contradictory insights about aspects that contribute to a successful participatory design project and enable participants to make a useful contribution, they confirmed a number of aspects that are known to relate to project impact or general project management. Given that the interviewees did not receive detailed information about participatory design in advance, their list of conditions for participatory design shows the seriousness and capability of the interviewees. Noticeable is the high number of steering committee members stressing that (1) participants must receive time (working hours) for the project (6/7) and claiming that (2) commitment from the management is important (4/7). Whereas the first aspect was realized in project SWING, participants, steering group members and domain experts sometimes doubted the second.

7.6.2 RELEVANCE OF STAFF PARTICIPATION

To find to what extent staff involvement was actually perceived as relevant to the participants the opinion about the relevance off staff involvement, the core of participatory design, was assessed in the questionnaires and the evaluation interview. In the Questionnaires 1 to 5 they were asked to react to the statements "I think it is important to be involved in new developments with respect to my work" (QQ33) and "The staff must be involved in decisions that concern changes to the daily work" (QQ34) on a five-item Likert scale ("completely disagree" (1), "disagree" (2), "neither agree, nor disagree" (3), "agree"(4), or "completely agree" (5)). An analysis of the reaction of both statements together and apart between questionnaires with the help of the Kruskal-Wallis ANOVA method did not show a significant difference. However, the box-whisker plots show that most respondents either agree (value 4) that it is important to be involved in new developments related to their work or completely agree that the staff must be involved in decisions that concern changes to the daily work (value 5) (see Figure 7.30).

During the evaluation interview the participants were asked how important it is according to them to let employees participate in a project like SWING (IQ 32). Four respondents simply agreed, without further explanation, that it is important,[1] or even that the employees are the most important people to include.[2] Some respondents elaborated that it is important to get commitment,[3] or to give the employees the feeling that they are listened to.[4] Others tied staff participation to the quality of the results and said that it is important to include employees to gain useful results.[5] Three steering committee members stated that such things must come from the staff instead of from someone behind a desk or the architect,[6] because they are the ones who must work with the

[1] 2/5 participants

[2] 2/7 steering committee members

[3] 1/5 participants, 2/7 steering committee members, 1/2 domain experts

[4] 1/5 participants, 1/7 steering committee members

[5] 1/5 participants, 1/7 steering committee members, 1/2 domain experts

[6] 3/7 steering committee members

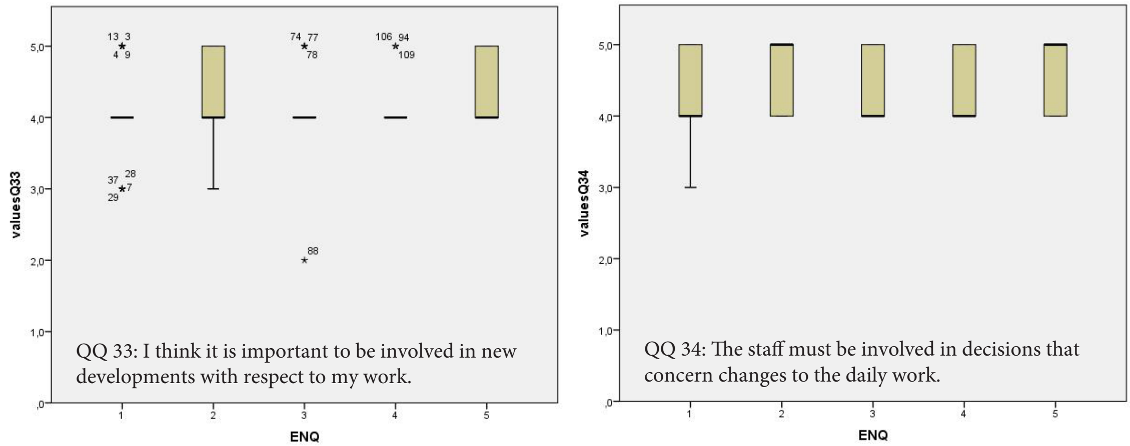


Figure 7.30: Box-whisker plots of responses to questionnaire questions QQ33 and QQ34 (vertical axis) for the five questionnaires (horizontal axis), (value 1 corresponds with "completely disagree", 5 with "completely agree").

results. One steering committee member stated that including staff is important to cultivate thinking about one's own work.7

[7]1/7 steering committee members

Preferred level of involvement

During the interviews the participants were also asked what kind of activities employees should be part of and which ones not (IQ33).

Only one steering committee member answered they should be part of "all activities".[1] Different respondents think, that employees should be excluded from the determination of the four topics,[2] strategic decisions,[3] decisions that have to be made by the project group,[4] decision making in general,[5] the precise filling-in,[6] and the evaluation.[7] Some respondents discriminated between the contents of the activities. According to them, employees should be involved in activities that relate to content in general,[8] to work procedures,[9] to "practical stuff",[10] and in decisions that relate to work activities one is involved in.[11] Furthermore, one participant stated that it is better to involve staff only in a small part of the project,[12] and a steering committee member that it is important not to burden the employees with everything.[13] Five respondents added that the choice of kind of activities employees were included in SWING was good.[14]

[1,2]1/7 steering committee members
[3]1/2 domain experts
[4]1/7 steering committee members
[5]1/5 participants
[6]1/7 steering committee members
[7]1/5 participants
[8]1/7 steering committee members
[9,10]1/5 participants
[11]1/7 steering committee members, 1/2 domain expert
[12]1/5 participants
[13]1/7 steering committee members
[14]2/5 participants, 3/7 steering committee members

Interpretation

In the questionnaire the most respondents agree that it is important to be involved in new developments related to their work and completely agreed that the staff must be involved in decisions that concern changes to the daily work. This opinion was not changed during the course of project SWING. During the interviews, all respondents agreed that staff involvement is relevant both to gain commitment and to achieve results of good quality. In terms of the preferred level of involvement, there was no clear answer. However, the interviewees were not dissatisfied with the level of involvement in SWING.

7.6.3 PARTICIPATORY DESIGN- IMPACT

The impact of project SWING was evaluated by how much the information generated by SWING was expected to be used in practice by MST ("use of the information") and how valuable they were ("value of that information"). Both aspects were addressed during the evaluation interview and the questionnaires.

Use of information

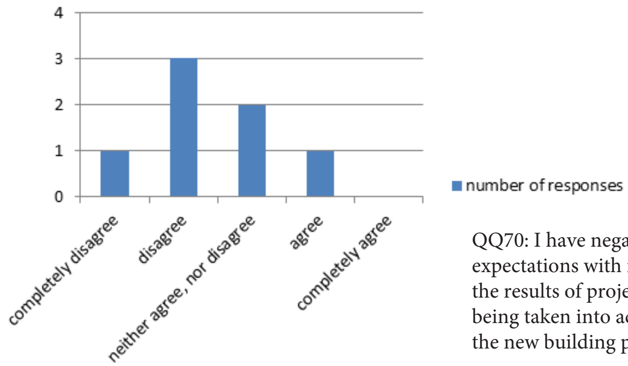
Because the MST building project was still in progress at the time of the interviews, the participants could only be asked about their expectations of the use of the information (IQ25).

Six interviewees[1] believed that the information will be used properly, two were mildly positive[2] and four said they were hoping that it will be used.[3] More steering committee members than participants believed that the information will be used. Two participants[4] were afraid that either "they will cut important things due to costs" or that "they will just freely treat it as a notification". Also, one steering committee member wondered to what extent the ideas will remain unchanged.[5] Two steering committee members thought that the use of the information will depend on whether it is financially feasible, and who the board chooses who becomes the owner of the results.[6]

[1] 1/5 participants, 3/7 steering committee members, 2/2 domain experts
[2] 2/5 participants
[3] 2/5 participants, 2/7 steering committee members
[4] 2/5 participants
[5] 1/7 steering committee members
[6] 2/7 steering committee members

Some participants made comments regarding the quality of the information generated in SWING under question IQ 25. These will be mentioned in the next section, because they do not describe expectations with respect to the use of the information.

The expectations of project participants whether the results of project SWING will be taken into account in the new building project was also an item of Questionnaire 5 (QQ70). The statement used was "I have negative expectations with respect to the results of project SWING being taken into account in the new building project."There were seven responses in the range of one to four (see Figure 7.31). Respondents who answered "agree" or "completely agree" were asked to clarify their reaction (QQ71). Since there was only one participant agreeing with the statement, there was only one clarification, stating: "I doubt how serious the results will be taken into account in the strategy and planning, because that is not clear."



QQ70: I have negative expectations with respect to the results of project SWING being taken into account in the new building project.

Figure 7.31: number of responses to QQ70.

In the Questionnaires 1 to 5 respondents were confronted with the following statement (QQ21): "I think that with project SWING we will have a major influence on the new building project". Furthermore, in Questionnaires 1 to 4 the following statement was given: "With project SWING, we have the opportunity to provide an important contribution to the new building project" (QQ22).
Analysing the responses to the two statements together for the Questionnaires 1 to 4 and looking for differences between Questionnaires 1 to 4 using a Kruskal-Wallis ANOVA method did not result in a significant outcome. Analysing the two statements separately also did not result in a significant difference between Questionnaires 1 to 5 for statement QQ21, or between Questionnaires 1 to 4 for statement QQ22.

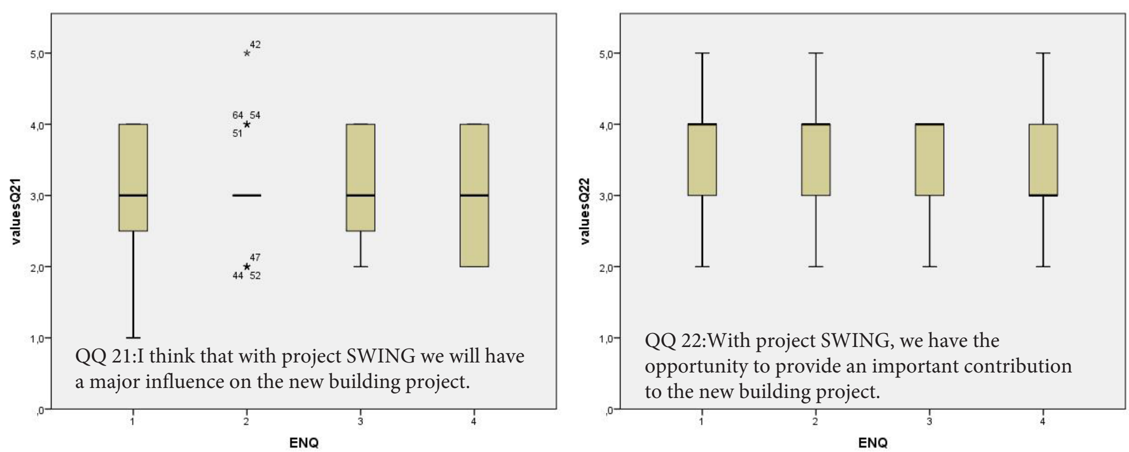


Figure 7.32: Box-whisker plots of responses to questionnaire questions QQ21 and Q22 (vertical axis) for the first four questionnaires (horizontal axis), (value 1 corresponds to "completely disagree", 5 to "completely agree").

Whereas the medians in the box-whisker plots for the responses to QQ21 are mostly around 3, meaning “neither agree, nor disagree”, the medians for question QQ22 are closer to 4 (“agree”) (see Figure 7.32). This difference in outcome can probably be explained by the much stronger formulation of statement QQ21 (“major influence for the building project”).

Value of information

The participants’ evaluation of the value of the information generated in SWING was evaluated in the evaluation interview and in the questionnaire. During the evaluation interview, interviewees were asked how they evaluated the quality of the project results (IQ13). Participants rated the quality of the results based on correctness, diversity, and innovativeness, and elaborated what kind of follow-up the results need.

The quality of the results was described as generally good by three interviewees,[1] a good basis to proceed by three others,[2] right,[3] good for the time available, and of high quality due to the involvement of different disciplines.[4] Others described the results as very diverse, and conform to expectations.[5] As addressed in the previous section, there were also some answers to question IQ27 that related to the quality of the results. One steering committee member said that there were rather good results,[6] whereas one participant criticised the feasibility.[7] One steering committee member referred in IQ 27 to the contribution the project made to the commitment, saying that “The protests about walking distances have stopped; that’s already a result”.[8]

The innovativeness of the results was addressed as “there is not too much changed, but this is realistic”,[9] not completely innovative due to daily rhythm,[10] “I had hoped for bigger breakthrough”[11] and “we finished with what was our input”.[12]

A number of interviewees addressed the follow up of SWING, saying that it is possible to translate and detail the results for the wards now,[13] that as a next step the patient processes should be looked at,[14] that SWING is the starting signal for the facility services to further detail plans,[15] and that a work group or platform could be developed thanks to the contacts SWING created.[16] Four steering committee members said that the information is not complete or that there is still a lot to do,[17] and one participant (not a nurse)[18] stated that “they” do not know yet how to plan the daily shifts. One steering committee member stated that the location where every specialism will be accommodated in the new building needs to be known before they could proceed.[19] A positive comment was that the results will help to develop good patient

[1] 2/5 participants, 1/7 committee members
[2] 2/7 steering committee members, 1/2 domain experts
[3] 1/5 participants
[4] 1/7 steering committee members
[5] 1/2domain experts
[6] 1/7 steering committee members
[7] 1/5 participants
[8] 1/7 steering committee members
[9] 1/5 participants
[10,11] 1/7 steering committee members
[12] 1/2 domain experts
[13] 1/5 participants
[14] 1/7 steering committee members
[15] 1/2 domain experts
[16] 1/7 steering committee members
[17] 4/7 steering committee members
[18] 1/5 participants
[19] 1/7 steering committee members

care.[20] Another interviewee indicated that the project is not finished and follow-up is needed.[21] A neutral comment stated that maybe not everything is usable, but that the usable results need to be followed up.[22] Two steering committee members thought that the question was difficult to answer at or that she did not have the overview to answer the question respectively.[23]

[20] 1/2 domain experts
[21] 1/7 steering group members
[22] 1/5 participants
[23] 2/7 participants

Interpretation

More interviewees were positive about the quality of the project results than believed that the generated information will eventually be used. Only six out of fourteen interviewees mentioned that they expect that the information will be used properly in the new building project. Project participants seem to have more doubt that the information will be used than steering committee members and domain experts. This can be explained by the fact that the steering committee members and domain experts having more influence on the use of the information than the participants do. The explanations given indicate that interviewees tie their assessment to the people who they expect will handle the follow-up and implementation and not to the quality of the project results per se.

Nine of fourteen interviewees made positive comments about the quality of the project results. There was only one negative comment, stating, that the interviewee was not sure, whether everything was feasible to be implemented. Four interviewees made comments with respect to the innovativeness of the results, which was rated low by them. One of them thought that this was a realistic result, while another attributed the lack of innovation to the difficulty of changing the daily rhythm of the wards. A domain expert was clearly disappointed with the innovativeness, and indicated, that the input he had had given on one topic, finally became the result, hence, that the participants had not generated new content on that topic.

With respect to follow-up, the prevailing opinion was that the project created a good basis to build upon and form the teams to do the follow-up. Overall, it can be concluded that while the interviewees believed that SWING generated valuable information, they had doubts that these results will eventually be used by MST. Whether their doubts are legitimate will only become clear in the future. At this moment in time, we still expect that the design results will be used, and SWING will have an impact and hence be called a participatory design project.

7.6.4 PARTICIPATORY DESIGN - INFLUENCE

In the evaluation interview, the influence of project SWING was evaluated with respect to scope of and the number of the decisions made in SWING.

Scope of decisions

Participants were asked to what extent the scope of the decisions that could be made in SWING was broad enough (IQ26). While the majority of the respondents had difficulties understanding the question properly, some were able to give input about the scope and the boundaries of the project.

[1] 3/7 steering committee members, 1/2 domain experts
[2,3] 1/7 steering committee members
[4] 1/2 domain experts
[5] 1/5 participants
[6] 1/5 participants, 1/2 domain experts
[7] 1/7steering committee members
[8] 1/2 domain experts
[9] 1/7steering committee members
[10] 2/7 steering committee members
[11] 1/2 domain experts
[12] 1/2 participants

The scope was evaluated as all right[1] or good.[2] One steering committee member stated that while the focus of the project was the nursing work processes, there were still enough directions to choose from for the project participants.[3] Some interviewees made comments about the boundaries of the project and the possibilities within these boundaries. One domain expert doubted that the participants had used the full spectrum of possibilities,[4] whereas another participant said that sometimes they had been busy with a broader scope than was needed.[5] Two respondents described the project boundaries as broad,[6] one steering committee member even as too broad ("maybe the participants had too much freedom, and we should have steered a little more").[7] One domain expert stated that the boundaries were clear;[8] a steering committee member that there was enough room for ideas.[9] Critical remarks included that the project should have started earlier,[10] that the project was running in parallel to management decisions, and the management had every freedom to proceed with it as they like (no commitments).[11] One participant (not a nurse) stated that she would have preferred that her area of work had been central.[12]

Number of decisions

For getting an idea about the participants' opinion about the number of decisions, they were asked during the evaluation interview how they evaluated the quantity of the project results (IQ15).

[1] 1/5 participants
[2,3] 1/7steering committee members
[4] 1/2 domain experts
[5] 1/7steering committee members

One interviewee remarked that many things had been discussed,[1] a steering committee member said that "we" managed to get the maximum out of it,[2] and another participant thought the quantity was conform the expectations.[3] Furthermore, a domain expert stated that for him personally there had been many useful results, since he spoke to people he otherwise would not have met.[4] However, one steering committee member thought that some things could have led to more results.[5] There were also three comments about the number of innovations produced during the project. One positive, stating that there are new ideas,[6] and two critical,[7] including one participant saying that he expected more innovative ideas. Another participant stated that in her group there were no new things introduced that could have led to new ideas. Three respondents did not know how to answer.[8]

[1] 1/5 participants
[2,3] 1/7steering committee members
[4] 1/2 domain experts
[5] 1/7steering committee members
[6] 1/5 participants
[7] 2/5 participants
[8] 1/5 participants, 1/7 steering committee members, 1/2 domain experts

Interpretation

While the scope and boundaries of the project was perceived by most participants as sufficiently broad, some even thought they were too broad. There were not many responses with respect to the number of the decisions made in SWING. Four expressed satisfaction, while one was negative. The number of innovative ideas was rated high by one and low by two respondents. Overall, the majority of respondents who answered the questions were satisfied with the scope of the project and the number of decisions. In summary, the perception of influence in SWING was in line with participatory design.

7.6.5 PARTICIPATORY DESIGN – AGENCY

The agency in project SWING was evaluated with respect to solidarity and willingness amongst the participants. These two aspects were assessed during the evaluation interviews in project SWING (IQ27 and Q28, respectively).

Solidarity

Solidarity was confirmed by 12 out of 14 interviewees.[1] Two qualified their agreement, saying that there was solidarity at the end of the project,[2] and two others said that they at least did not see any conflicts.[3] Two interviewees indicated that there were discussions and differences in opinion.[4] A steering committee member said that there were differences in interest, which may have vanished in the group setting.[5] Another one said that the participants saw opportunities to cooperate.[6] While one participant stated that all participants were working towards the same goal, another said that she had the idea that "we must do it with each other".[7]

The interviewees also provided a number of perceptions about the atmosphere during the workshop and workshop setup, which are related to the solidarity concept. The atmosphere was described as cosy,[8] pleasant,[9] and respectful.[10] According to three interviewees, every voice was heard.[11] Others said that the hierarchy was levelled[12] and people felt save to speak their mind.[13] One steering committee member was surprised to find the ICT department to be very service minded during the workshops.[14] Furthermore, the goals were clear according to two interviewees,[15] and there was enough room for discussion.[16]

[1] 12/14 interviewees
[2] 1/5 participants, 1/7 steering committee members
[3] 2/7 steering committee members, 1/2 domain experts
[4] 1/5 participants, 1/7 steering committee members
[5,6] 1/7 steering committee members
[7,8] 1/5 participants
[9] 1/7 steering committee members
[10] 1/5 participants, 1/7steering committee members
[11] 1/5 participants, 2/7 steering committee members
[12,13,14] 1/7 steering committee members
[15] 1/5 participants, 1/7 steering committee members
[16] 1/5 participant

Willingness

[1] 4/5 participants, 4/7 steering committee members, 1/2 domain experts
[2] 1/2 domain experts
[3] 1/5 participants, 1/7 steering committee members
[4] 1/5 participants
[5] 1/7 steering committee members
[6] 2/7 steering committee members
[7] 2/5 participants

Nine interviewees stated that the willingness of participants to contribute was good[1] or at least became good "as the project proceeded".[2] Two interviewees even described the participants as enthusiastic.[3] Reasons for the good level of willingness were speculated to be that everybody would have to deal with the new building situation[4] and that they had chosen to give their opinion.[5] Two members of the steering committee stated that they did not see high willingness of the participants to contribute right away.[6] One thought that not everybody realized the importance of the project right from the start. The other thought that it was hard to say, because people cancelled easily, but that the people who were present did participate actively. This was perceived differently by two participants,[7] who stated that everybody was present, and that the sessions were well visited.

Interpretation

The majority of interviewees thought that the participants were willing to contribute, and that there was good solidarity within the group. Solidarity was attributed to the workshop atmosphere by half the interviewees. The willingness to participate was perceived lower by the steering committee members than by the participants. This result can probably be explained by the fact that the steering committee had to deal with the cancellations of participants. In conclusion, the positive results with respect to agency in SWING are a sign of a proper participatory design project.

7.6.6 PARTICIPATORY DESIGN - BENEFITS FOR THE INDIVIDUAL

The personal benefit participants gain from a project, e.g., growing competencies or self-efficacy, is one of the defining characteristics of participatory design. Whether participants personally benefitted from project SWING was assessed by the evaluation interviews and a questionnaire. The questionnaire was used to explore whether the perception of participants of their self-efficacy or creativity changed during the course of project SWING. During the evaluation interview the participants were asked to what extent they personally benefitted from their participation (IQ29), to what extent the participants did get a better insight into their own work (IQ30), and how important personal benefit or gain of insight for project participants (IQ34 & IQ35) were to them. The personal benefits from the HEAD game were not separately evaluated, since the goal was to assess the personal benefits from the participatory design approach of SWING as a whole.

General impression of the personal benefits

During the evaluation interviews, the participants were asked whether and to what extent participants did benefit personally from their participation (IQ29). The given responses involve learning, experience exchange, being listened to, and acquiring a special role on the own ward. The results are summarized in the personal benefits coding framework below:

1. *learning*
    - *vision & argumentation of the organization with respect to new building*
    - *working in a project*
    - *technology*
    - *ways of thinking out of the box*
2. *experience exchange*
    - *with colleagues*
    - *with other disciplines*
3. *being listened to*
4. *(acquiring a special role on the own ward)*

All participants,[1] two steering committee members, and one domain expert listed concrete individual benefits for the participants (see benefits coding framework). These benefits concerned learning,[2] experience exchange[3] and being listened to.[4] Participants named learning about the vision and argumentation of MST, working in a project, about technology, and ways of thinking out of the box or about the future.[5] The latter aspect was also named by one steering committee member. Exchange with other colleagues and other disciplines were also mentioned. Being listened to was simply stated as a benefit without further elaborations.

Two steering committee members made assumptions with respect to benefits.[6] The assumptions concerned the participants acquiring a special role on their own ward, because they had due to their participation in SWING "exclusive" information about the building project they could share at the ward. However, they did not know whether those expectations came out. One domain expert was happy about being able to arrange a meeting for observing a nutrition assistant at work, thanks to a contact he laid in SWING.[7] Two steering committee members indicated that the results are not concrete enough to say whether nurses will benefit from them when they start working in the new building or not.[8] One thought that some participants benefitted individually, while others did not.

[1] 5/5 participants, 2/7 steering committee members, ½ domain experts
[2] 7/14 interviewees
[3] 4/7 interviewees
[4] 3/14 interviewees
[5] 3/14 interviewees
[6] 2/7 steering committee members
[7] 1/2 domain experts
[8] 2/7 steering committee members

Project experience

Questionnaire 5, the questionnaire after the project, contained a statement used to evaluate whether project SWING provided a personal benefit to participants by being a positive experience. The statement in Questionnaire 5 was "Project SWING was a positive experience for me" (QQ67). The nine responses were all either "agree" or "completely agree". In the next question, respondents were asked to elaborate on their reaction (QQ68). Two participants mentioned that they perceived it as positive that the staff was consulted ("The staff is consulted in the new building project. In our daily work, this often lacks; new processes are introduced without consultation of the staff, and afterwards it often turns out that things could have been done differently. In the meantime much time and commotion have passed by."). One participant said that it was interesting to participate in the project, and another mentioned, "I liked to see how you can engage with the work processes and how you can play out the future situation realistically [with the VR-tool]." The three respondents who completely agreed said that imagining the future work situation was interesting, that it was "refreshing and motivating" to exchange thoughts with equal minded people and that it was good to have been able to exert some influence on the building project.

Perception of self-efficacy and creativity

The participants perception of their own self-efficacy and creativity was addressed in all five questionnaires, employing the nine item perception of own self-efficacy scale of the California Psychological Inventory (Gough, 1996), and the nine item perception of own creativity scale of the Hogan Personality Inventory (Hogan & Hogan, 1995). The null-hypotheses were:

1. There is no change in participants' perception of their own self-efficacy during the SWING project.
2. There is no change in participants' perception of their own creativity during the SWING project.

For the self-efficacy scale, there were respectively 39, 29, 21, 18, and 7 respondents in the Questionnaires 1-5. In-between subject analysis for non-parametric data with a Kruskal-Wallis ANOVA method showed no significant difference between the five questionnaire groups. A Mann-Whitney analysis between the first and the last group also showed no significant difference.

The perception of own creativity also showed no significant results in the Kruskal-Wallis ANOVA analysis in-between all five questionnaires (with 40,29,22,22 and 7 respondents). The Mann-Whitney test between the first and the fifth questionnaire shows a significant difference though (asymptotic significance $p < 0.05$). This shift is also visible in the box-whisker plots (see Figure 7.33). However, as the number of respondents in the Questionnaire 5 was only seven the result is not representative for the whole group and caution is in order before rejecting the null-hypothesis.

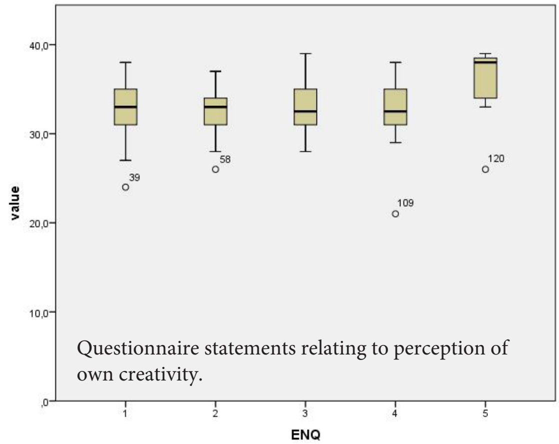


Figure 7.33: Box-whisker plot of values for the responses to questionnaire statements relating to perception of own creativity (vertical axis) for the five questionnaires (horizontal axis), (low values corresponds with a lower perception of the own creativity).

Overall, project SWING did not seem to have a significant effect on participants' perception of their own self-efficacy or creativity.

Confidence about own contribution

Three statements were used in Questionnaires 1 to 4 and one statement in Questionnaire 5 to analyse whether the participants' confidence about the relevance of their own contribution to SWING changed over the course of the project.

In Questionnaires 1 to 4 the statements "my experience is valuable for the design process of the work processes in the new building" (QQ35), "I think that my knowledge can add much to the plans for the new wards" (QQ36), and "I am afraid that I cannot contribute much to the new building plans" (QQ37) were used.

The sum of the points respondents gave for the three statements (which were corrected for the negative formulation of question QQ37) were analysed for differences between the four groups with a Kruskal-Wallis ANOVA analysis. The responses were 41, 29, 22, and 22 for the four questionnaires. However, there was no significant difference found. Comparing the responses of questionnaires for the statements separately also did not result in any significant differences between questionnaires.

Whereas, as illustrated by the box-whisker plots (see Figure 7.34), for questions QQ35 en 36 ,the responses centred in the area of agree (4), and contain many extremes, the responses for question QQ37 show less extremes and are positioned more towards "neither agree nor disagree"(3) than disagree (4, in the version corrected for negativity) (see Figure 7.35). In other words, there is agreement with the statements "my experience is valuable for the design process of the work processes in the new building" and "I think that my knowledge can add much to the plans for the new wards", while there is only slight disagreement with the statement "I am afraid that I cannot contribute much to the new building plans". However, this might be due the way the statement was formulated, since participants might have read plans as architectural plans instead of taking a more general interpretation including working processes (the architectural plans were already finished and could not to be changed anymore).

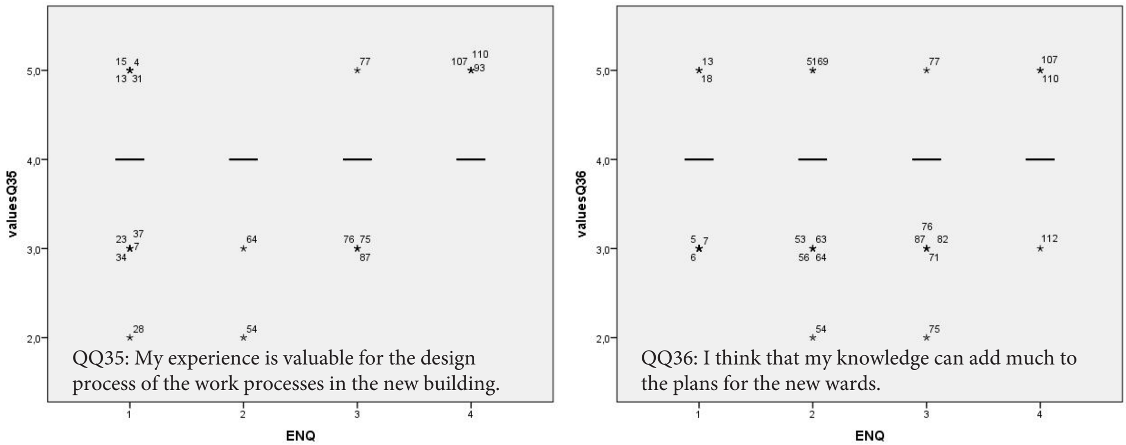
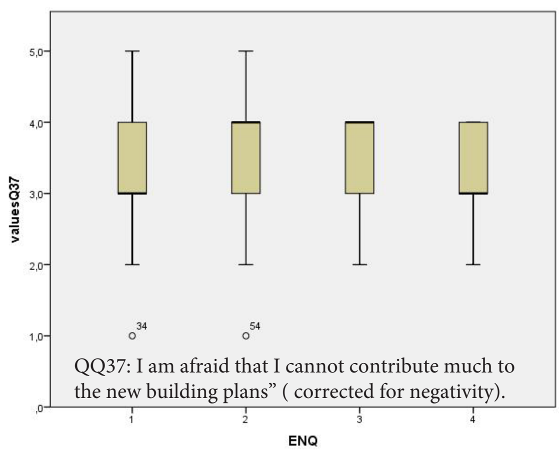


Figure 7.34: Box-whisker plots of responses to questionnaire questions QQ35 and QQ36 (vertical axis) for the first four questionnaires (horizontal axis), (value 1 corresponds with "completely disagree", 5 with "completely agree".

Figure 7.35: Box-whisker plots of responses to questionnaire question QQ37 (vertical axis) for the first four questionnaires (horizontal axis), (value 1 corresponds with "completely agree", 5 with "completely disagree").



In Questionnaire 5 the following statements were used: "I think that my knowledge has added much to the plans for the new wards" (QQ61) and "With project SWING we will make an important contribution to the new building project" (QQ69). Respondents were asked to elaborate on their answer to statement QQ61 in question QQ62. QQ61 had in total 15 participants.

One person disagreed with the statement, because "all plans are already finished. The architecture cannot be changed anymore, which means that we have to adapt our way of working". Five respondents neither agreed nor disagreed; one stating the same problem as the respondent who disagreed with the statement, and another one that because he was a paramedic he could not contribute enough to the nursing processes (see Figure 7.36). The different background was exactly the reason for another participant to agree to the statement, since he saw the benefit in his differing perspective. Together with this respondent, nine other respondents

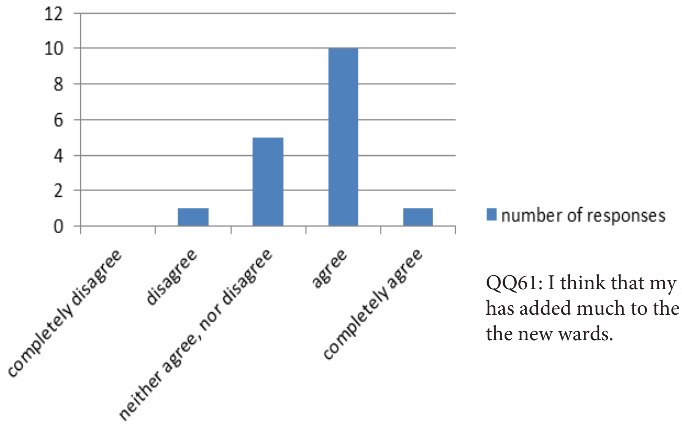


Figure 7.36: Number of responses for statement QQ61 in Questionnaire 5.

QQ61: I think that my knowledge has added much to the plans for the new wards.

agreed with the statement, that their knowledge has added much to the plans for the new wards. The reasons named to ground that were that they had lots of practical experience, that one as advisor continuously tuned supply and demand and that the combination of the recent move (of the own ward) and the exchange of ideas in SWING resulted in good ideas, that they had much contribution in the different sessions, that they generally evaluated the contribution of staff important, because "without contribution of staff things are forgotten or go wrong", and that they thought it is important to extensively test plans with respect to practical feasibility. The one respondent who agreed stated that she has a clear opinion she dared to share and was enthusiast and critical.

The responses to QQ69 showed that the highest percentage of responses was in the category "completely agree", while only one respondent disagreed, that SWING will make an important contribution to the new building project (see Figure 7.37).

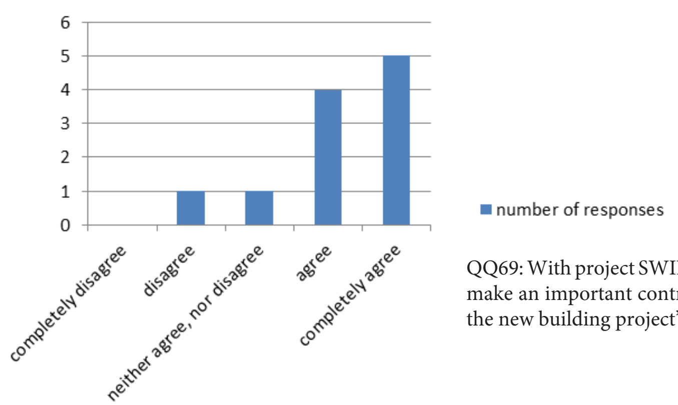


Figure 7.37: Number of responses for statement QQ69 in Questionnaire 5.

QQ69: With project SWING we will make an important contribution to the new building project") .

Growth of insight & overview

During the evaluation interviews, interviewees were asked, to what extent participants got a better insight or overview of their own work.

[1]1/5 participants
[2]4/5 participants, 7/7 steering committee members, 2/2 domain experts
[3]7/14 interviewees
[4]3/14 interviewees.

Only one participant said that she could not really say that about her own work, since it was not clear enough how things would work out in the new building.[1] All other interviewees confirmed that participants got a better insight,[2] since they became more aware about the current way of working and started questioning it,[3] and because participants learned from experience of others.[4]

Relevance of personal benefit to the project members

The relevance the project members attach to the personal benefit derived from their participation was tested by a number of interview questions during the evaluation interview, addressing the importance of participants benefitting personally from their participation, in general (IQ34) and the importance of participants getting a better overview/insight of/into their own work (IQ35).

11/5 participants, 2/7 steering committee members
29/14 interviewees
31/7 steering committee members, 1/2 domain experts
41/7 steering committee members
51/7 steering committee member
61/2 domain experts
71/7 steering committee members
82/5 participants
91/7 steering committee members

Three interviewees thought that this was not important because the participation should be done for the sake of MST or the patient, not the staff.[1] Nine others thought that it is important that the participants benefit personally.[2] Some qualified their opinion by saying that it is important to grow willingness for future projects,[3] to develop a "MST-feeling",[4] to have them participate at all and invest time,[5] especially if one of your main focus is hospitality,[6] to motivate them for working in the new building,[7] and because personal growth is important.[8] One member of the steering committee thought that there is personal benefit to be gained with every participation in a project.[9]

Relevance of getting a better knowledge of one's own work

Interviewees were asked to what extent it according to them is important, that participants receive a better overview/insight of/into their own work (IQ35).

[1]1/5 participants
[2]7/7 steering committee members, 1/2 domain experts
[3]1/5 participants
[4]1/2 domain experts

One participant indicated that participants need to have a good understanding before the project to think about overarching topics.[1] Eight interviewees[2] thought it is important, with two of them saying it is needed "because then you can improve it (the work)". Another participant stated that it is important, because "then people understand why processes are as they are, and complain less"[3] and one domain expert even thought that a better insight was the core of the project.[4]

Interpretation
Project SWING did not have a significant effect on the perception of the participants' own self-efficacy and creativity or their confidence in their own contribution to SWING. However, most participants agreed that they or the project could make a relevant contribution to the new building project. The participants' confidence in their own contribution did not significantly change during the project.

Considering that all interviewed project participants listed concrete personal benefits of SWING, it is very likely that the majority of all participants benefitted personally from the project. Personal benefit and growth of knowledge of one's own work were perceived relevant for a successful project by the majority of interviewees. Nine out of fourteen interviewees believed in its importance. The reasons given were all instrumental or political, not philanthropic, involving the success of SWING and future projects of MST in one way or another.

All but one interviewee confirmed that participants got a better insight into their own work. Eight out of fourteen interviewees thought that getting a better understanding of one's work is important in projects such as SWING. Not a single interviewee indicated that this was not important. There were only two explanations given, why participants received this aspect as relevant. One participant seeing knowledge of one's own work as a condition to be able to improve processes, and another as a way to prevent complaining about processes developed by others. Furthermore, the questionnaire showed clearly that project SWING was perceived as a positive experience. Participants liked to be involved and to engage in imagining their future work processes with the provided tools.

In conclusion, Project SWING participants did personally benefit from SWING by learning, exchanging experiences, being listened to, getting a better insight into their own work, and having a positive experience. Consequently, project SWING was a real participatory design project in this respect.

7.6.7 CONCLUSION

This section addressed the question to what extent project SWING was participatory. The properties defining the extent of participation were presented in Chapter 3 as impact, influence, and agency. Furthermore, the individual benefit for participants was assessed. To determine whether project SWING was perceived to possess these qualities, participants were interviewed and asked to fill out questionnaires about these qualities. However, before directly addressing these qualities, participants were asked what in their opinion necessary conditions for a successful project were and if they believed that staff involvement is relevant.

The results showed that participants believe that staff involvement is important for the commitment and the quality of project results. The participants also repeated many of the conditions for a successful project found in the participatory design literature, showing a keen understanding of project dynamics. In terms of the extent of participation, the majority of participants judged the impact, influence, and agency satisfactory. Furthermore, they described individual benefits in SWING such as learning, experience exchange and being listened to. The majority of participants rated SWING a positive experience.

With respect to the use of the information generated in SWING, interviewees had doubts. These doubts may indicate unclear agreements or a bad communication with respect to the commitment of the board to SWING. Since these doubts concern an expectation with respect to a future event and it is expected by the researcher that the results from SWING will be used by MST, it is safe to conclude that project SWING was genuinely participatory.

7.7 THE VALUE OF THE SWING PARTICIPATORY DESIGN APPROACH

After having confirmed that SWING was genuinely participatory, the benefit and usability of a participatory design approach for healthcare organizations can be assessed. This was achieved by

an evaluation of the organizational ***project set-up and course*** by project members with respect to a number of predefined aspects, in order to review the evaluation of usability and benefits (see 7.7.2 to 7.7.5) against the background of these aspects (see Section 7.7.1),

an open evaluation of the approach's ***benefits*** by project members, to explore whether SWING helped with creating ***commitment to the organizational change process*** (see description in Section 7.5.1) and to create a completer evaluation of the approach (by project members) (see Section 7.7.2),

an evaluation of the ***usability*** of the participatory design approach for a healthcare organization (MST) by project members with respect to a number of predefined aspects (see Sections 7.7.3-7.7.5),

(shortly assessing the change in ***commitment to the organization*** (MST) during the project in order to see, if possible commitment for the organizational change process induced by SWING might also have positive effects on the overall commitment for the organization (see Section 7.7.6).)

See Figure 7.38 for an overview of the assessment.

The effectiveness of the participatory design approach was assessed in reference to the starting point for the project, and opinions about the quality and of the project results and the extent to which the results meet the project goals. To assess the efficiency, opinions about quantity of project results, duration, unexpected costs, and cost-benefit ratio were employed. The satisfaction about the participatory design approach was assessed with respect to the participants' satisfaction with their role in the project. The results are presented in a similar fashion as in the previous section including the ratio notation.

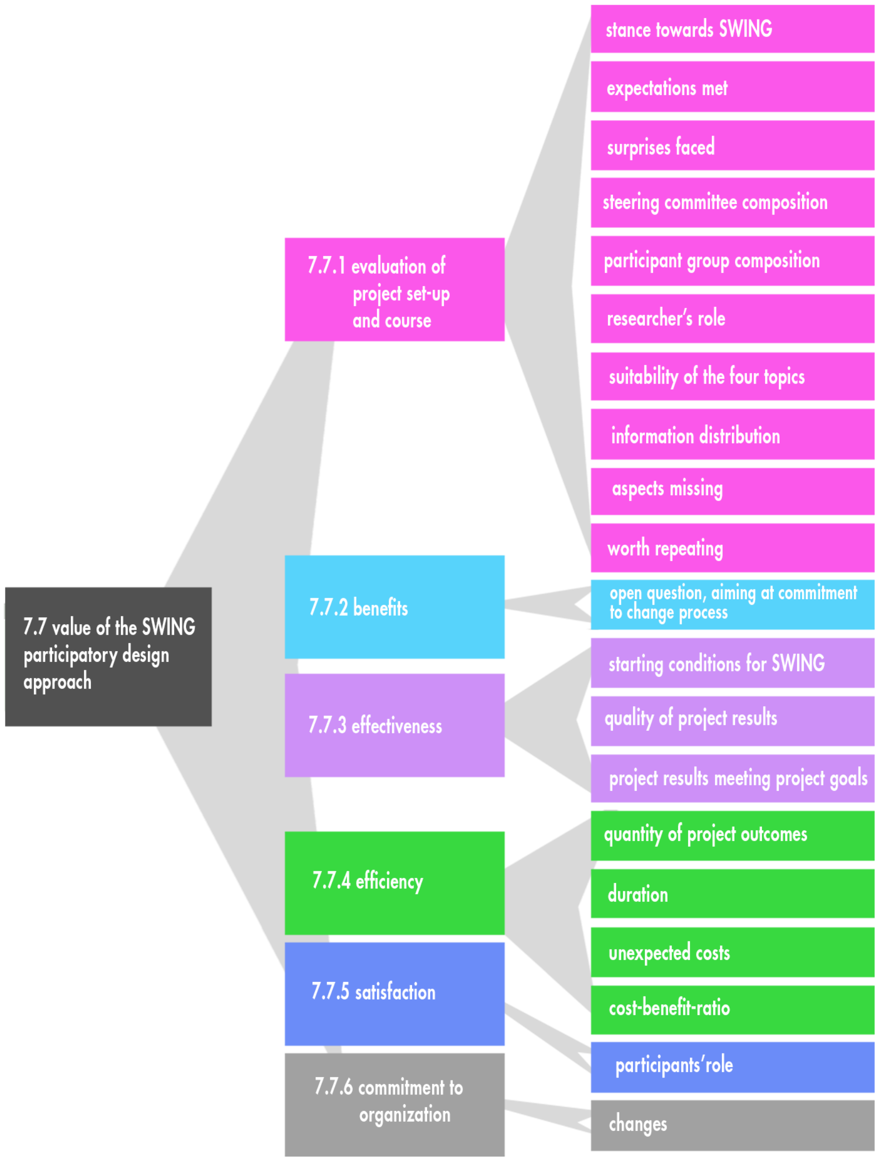


Figure 7.38: Overview of the assessment aspects to evaluate the value of the SWING participatory design approach for a healthcare organization.

7.7.1 EVALUATION OF PROJECT SET-UP AND COURSE

Project team members were asked a number of questions about the setup and course of SWING during the interview after the first series of design workshops and the evaluation interview. In particular, they were asked during the evaluation interviews about their general stance towards project SWING (IQ7). During the interview after the first series of design workshops, they were asked about their positive and negative expectations with respect to the project and whether these had been realized (Q3, IQ 8, 9, 10, and 11). Furthermore, they were asked whether anything surprising happened during the course of the project (Q4 and IQ12). The expectations of the participants towards SWING were also monitored by questions (QQ23-25) that were repeatedly asked in Questionnaires 1 to 4.

The project organization was evaluated during the evaluation interviews with respect to the composition of the steering committee (IQ37), the project group (everybody who participated in the workshops; IQ 38), the role of the researcher (IQ57), the suitability of the four project topics (IQ42), and the information distribution during the project (IQ39). Furthermore, participants had to address whether they missed anything during the project in Questionnaires 2 to 5 (not in Questionnaire 1 because it was issued before the start of the project). Finally, participants were asked during the evaluation interviews whether they believed that the project was worth repeating (IQ53), and if so under what conditions (IQ54).

[1] 3/5 participants
[2] 4/7 steering committee members
[3] 1/2 domain experts
[4,5] 4/14 interviewees
[6] 6/14 interviewees
[7] 2/7 steering committee members

Stance towards SWING

Three of the five interviewed participants[1] indicated that their stance was positive; one thought that the project was set up from a research perspective, and another participant was neutral. Four of the seven interviewed members of the steering committee were positive.[2] One of the domain experts called the project "interesting".[3] The interviewee who indicated that the project was set up from a research perspective was asked to elaborate on her answer. She based her comment on the observation that she had to fill in questionnaires after and between workshops, rather than elements of the setup of the project itself.

There were no negative reactions to the project. As far as explanations for the positive reactions are concerned, four interviewees said that including users in general was good,[4] four stated that including different disciplines was useful,[5] and six made positive comments about the workshops.[6]

Two members of the steering committee[7] addressed the timing of the project, which was perceived as good by one and too late by the other. One participant (a secretary) stated that the project was more aimed at nurses than her own role and she therefore believed to not have been able to contribute very well.[8] Three interviewees addressed the results[9] with one steering committee member saying that "I might have expected more innovation" and two participants wondering what will happen to the results after SWING. One participant commented that she thinks that her job will change a lot in the new building.[10]

[8] 1/5 participants
[9] 1/7 steering committee members, 2/5 participants
[10] 1/5 participants

In summary, when asked for their general stance toward SWING after the project, eight interviewees made positive comments with respect to the project, most of them based on the opinion that inclusion of staff and bringing together different disciplines in general is beneficial. There were no negative reactions to the project in general. However, critical comments were made with respect to the innovativeness of the results and the use of the results after the project.

Expectations met
After the first series of design workshops, six interviewees were asked what they had expected from the workshop, and to what extent the workshop had fulfilled these expectations (Q3). One interviewee did not know what to expect, two said that the workshop had matched their expectations. Different interviewees made three comments with respect to a positive development during the workshop, indicating that they had expected that the workshop participants would be more caught up in details, that they had expected more political issues, which turned out to be no problem with the participants, and that the participants realized that ICT could shorten walking distances. However, three interviewees had hoped for more insight into- and innovation of working processes in the first series of workshops.

When asking them during the evaluation interviews after the project about their positive expectations with respect to SWING (IQ8), six interviewees[1] (the majority of whom had not been involved with the setup of the project) indicated that they had entered the project without preconceived ideas. Furthermore, some interviewees said that thinking about the future working practice in general terms was their expectation. One steering group member[2] mentioned that she had hoped people would be eager to participate in imagining the future work processes, and another[3] expected that the things people were afraid of could be brought up fast and dealt with, to reduce concerns.

When asked for negative experiences, seven interviewees[4] indicated not to have had any. Only one steering group member had been afraid that SWING would start a life of its own and eventually turn the staff against the project bureau, claiming that the project bureau was building a hospital the staff cannot work in.[5]

As the most positive expectations where not very specific, it was not hard to meet them. Two interviewees stated that the project developed

[1] 3/5 participants, 1/7 steering group members, 2/2 domain experts
[2,3] 1/7 steering group members
[4] 7/14 interviewees
[5] 1/7 steering committee members

better than expected.[6] While two steering committee members said that they had expected more innovation,[7] another one thought instead that people were really thinking out of the box.[8] Three interviewees said that participating in imagining future nursing processes was realized.[9] The steering committee member who was afraid that the project might turn against the project bureau thought that the participants instead realized that the walking distances will not be a large problem with the use of new technologies, but realized that the participants were only a fraction of the total MST staff.[10]

[6] 1/5 participants, 1/2 domain experts
[7] 2/7 steering committee members
[8] 1/7 steering committee members
[9] 3/14 interviewees
10steering committee member

Participants' expectations towards SWING were also evaluated by a number of statements in Questionnaires 1, 2, 3, and 4. The statements were: "I expect, that project SWING will be a positive experience for me" (QQ23), "I have negative expectations with respect to project SWING" (QQ24), and "I expect, that we will do pleasant activities during SWING" (QQ25). The results were corrected for the negative formulation of question QQ24 and analysed together, using the Kruskal-Wallis ANOVA method. However, no significant difference between the beginning (Questionnaire 1) and end situation (Questionnaire 4) was found. The boxplots show that the values from the responses are centred around 12 points, which means that the respondents overall agreed to have had positive expectations with respect to the project (4 points means "agree" for questions QQ23 and 25, and "disagree" for question QQ24) (see Figure 7.39).

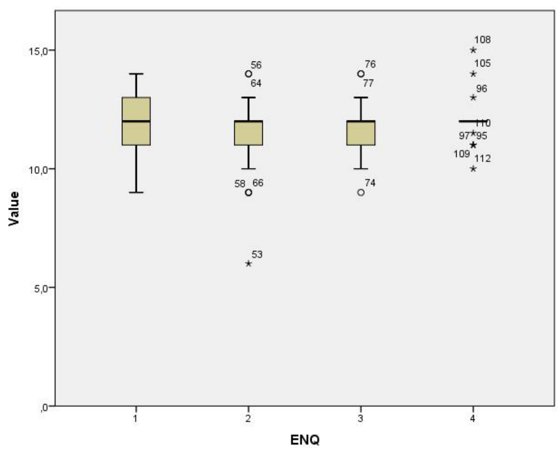


Figure 7.39: Box-whisker plot of values for the responses to questionnaire statements QQ23, QQ24 (corrected for negative formulation) and QQ25 (vertical axis) for the five questionnaires (horizontal axis).

QQ23: I expect, that project SWING will be a positive experience for me.
QQ24: I have negative expectations with respect to project SWING (corrected for negative formulation).
QQ25: I expect, that we will do pleasant activities during SWING.

In summary, half the interviewees in the evaluation interview (most of whom had not been included in the set-up of the project) entered the project without specific positive or negative expectations. Only two positive and one negative expectation (or apprehensions) were given. The questionnaires showed an overall positive expectation towards the project, which did not change significantly during the project. As most positive expectations where not very specific, it was not hard to meet them. Two interviewees even stated that the project developed better than expected and the negative expectations have not realized. Some interviewees indicated that they had expected more innovative results.

Surprises faced

After the first series of design workshops, the interviewees were asked whether anything had happened during the workshops that had surprised them (Q4). Two interviewees were not surprised, two were surprised by the constructive attitude of the participants (enabled by the use of the workshop tools), by the good ideas of the nurses, by the mentality switch of one participant who initially was very sceptical and then suddenly realized that she had to think in a different way, by the people spontaneously realizing that the processes must be improved, and by the game approach.

A similar question was asked during the evaluation interviews after the completion of project SWING (IQ12).

Three interviewees were not surprised by anything.[1] Two participants and two steering group members were positively surprised by the game techniques.[2] Another participant was positively surprised by the brainwriting technique. Two other participants were positively surprised by coming in contact with other disciplines and learning more about the organization.[3] The external domain expert was surprised by a number of things, including the tension between working well and efficiently, and providing sufficient attention to the guest (patient).[4] The negative surprises all involved the participants: The internal domain expert and one steering group member were negatively surprised by their own staff, in the sense that they, according to these two interviewees, held on to traditions and were not capable of formulating things in a new way.[5] The same domain expert was surprised that, according to him, nurses focused more on differences than similarities. One steering group member was negatively surprised by how participants handled their participation as if there were "no obligations".[6]

[1] 3/14 interviewees
[2] 2/5 participants, 2/7 steering group members
[3] 2/5 participants
[4] 1/2 domain experts
[5] 1/2 domain experts, 1/7 steering group members
[6] 1/7 steering group members

Whereas in the interview after the first series design workshop, interviewees indicated to be positively surprised by the constructive attitude, good ideas and a mentality switch of the participants, in the evaluation interview all negative surprises were related to the participants attitude and behaviour. From the three interviewees in the first interview expressing a positive surprise about that aspect, one did express disappointment in the end (the other did no more participate in SWING at that time). Positive surprises in the evaluation interview concerned the used techniques and the interdisciplinary approach.

[1] 9/14 interviewees
[2,3] 3/14 interviewees
[4,5] 1/14 interviewees
[6] 1/5 participants
[7] 2/7 steering committee members

Composition of the steering committee

In the evaluation interview, project team members were asked what they thought about the composition of the steering committee. Nine interviewees made positive comments.[1] The composition of the steering committee was perceived as all right by three interviewees,[2] as comprehensive enough by three other interviewees,[3] as good with respect of the professional functions of the members by one,[4] and as a good mix by another one.[5] One of the nutrition assistants stated that someone from the kitchen should have been part of committee.[6] Two steering group members regretted the change in function of two members during the project.[7]

[1] 9/14 interviewees
[2,3,4] 1/7 steering committee members

Composition of the participant group

The project team members were asked for their opinion about the composition of the participant group during the evaluation interview. The participant group composition was perceived as positive by nine interviewees.[1] One of them stated that it was a good representation of the hospital staff. While one member of the steering committee missed the participation of doctors,[2] another one said that she would have expected that doctors would have chosen to drop out of the project quickly, because the nurses were the focus of SWING.[3] Another member of the steering committee was disappointed with the participants, since he expected that people who volunteered to participate in SWING would have been eager to be a pioneer, but instead many participants cancelled the meetings very readily.[4]

[1] 7/14 interviewees
[2,3] 1/14 interviewees

Researcher's role

During the evaluation interview, participants were asked if SWING would have been possible without the help of the researcher. Half of the interviewees[1] did not believe that a project like SWING could have been set up without an external specialist, because someone from within MST would have been too biased,[2] the knowledge about the design techniques were not available within MST,[3] and even if the researcher made the use of those techniques possible,[4] there is a need for an objective party,[5] and finally it would have been less effective without the researcher. Four interviewees thought that it would have been possible.[6] However, one of them thought that even though there were internal people up for the task, a research-based approach gave the project more relevance in the eyes of the decision-maker within MST.

[4] 1/14 interviewees
[5] 4/14 interviewees
[6] 4/14 interviewees

Suitability of the four topics

The participants were asked during the evaluation interviews what they thought about the division of the project into the four topics (nursing activity flow & visitors, ICT & communication, material logistics, and catering; IQ42). Nine of the fourteen interviewees thought the division was good.[1] Explanations that were given included that splitting up the design problem was needed since it was too large otherwise,[2] that the most relevant topics were covered,[3] that all central topics and sore points were covered,[4] and that it was good to develop the process on the ward from the perspective of the four topics.[5]

One domain expert[6] and two steering committee members[7] also thought the division in four topics was good. However, one domain expert said that perhaps the central question should have been how to treat the patient.[8] One steering committee member said that there was some overlap between topics,[9] another that there are probably more topics to be worked out like this and yet another thought that it might have been a better idea to let the participants determine the topics instead of the project managers.[10]

[1] 5/5 participants, 3/7 steering committee members, 1/2 domain experts
[2,3,4] 1/5 participants
[5] 1/7 steering committee members
[6] 1/2 domain experts
[7] 2/5 steering committee members
[8] 1/2 domain experts
[9,10] 1/7 steering committee members

Information distribution

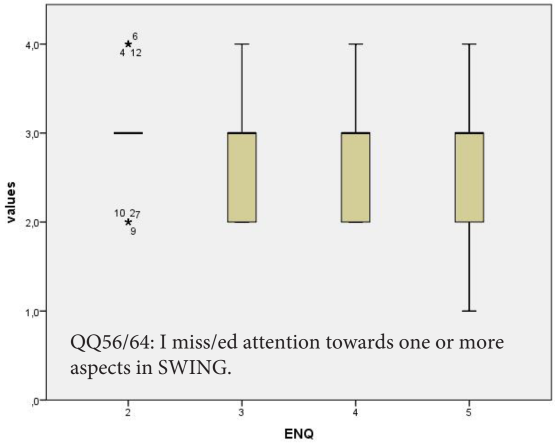
All reactions towards the information distribution in the project during the evaluation interview were positive. Comments included that the mail, the information documents, and the invitations were on time, that the planning of the meetings went well, and that the information was clear. However, one steering group member thought[1] that the information towards people who were not part of the project could have been better.

[1] 1/7 steering committee members

Aspects missing

In Questionnaires 2 to 5 the respondents were asked whether they miss (QQ56, Questionnaire 2-4) or missed (QQ64, Questionnaire 5) attention towards one or more aspects in project SWING. If respondents answered, “agree” or “completely agree” to these questions, the follow–up question asked them to clarify their reaction (QQ57 & QQ65).

Figure 7.40: Box-whisker plots of responses to questionnaire questions QQ56 (vertical axis) for the first four questionnaires (horizontal axis) and QQ64 (vertical axis) for the fifth questionnaires (horizontal axis) (value 1 corresponds with "completely disagree", 5 with "completely agree").



The results of the responses to QQ56 and QQ64 in the different questionnaires were analysed using the Kruskal-Wallis ANOVA method. However, there was no significant difference between questionnaires found. The box-whisker plots show that in the last questionnaire after the project (5) there were respondents who completely disagreed that they had missed aspects in the project (see Figure 7.40). This can probably be explained by the retrospective character of the last questionnaire.

When asked to clarify what the missing aspects were in Questionnaire 2, three respondents stated that they had missed involvement with the first phase of the building project "It is too late. People who do not have to work with them themselves already set the conditions. Afterwards, it is the turn for the staff to correct what has not been thought through with the means that are left." Other missed aspects that were mentioned included someone who could have provided explanations about the architecture, hygiene as one of the topics, and decisiveness. In Questionnaire 3 only one clarification was added, stating that practical ideas were missing. In Questionnaire 4 the involvement in the first phase of the building project was once again named by two respondents, as well as the processes around the isolation rooms, the practical implications for new building, and the process of receiving and sending cultivation materials. In Questionnaire 5 one respondent mentioned the involvement of doctors as a missing aspect and one missed the results of parallel workshop teams in the project.

In summary, the involvement in earlier phases of the building project is named a number of times in the earlier questionnaires, while towards the end of the project more detailed elements were mentioned, e.g., the processes around isolation rooms and the inclusion of doctors.

Worth repeating

Nine out of fourteen interviewees thought that the approach used in SWING is worth repeating for future projects of MST.[1] One member of the steering group believed that such a project will not happen again with that many people involved, because it was too expensive.[2] Another steering group member thought that projects cannot be approached like SWING frequently, but that parts from the approach can be taken and reused.[3] Two steering group members (probably misunderstanding the question) stated that SWING needs a follow-up and not be repeated.[4] Some participants suggested that SWING could have been better with smaller groups,[5] with a MST leader who can focus more on the project than was the case with SWING,[6] an earlier starting point when more things could still be changed,[7] and with the workshops planned closer after each other to keep the project more alive for the duration of the project.[8]

[1] 9/14 interviewees
[2,3] 1/7 steering group members
[4] 2/7 steering group members
[5] 1/5 participants
[6] 1/7 steering committee members
[7] 1/2 domain experts
[8] 1/7 steering committee members

Interpretation

The majority of interviewees had a positive stance towards the project and thought the approach to be worth repeating, albeit perhaps in a less comprehensive fashion. Interviewees did not have specific expectations with respect to the project. While interviewees in the earlier interview indicated surprise about the constructive attitude and contributions, participants in the evaluation interview expressed their disappointment about the same aspects. Perhaps, the positive surprise after the first series of design workshops led to unrealistically high expectations for the second design workshop series. Criticism on the project focused on that the late starting date of the project within the building project process and the lack of innovative design results.

The project organization was generally evaluated positively. The majority of the interviewees perceived the composition of the steering committee and the participant group as good. However, there were different opinions about whether doctors should have been included in the project or not. The information distribution within the project and the division of the problem into four topics were well received. While four interviewees thought that a similar approach could have been achieved without the help of an external researcher, nine disagreed.

7.7.2 BENEFITS

The project members were asked to name the benefits of SWING during the interview after the first series of design workshops and during the evaluation interviews after the completion of the project. During the first interview six project members were asked what they thought were the benefit of the SWING workshops for MST (Q1). Given the participatory nature of the project setup, responses dealing with commitment to organizational change process such as increased willingness to participate in SWING, the willingness to move away from the current situation and design a new one, as well as involvement with and commitment to the new building project were hoped for. Interviewees did mention benefits with respect to experience exchange, organizational change processes, and design results. More specifically, the results are classified by a coding framework that has been derived by analysing the responses from the interview.

1. experience exchange	• ***with other disciplines (mutual understanding)*** •
2. organizational change processes	• *participants stopping "complaining"* • *participants overcoming resentments* • *participants letting go current situation* • *participants realizing, that there are possible solutions* •
3. design results	• *checking whether the points of departure for the building project match with reality* • *discovering additional questions*

Some of the benefits are the same as the individual benefits interviewees discussed earlier (see the bold part and see Section 7.6.6). Interviewees named one or more benefits and each response was unique. One interviewee mentioned experience exchange as a benefit, four of the interviewees named design process related aspects, and two design result related aspects, without indicating specific results. The four interviewees, whose answers were process related, qualified that the benefit was the moment of insight, when nurses while playing realized that there are solutions to deal with the longer walking distances, that participants stopped "complaining", overcame resentments and actively did things, that the workshops enabled participants to let go of the current situation, and the mutual understanding of nurses and facilitating services ("I understand the complaints of the nurses better, now"). Two answers were design result related; one indicating that the workshops helped to check whether the points of departure for the building project match with reality, another indicating that revealing additional questions with respect to the MST building project that had not yet been addressed was the benefit.

During the evaluation interview (IQ17) after the completion of the project, participants were asked again what they perceived were the benefits of the project. The named benefits included learning, experience exchange, being listened to, organizational change processes, and design results. The benefits are summarized by the coding framework below, which is more extensive than the first framework. Some of the indicated benefits are, again, the same as the individual benefits

discussed earlier (see the bold part and see Section 7.66).
Benefits coding framework evaluation interview:

1. *learning*
   - ***about organization***
   - *that there is more possible than participants think*

2. *experience exchange*
   - ***with colleagues***
   - ***with other disciplines***

3. *being heard*

4. *organizational change processes*
   - *willingness to change*
   - *involvement of staff with the building project*
   - *commitment with the building project*
   - *platform*
   - *starting up a thinking process*

5. *design results*
   - *ICT technology*
   - *mapping walking routes*
   - *naming responsibilities*

The benefits mentioned most frequently were that everybody had the opportunity to contribute or was being heard[1] and that the project allowed interdisciplinary exchange.[2] In addition, a number of benefits related to the organizational change process were listed, including the contribution to the willingness to change,[3] involvement of nurses and others in the new building project,[4] and commitment to the new building project,[5] a platform,[6] and that a thinking process had been started.[7] Only a few specific design results were mentioned involving the identification which ICT technology to use,[8] mapping the walking routes,[9] and naming responsibilities of staff members.[10] A few more unspecific design results were named as benefits: thinking about four topics, a number of minor, ward specific issues,[11] partial agreements,[12] a basis to set up work procedures,[13] a number of good aspects to build upon,[14] and "some of the design results".[15] Furthermore, one member of the steering committee stated that it was a benefit that participants learned that there is more possible than they think.[16] Another participant said that she learned a lot from her colleagues and about the organization during the project.[17] Only one participant stated that the benefits of SWING still need to become clear.[18]

[1] 4/5 participants
[2] 3/7 steering committee members, 1/2 domain experts
[3] 1/2 domain experts
[4] 3/7 steering committee members
[5] 2/7 steering committee members
[6,7] 1/7 steering committee members
[8] 1/5 participants
[9] 1/7 steering committee members
[10] 1/2 domain experts
[11] 1/5 participants
[12, 13,14,15,16] 1/7 steering committee members
1[7,18] 1/5 participants

Interpretation

Interviewees clearly perceived that SWING delivered benefits. Apart from the individual benefits the participatory design approach in SWING yielded, which are of course indirect benefits for the organization as well, there were also a number of direct benefits for the organization mentioned. Especially, a number of benefits that relate to the organizational change processes were named. This feedback indicates that the project goal of gaining commitment among the staff for the new building has been achieved. Furthermore, specific design results were named as benefits of the project, which means that the project has been successful in this area as well. To what extent, will be assessed in more detail in the following section.

7.7.3 EFFECTIVENESS OF THE SWING PARTICIPATORY DESIGN APPROACH

Effectiveness is defined as the accuracy and completeness with which specified goals are achieved. To evaluate the effectiveness of the project SWING participatory design approach, the starting conditions of the project, the quality of the project results, and to what extent the project results meet the project goals were evaluated with the help of interviews and questionnaires. Analysing the starting conditions of a project is relevant because they significantly affect the course of a project.

Starting conditions for SWING

The starting conditions of project SWING were evaluated in Questionnaires 2 to 5. They were not assessed in Questionnaire 1, because Questionnaire 1 was issued before the first workshop, when the participants did not yet know the starting conditions.

In Questionnaire 2 the respondents were given the statement "I think the starting conditions (the things that were determined beforehand) for this project are worrisome" (QQ54) and asked them to clarify if they filled in "agree" or "completely agree" (QQ55). The (corrected) reactions ranged from 1 (completely agree) to 4 (disagree). As clarification four respondents stated, that they were concerned about the single person rooms, two rated, that the whole arrangement seems to be fixed already, and another two that there had already been much determined without input from the staff. One respondent stated, that the already determined ward layout leads only to problem solving [for project SWING], instead of designing a ward that is practical and comfortable from the beginning. One participant who did not think that the conditions are worrisome said, that she had the feeling that the suggestions she made, when she was visiting the test room, were taken seriously.

In Questionnaire 2 furthermore the statement was used "The starting conditions (the things that were determined beforehand) for this project provide enough space from the SWING participants to contribute to the working processes."(QQ48) and in Questionnaires 3 to 5 "The starting conditions (the things that were determined beforehand) for this project provide enough space for contributions from the

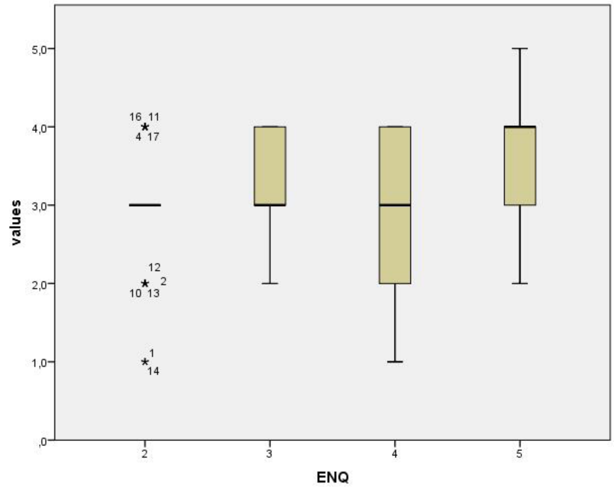


Figure 7.41: Box-whisker plots of responses to questionnaire questions QQ48 (vertical axis) for the second questionnaire (horizontal axis) and QQ59 (vertical axis) for the questionnaires three to five (horizontal axis), (value 1 corresponds with "completely disagree", 5 with "completely agree").

QQ48/59: The starting conditions (the things that were determined beforehand) for this project provide/d enough space from the SWING participants to contribute to the working processes.

SWING participants." (QQ59). The reactions to both statements were, due to their similarity, analysed together. However, a Kruskal Wallis ANOVA method analysis did not result in a significant difference between the questionnaires.

Reactions covered the full spectrum from "completely disagree" to "completely agree" (see Figure 7.41). In Questionnaire 3, respondents were asked to clarify their reaction if they had filled in "agree" or "completely agree" (QQ60). Three participants disagreed with the statement. Nine participants were undecided ("neither agree, nor disagree"). Eleven respondents filled in "agree", five explaining that according to them only the broad conditions were fixed, but that the processes still could be filled in. Another one said that she expected that the results from the project will be implemented in the new building. Finally, one participant remarked that not everything was determined and that suggestions were taken into deliberation. In summary, respondents differed in their opinion about the starting condition for project SWING. However, the argument that many aspects such as the ward layout had already been determined was given repeatedly by people who were worried about the starting conditions and the room for contributions in SWING.

Quality of project results

The participants' evaluation of the value of the information generated in SWING was gathered in the evaluation interview, and has been described in the Section 7.6.3 "Impact". As described in 7.6.3 , participants rated the quality of the results based on correctness, diversity, or innovativeness, and elaborated on what kind of follow-up the results need. The majority of interviewees was positive about the project results. However, some criticism was voiced with respect to the innovativeness of the project results.

Project results meeting project goals

During the evaluation interview, participants were asked to evaluate how the project results met the project goals (IQ14). Many interviewees had difficulties answering the questions. Five respondents thought that the this was fine.[1] Four of them qualified their statement, saying that the goals were achieved,[2] that every topic was completed with recommendations for the board,[3] and that there were clear results for either the ICT topic,[4] or the first topic.[5] Three more respondents were positive,[6] but with reservations including that the results are not ready to be used but can be built on,[7] that the results can make transition easier but must be detailed more,[8] and that the same results could have achieved with less people but at the risk of decreasing the commitment effects.[9] One participant did not know an answer,[10] while another one said that this depends on how MST proceeds with the results.[11] Several aspects that impeded that results could meet the project goals were named including that the boundaries were too wide,[12] that in the beginning the catering concept and the concept for organizational change were not defined, but were important for participants,[13] and that an earlier start would have been better.[14] One domain expert stated that there has not been any decision making.[15]

[1] 1/5 participants, 4/7 steering committee members
[2] 1/5 participants
[3] 1/7 steering committee members
[4] 1/5 participants
[5] 1/7 steering committee members
[6] 3/14 interviewees
[7] 1/2 domain experts
[8,9] 1/7 steering committee members
[10,11] 1/5 participants
[12] 1/7 steering committee members
[13] 1/2 domain experts
[14] 1/7 steering committee members
[15] 1/2 domain experts

In summary, the majority of the interviewees evaluate the extent to which the results meet the project goals as good. However, there are some who thought that the project results were not yet completed or ready to be used. Interviewees did not agree about whether the project boundaries were too broad or too narrow given the late start of the project within the building project.

Interpretation

The questionnaire revealed that there was no consensus on whether the starting conditions of SWING were good. There was some criticism saying that SWING started too late to make a valuable contribution. Despite that, the quality of the project results and the extent to which they meet the project goals were rated positively by the majority of the interviewees. Only the innovativeness of the results was questioned by some participants (three out of fourteen). Overall, the project was perceived to be effective in generating useful and practical results, but probably not to generate highly innovative results.

7.7.4 EFFICIENCY OF THE SWING PARTICIPATORY DESIGN APPROACH

Efficiency is defined as the resources spent in relation to the achieved goals. The efficiency of project SWING has been evaluated assessing the quantity of the project results, the duration of the project, unexpected costs, and the cost-benefit ratio.

Participants were questioned about these elements during the interview after the first design workshop and during the evaluation interview.

Quantity of project results

The participants were asked what they thought about the quantity of the project results during the evaluation interview (IQ15). The results have already been described in Section 7.6.4. There were not many responses with respect to the number of the decisions made in SWING, but four of them expressing satisfaction with the number and one expressing criticism. The number of innovative ideas was rated high by one and low by two other respondents.

Duration

Interviewees were asked during the evaluation interviews about their opinion about the duration of the project (IQ36).

One participant wished the project would have been longer because she enjoyed it and wanted to go deeper,[1] five interviewees thought the duration was fine,[2] with one steering committee member adding that the duration gave participants the time to digest and discuss with their colleagues. One participant thought SWING was quite long,[3] two steering committee members thought it was too long,[4] one of them adding, "We got passed by the practice". One domain expert had no opinion about the matter.[5]

[1] 1/5 participants
[2] 3/5 participants, 2/7 steering committee members, 1/2 domain experts
[3] 1/5 participants
[4] 2/7 steering committee members
[5] 1/2 domain experts

Unexpected costs

Interviewees were asked whether they thought that there were costs related to the project other than the usual man-hours, materials, room rent, etc. (IQ18). In particular, non-monetary costs such as stress for participants, reputation damage, or that other projects suffered were meant. This had to be explained to the interviewees by concrete examples.

Eight of them denied any additional costs.[1] One steering committee member indicated that the project had taken more hours than planned,[2] another claimed not to have the insights to evaluate this,[3] and one domain expert said that this depend on the interpretation.[4]

[1] 2/5 participants, 4/7 steering committee members, 2/2 domain experts
[2,3] 1/7 steering committee members
[4] 1/2 domain expert

Cost-benefit ratio

The cost benefit ratio was evaluated twice, first during the interview after the first design workshop and then during the evaluation interview. In the interviews after the first design workshop, participants were asked how they perceived the cost-benefit ratio of SWING (Q9). Two interviewees addressed the time investment, stating that it was considerable, but that the approach taken was necessary and will eventually be worthwhile. In addition, they said that one could not have gotten more out of the setting in this short time ("we never achieved this much in any other session"). One participant stated that the investment for SWING needed to be done to ensure that everything will work in the new buildings, which are a much larger investment. Another called the costs for SWING "peanuts", "if you can make things fit this way". Two interviewees did not give a clear answer. One said that she could not judge what the cost-benefit ratio was for the nurses, but hopes that they spread the information across the wards. The other found it difficult to assess the ratio, but said that for them (ICT department) the project provided insights and "we still talk about it". Yet another interviewee did not address the cost-benefit ratio, but was worried that only a few members of the staff of MST were participating in SWING and wondered how to reach the others.

The evaluation interview after the project addressed a similar question, asking the interviewees to what extent the costs and benefits are balanced (IQ19).

[1] 1/7 steering committee members, 2/2 two domain experts
[2] 2/7 participants, 1/7 steering committee members
[3,4] 1/7 steering committee members
[5] 2/5 participants, 3/7 steering committee members
[6] 1/5 participants

Three interviewees thought that they are balanced,[1] four thought that they are in balance as long as MST adopts the results.[2] One steering committee member thought that "without SWING we would not have been where we are" and "maybe we should be happy over the fact that there is criticism about the results".[3] Another one stressed the benefit of bringing people together and creating involvement with the new hospital, saying "Do not underestimate the effect of including people in this way".[4] Five interviewees thought that this question was difficult to answer,[5] with one of them adding "how much may it costs to start up a thinking process?" and two of them saying that this can only be answered when everything is finished. One participant thought that there would have been more results, if the project had been carried out prior to the completion of the building design.[6]

Interpretation

Due to the mixed responses, a clear answer to the question whether the SWING was perceived as efficient cannot be given. Participatory design is known to be a costly approach with respect to time and man-hours needed. While participants addressed the substantial time investments during the interviews, the majority thought that the costs and benefits were in balance or would be as long as the results were to be used by the organization. Criticism was uttered particularly with respect to the innovativeness of the results and the duration of the project. The duration was perceived to be too long by two steering committee members, whereas other thought that the time was needed for participants to digest and discuss it with their colleagues. There were no additional non-monetary costs signalled, besides the extra hours for the additional workshop.

7.7.5 SATISFACTION ABOUT THE SWING PARTICIPATORY DESIGN APPROACH

The satisfaction of the participants with the participatory design approach of SWING was evaluated by asking interviewees how they perceived their role in the project. This aspect is related to the personal benefits discussed in Section 7.6.6.

Participants role

Participants were asked how comfortable they were with their own role in the project (IQ22), to what extent they could bring in their own ideas (IQ23), and to what extent their voices had been heard (IQ24).

Ten interviewees were positive[1] about the role they played, while one of the domain experts was mildly positive.[2] Explanations by the participants were that they could express their opinion or knowledge,[3] there was time for everybody to give his/her opinion,[4] people listened to each other,[5] the group size was not too big,[6] and the group remained the same[7] (which is technically not true in all cases). In addition, one participant commented that there was not anything she could not tell,[8] and that she hierarchical standings did not matter even when she sat together with the ward manager and other important people.[9] Two steering committee members told that they wished they had been more involved or had been able to invest more time.[10] The comments of the steering group members were similar to the ones of the participants, saying that they were listened to,[11] the atmosphere was open,[12] and everybody could be him- or herself.[13] However, one domain expert and one member of the steering committee questioned their own ability to contribute during the sessions, stating that "sometimes I felt that I did not know enough about the processes and mainly listened" (domain expert) and "I wonder if my participation was of additional value" (steering committee member).[15]

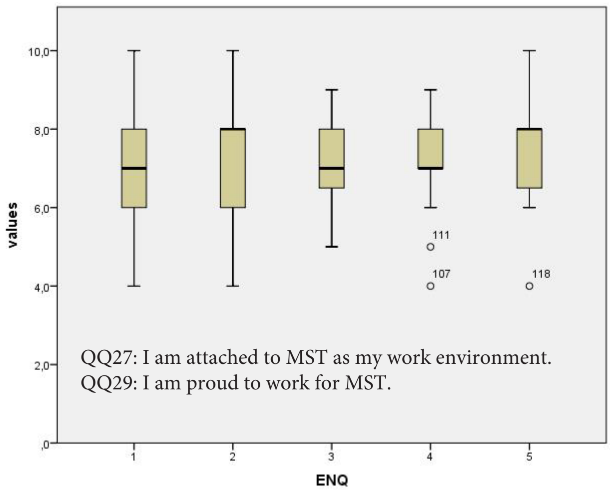
[1] 5/5 participants, 4/7 steering committee members, 1/2 domain experts
[2] 1/2 domain experts
[3] 2/5 participants
[4,5,6,7,8,9] 1/5 participants
[10] 2/7 steering committee members
[11,12,13,14] 1/7 steering committee
[15] 1/7 steering committee members, 1/2 domain experts

When asked whether they could bring in their own ideas, there were eleven positive reactions.[1] One participant was also positive, but added that the project was mainly about the nurses.[2] One younger participant stated that it was sometimes difficult to bring in ideas, because she had less experience.[3] The second domain expert said that he brought in ideas whenever he could.[4] One steering committee member had not been present at the workshop and hence said that she only contributed ideas about the process.[5]

[1] 4/5 participants, 6/7 steering committee members, 1/2 domain expert
[2,3] 1/5 participants
[4] 1/2 domain expert
[5] 1/7 steering committee members

In response to question IQ24 all fourteen interviewees were positive that they have been heard in the project.

Figure 7.42: Box-whisker plots of responses to questionnaire questions QQ27 and QQ29 together (vertical axis) for the five questionnaires (horizontal axis) (value 2 corresponds with two times "completely disagree", 10 with two times "completely agree").



Project experience

The questionnaire after the project contained a statement intended to evaluate, whether project SWING provided a personal benefit to project members by being a positive experience: "Project SWING was a positive experience for me" (QQ67). As described in Section 7.6.6, all nine responses were either "agree" or "completely agree".

Interpretation

Eleven out of fourteen interviewees felt comfortable in their role. The others regretted that they had not been able to invest more time in the project, or doubted their ability to contribute to SWING. In addition, twelve out of the fourteen interviewees felt they could add their own ideas to the project. Of the remaining two, one had not participated in the workshops (the project commissioner), while the other, a younger participant, thought her lack of experience meant that she could not contribute useful ideas. All fourteen interviewees confirmed that their voice had been sufficiently heard during the project. Furthermore, the respondents perceived project SWING as a positive experience and liked to be involved and engage in imagining their future work processes with the provided design tools. Overall, participatory design approach of project SWING was successful in providing a satisfying way for medical staff to play an active part in the design process of the future nursing work processes.

7.7.6 ORGANIZATIONAL COMMITMENT

The change in project members' organizational commitment to MST was evaluated by their reactions to the following two questionnaire statements: "I am attached to MST as my work environment" (QQ27) and "I am proud to work for MST" (QQ29) in Questionnaires 1 to 5. For both questions together, there was no significant difference found between questionnaires according to the Kruskal-Wallis ANOVA analysis.

The minimum value was a two, the maximum a ten. The box-whisker plots medians show a tendency towards agreement (see Figure 7.42). Analysing the statements separately also delivered no significant difference. In summary, the questionnaire did not show a significant change of participants' organizational commitment during the course of project SWING.

7.7.7 CONCLUSION

In conclusion, the participatory design approach in SWING was effective in the generation of useful practical results for the future nursing workflow in a satisfying way and especially in the channelling of an organizational change process, providing commitment and involvement towards the building project, which are valuable for the MST organization.

The majority of interviewees has a positive stance towards the project and its organization with respect to steering committee, project groups and information distribution, and thinks the approach is worth repeating, possibly in a slimmed, less extensive version. According to interviewees, the participatory design approach in SWING has not only yielded individual benefits but also a number of direct benefits for the organization. Besides design results, most of these benefits relate to the organizational change processes, i.e. the willingness to change, involvement of staff with the building project, commitment with the building project, the generation of a platform that can be employed in follow-up projects, and the starting up of a thinking process.

Even though project SWING did not bring forward the innovative results some interviewees might have been hoping for, it was rated to be an effective approach to produce useful input for the future nursing processes. The starting conditions, that were criticised by a number of project members, and comprehended that the building plans were already defined, might have been one of the reasons the project worked towards a lot of detailed, practical results, instead of towards revolutionary concepts.

Whereas the effectiveness of the approach was confirmed, the interviews and questionnaires were ambiguous with respect to the efficiency of SWING. Interviewees addressed substantial time investments, however, a slight majority of interviewees in the evaluation interview think that the costs and benefits are in balance, or can be in balance, if the results are used by the organization. However, due to few project participants having experience with projects as extensive as SWING, none of the project members having experience with participatory design, the qualitative nature of the project results, and no benchmark or reference for comparison defined.

It can, however, be confirmed that project SWING provided a satisfying way for project members to engage with the future nursing work processes. This was mainly due to the open atmosphere in the workshops.

7.8 THE VALUE OF THE HEAD GAME

The value of the HEAD game was assessed within the SWING participatory design context with the cases of the four different workshop topics as subjects. The evaluation is based on the interview after the first design workshop, the evaluation interview and analysing the results of every topic of the two design workshops. The value of the HEAD design game for a healthcare organization was assessed by

- a ***general evaluation*** of the game design by the project team (see Section 7.8.1),
- interviewing project team members about the ***game's applicability*** (see Section 7.8.2),
- interviewing them about the three aspects of ***usability*** (see Sections 7.8.3-7.8.5), and
- analysing the ***design results*** of the game for different topics (see Section7.8.6)

See Figure 7.43 for an overview of the assessment.

The usability has been assessed with respect to effectiveness, efficiency, and satisfaction. The effectiveness of the HEAD game has been assessed with respect to the perceived contribution of the game to achieving the project goals, and the perception about the influence of the game on the number and scope of the design results. The evaluation of the game's efficiency is based on its perceived influence on the quantity of game results and its perceived efficiency. Satisfaction is evaluated with respect to the appeal of the game to the game participants.

The design results from the workshops were coded according to categories of the design properties they belong to. The most fundamental and the most innovative results were identified by the researcher the project commissioner and the MST project manager,The number and types of results were compared between series, between topics and it was controlled, whether categories that related to the healthcare environment and activity properties in focus of the different topics (see Section 7.3.2 and 7.3.3) had above average numbers of results.

Figure 7.43: Overview of the items that were assessed in this chapter.

7.8.1 EVALUATION OF THE GAME DESIGN

In order to evaluate the HEAD game the participants were confronted with four questions during the evaluation interview dealing with the game setup, the activities involved, and advantages and disadvantages. In particular, the questions were: "How do you think about the set-up of the workshops?" (IQ40), "How do you think about the activities in the workshops?" (IQ 41), "What are, according to you, the advantages of the applied game technique?" (IQ45), and "What are, according to you, the disadvantages of the applied game technique?" (IQ46).

Set-up

[1] 14/14 interviewees
[2] 5/14 interviewees
[3] 3/5 participants

The workshop setup was evaluated positively by all interviewees.[1] Five interviewees,[2] of whom three participants[3], gave no explanation, while nine interviewees provided various explanations for why the setup was good according to them or which parts they especially liked. The explanations included that there was a clear introduction and looking back to the previous workshop was useful, that participants started without preconceived ideas and then were allowed to slowly get into the topic during the workshop, that people were relatively quick to participate because the game had a low participation threshold, that the practical part was not tedious, that there was the opportunity to go deep into topics, and that the game "evolved naturally". The statement of one member of the steering committee was "delightful; with instruments that looked somewhat childish you managed to make people get going and think about their own work".

Activities

[1] 11/14 interviewees
[2] 2/5 participants
[3] 8/14 interviewees

The activities during the workshops were evaluated positively by eleven interviewees.[1] Three participants were not asked to evaluate the activities, because they had addressed the activities already in previous questions.[2] Eight interviewees underpinned their positive reaction by saying,[3] the activities were inviting, dynamic, interactive, which made the them easy to follow, the game provided a good insight or overview (4 times) which helped to imagine situations (2 times), it was "realistic because you could imitate situations precisely", and "even though there was some time between the workshops, you were immediately back in the topic". One steering committee member stated: "I thought a whole afternoon would be too long, but the time flew by". Some participants said that the VR tool clears up how things really are, that the tool was special for the participants, and that it delivered valuable information. The only negative comment was that there was at times not enough time available.

Advantages and disadvantages

The advantages of the applied game technique were according to the interviewees the insight or overview it provided through the ability to visualize the ward and situations with the game board,[1] that the technique delivered more "feeling" and bonding with the subject, that the task cards are better for documenting than a written report by someone else, that the game has a low participation threshold, is inviting, facilitates interaction, keeps participants engaged, easily includes quiet people by giving them a playing figure, includes people in a relaxed way in the analysis of topics, is pleasant, provides a great amount of data about the use of the new building, and makes it easy for people to express their opinion due to the small groups. Furthermore, participants said that the brainwriting technique used in the second workshop put people in a different mode and delivered results that would not have been possible otherwise.

Three participants stated that the game had no disadvantages.[2] There was one slightly critical comments, saying that the technique was good for "doers", but maybe not for thinkers and that doing does not automatically lead to thinking beyond today's practice.[3] The disadvantages mentioned were: the uncertainty whether the game does depict reality,[4] the time investment,[5] the costs,[6] that the game board elicits resistance in the beginning,[7] and that the tendency was to play out today's situation instead of improving it.[8] The VR tool was said to be as uncomfortable to use[9] and as leaving the "digital challenged" behind.[10]

Finally, interviewees were asked if the game technique influenced their willingness to participate. Eight interviewees out of fourteen denied that, while three agreed.

[1] 10/14 interviewees
[2] 2/5 participants, 1/7 steering committee member
[3] 1/14 interviewees
[4] 4/14 interviewees
[5] 2/14 interviewees
[6,7,8,9,10] 1/14 interviewees

Interpretation

In conclusion, while the game technique did not influence the willingness of most participants to participate, the game technique was evaluated very positively. A large number of characteristics that the design of game was aiming for were explicitly named by the participants (see Chapter 6). Most importantly, the HEAD game succeeded in providing a way to anticipate hypothetical ward situations in a pleasant manner and in having a low participation threshold, was engaging, and included all types of staff, even the quiet participants.

7.8.2 APPLICABILITY

Interviewees were asked in the evaluation interview whether the game technique is applicable for other problems at MST (IQ55).

Results

[1]3/5 participants, 5/7 steering committee members, 1/2 domain experts
[2]1/5 participants
[3]8/14 interviewees
[4]1/5 participants, 1/7 steering committee members, 1/2 domain experts

Nine interviewees agreed with that statement.[1] Six different design problems were mentioned where the game could be applied, e.g., the emergency department or patient logistics. Furthermore, it was stated that the technique could be applied to create more commitment among the (other) staff who do not work with single-person rooms, yet. One participant remarked that she does not think the game setup is usable for "everything". [2]

In addition, when asked whether they would advise to use the technique more often at MST, eight interviewees agreed.[3] Two of them said it would be useful to "gain commitment". Three interviewees said that they would recommend it in combination with a clear goal definition, a more streamlined project approach, or only the basic technique, [without the extensive participatory design approach].[4]

Interpretation

The participants agreed that the game is useful for other problems as well and should be used more often within MST for future projects, albeit perhaps in a less extensive fashion.

7.8.3 EFFECTIVENESS OF THE GAME

As already addressed in Section 7.6.3, the quality of the project results was rated positively by majority of interviewees in the evaluation interview. In order to evaluate the effectiveness of the HEAD game in contributing to these results, participants were asked to what extent the use of the game technique has contributed to achieving the project goals (IQ47) and whether the use of the game technique influenced the scope and number of the results in the project (IQ51).

Contribution to achieving project goals

[1]13/14 interviewees
[2]4/7 steering committee members, 1/2 domain experts
[3]1/5 participants, 1/7 steering committee members
[4]1/5 participants
[5]1/7 steering committee members

Thirteen interviewees agreed that the game technique had had a positive influence.[1] Four steering committee members and one domain expert reacted positively without giving an explanation.[2] Other interviewees provided explanations that overlapped with the previously discussed advantages of the game. They mentioned that the game board provided a good overview of situation and the walking routes,[3] the mock-ups helped to evaluate if "it" would work,[4] it was good to make people think, without the game the delivered results would not have been generated,[5] because it stimulated discussion among the staff,[6] "it made you stick with the worksshop/questions",[7] and it worked in a non-demanding way and participants recognized themselves in the processes that were mimicked.[8] One member of the steering committee mentioned that the visioning workshops had helped because they had brought the participants into the right mind-set by allowing them to voice their concerns.[9] One participant addressed the use of the VR-tool by stating that it was "really fun to use but we had not enough time to become handy with it; we did not do much with the VR tool".[10]

[6,7] 1/5 participants
[8,9] 1/7 steering committee members
[10] 1/5 participants

Influence of the game on number and scope of decisions in SWING

Nine interviewees agreed that the use of the game technique influenced the scope and number of the decisions in the project positively.[1] Six of them gave explanations: you come across problems you would have missed otherwise,[2] it helps unconsciously, because it provides insights into things,[3] otherwise it would have been harder to take people's attention away from other things,[4] because you could immediately test the feasibility of ideas,[5] sometimes people were sceptical about things but when playing them out they realized the value of them after all,[6] and it put the processes into the context of the future environment the nurses will become part of.[7] Two interviewees[8] disagreed that the game technique had influenced number and scope of results. One of them because he doubted that any decisions have been made.[9] The other commented that the game technique did influence the time needed to generate these results, i.e., it was efficient.

[1] 9/14 interviewees
[2] 1/5 participants
[3,4,5] 1/7 steering committee members
[6] 1/5 participants
[7] 1/7 steering committee members
[8] 2/14 interviewees
[9] 1/2 domain experts

Interpretation

With thirteen out of fourteen interviewees agreeing that the game contributed to achieving the project goals and nine out of fourteen indicating that the game indeed positively influenced the scope and number of project results, it is safe to say that the HEAD game was rated as very effective.

7.8.4 EFFICIENCY OF THE GAME

Interviewees were asked whether the game technique influenced the quantity of the project results (IQ52 and to what extent the game technique was efficient, i.e., to what extent the technique had contributed to achieving the pre-set goals with relatively little effort (IQ48).

[1] 1/5 participants, 4/7 steering committee members
[2] 1/5 participants
[3] 1/5 participant, ½ domain experts

Influence of the game on the quantity of design results
Five interviewees stated that the game technique positively influenced the quantity of the project results.[1] One argument that was given was that "you come across unexpected things". One participant agreed,[2] but advised to work with even smaller groups. One participant and one domain expert denied that the technique influenced the quantity of the project results.[3]

[1] 2/5 participants, 4/7 steering committee members
[2,3] 1/7 steering committee members
[4] 1/5 participants

Efficiency of the game
The efficiency of the game technique was confirmed by six interviewees without explanation.[1] Two interviewees thought the technique was efficient, because it provided a good overview. Another agreed because "the technique demanded little from participants with playing figures and kilometre measurement" (referring to the VR-tool).
One member of the steering committee stated that the technique costs much time, but that she does not know any other way to do "it".[2] Only one steering committee member stated explicitly that with such a big time investment the gain should have been bigger.[3]
One participant questioned the efficiency of the VR tool, since according to her "the game board did as much as the VR tool".[4]

Interpretation
Similarly, to the results regarding the efficiency of the participatory design approach, also the rating of the efficiency of the design game is not clear-cut. Most of the interviewees who answered the questions indicated that the game was efficient and agreed that it influenced the quantity of the project results. However, most of the justifications provided did not involve efficiency per se, but rather involved that the game provided a good overview of the situation and thus enabled participants to contribute without much effort.

7.8.5 SATISFACTION

In order to evaluate the satisfaction of project members with taking part in the HEAD game, participants were asked during the evaluation interview whether the game technique was appealing to them (IQ49).

Appeal of the game technique

Nine interviewees rated the game technique as appealing[1] and elaborated that it was really clear,[2] interactive and stimulating to participate,[3] that the board was easy to handle,[4] and “I think that everybody was enthusiastic about it”.[5] One participant addressed the VR tool, stating that it was a little more demanding, and the speed of the game was very fast.[6]

[1] 3/5 participants, 5/7 steering committee members, 1/2 domain experts
[2] 1/5 participants
[3] 1/7 steering committee member
[4] 1/5 participants
[5] 1/7 steering committee members
[6] 1/5 participant

Interpretation

The interview responses, in combination with observations from the workshops indicate that the game is appealing to participants.

7.8.6 DESIGN RESULTS FROM THE GAME WORKSHOPS

The design results of the workshops were analysed in three different ways:

1. Participants were asked during the interview after the first series of design workshops what the most important results were.
2. The results of the design game workshops with different topics were collected, sorted, and analysed. The results include the nursing activity-flow, all design decisions that were noted on the different types of cards, all bottlenecks that were recorded with respect to the current procedure, and all follow-up questions. The number and types of results per workshop were compared between topics, and between the first and second workshop series. Furthermore, as every topic had specific focus points (see workshop descriptions in Section 7.3.2 and 7.3.3) it was controlled, whether the number of results in the categories responding to these focus points were higher than in other categories.
3. Decisions that are fundamental to the further detailing of the work processes and innovative results were pinpointed by the researcher, the MST project managers, and the project commissioner independently.

Perception of results from workshop series 1

In the evaluation interview after the first workshop the participants were asked what according to them were the most important results and of what type those results where (Q2). Four design related results were listed. Three of these concerned interviewees realizing different aspect: that the processes as they currently are will not work in the future hospital, that it currently is not completely clear who is responsible for what in the nutrition and catering process, and that the use of ICT should lead to a more sophisticated management of processes. The fourth design related result mentioned involved a partial mapping of the new workflow. With respect to the project, the interviewees mentioned that some participants have had a hard time to think in terms of the patient instead of work processes, but also that people are willing to change. Furthermore, they said that a "thinking process has started up with the participants", that nurses got a better idea of possibilities of ICT, and that "this kind of sessions delivers results much faster than other ways". Interviewees did not list any concrete design results, probably due to taking on a helicopter view. Most aspects addressed by the interviewees relate to realizing upcoming problems or vagueness in the current setup.

Number and categories of results from all game workshops

The results from every workshop were collected and sorted according to coding categories with respect to game properties. The coding categories were:

- Number of changes to nurse activity flow (adding activities, changing order etc.)
- New activities
- Decisions with respect to appliances/tools
- Decisions with respect to software
- Decisions with respect to responsibilities
- New rules/regulations
- Questions for organizers/management/other
- Bottlenecks in case of handling current processes

For a more detailed analysis for the specific SWING project, the results with respect to the planned activity flow are split up into "number of changes to the activity flow", and "new activities". For the workshops in which the group was split in two due to the number of participants, the changes to the activity flow were averaged between the two groups of participants. Furthermore, the results with respect to tools were divided into "software" and "appliances/tools". Information flow was only very sparsely addressed and was taken along with the property software, as it mostly concerned ideas with respect to a smart communication system. The space aspect (in SWING only location was relevant as a design result, as the building could not be changed) was documented by the task cards, and was treated as changes to the activity flow. Unplanned events were used as input for the game and are not considered design results. However, questions and bottlenecks were added as categories of results. Tables 7.11 and 7.12 show the numbers of results of each category. Tables describing the actual results can be found in Appendix 4.

	ICT & COMMU-NICATION	CATERING	NURSING PROCESSES AND VISITORS	MATERIAL LOGISTICS	SUM	ICT & COMMU-NICATION (EXTRA)
CHANGES TO NURSING WORKFLOW (AVERAGE)	10	1	8	1	19	0
NEW ACTIVITIES	1	0	0	1	2	2
APPLIANCES/TOOLS	5	0	6	0	11	3
SOFTWARE	2	3	0	1	6	15
RESPONSIBILITIES	0	8	2	8	18	0
RULES/REGULATIONS	0	2	7	0	9	0
POINTS OF ATTENTION FOR MANAGEMENT	0	1	1	3	5	1
BOTTLENECKS IN CASE OF HANDLING CURRENT PROCESSES	4	1	4	0	9	0
IMPORTANT FUNDAMENTAL CONCEPTS	1	8	1	4	14	1
INNOCATIVE CONCEPTS	0	0	1	0	1	3
SUM WITH ACTIVITY FLOW	**23**	**24**	**30**	**18**		**25**
SUM WITHOUT ACTIVITY FLOW	**13**	**23**	**22**	**17**		**25**

Table 7.11 : Number of results of Design workshop 1 & 1b that were validated during the evaluation workshops.

	ICT & COMMU-NICATION	CATERING	NURSING PROCESSES	MATERIAL LOGISTICS	SUM
CHANGES TO NURSING WORKFLOW (AVERAGE)	0	6	17	0	23
NEW ACTIVITIES	0	0	2	1	3
APPLIANCES/TOOLS	2	0	3	2	7
SOFTWARE	4	1	2	0	7
RESPONSIBILITIES	0	0	4	0	4
RULES/REGULATIONS	0	0	0	0	0
POINTS OF ATTENTION FOR MANAGEMENT	0	2	2	0	4
BOTTLENECKS IN CASE OF HANDLING CURRENT PROCESSES	0	0	1	0	1
IMPORTANT FUNDAMENTAL CONCEPTS	0	1	2	0	3
INNOCATIVE CONCEPTS	2	0	3	2	7
SUM WITH ACTIVITY FLOW	**8**	**10**	**36**	**5**	
SUM WITHOUT ACTIVITY FLOW	**8**	**4**	**19**	**5**	

Table 7.12: Number of results Design workshop 2.

Table 7.13: A list of all fundamental and innovative design results in the first and second design workshop series that were appointed by at least two assessors.

CONCEPTS RATED AS FUNDAMENTAL	
FIRST WORKSHOP SERIES	SECOND WORKSHOP SERIES
• every staff member should use a (half I-pad size) mobile device for phoning, viewing, and editing digital patient records (appointed 3 times) • patient information will be available digitally for all staff members who need it • the nutritional condition of patients is the responsibility of the nurses • organizing visits in the interest of the patient is the responsibility for the nurses • patients can order food from a menu (according to their nutritional plan) • fixed eating periods are needed to provide time for control moments and manage medication • visiting hours can be extended, but not to 24/7 • the staff room is too small for transfers • working with the buddy system (see Section 7.4.1)	• how can medication be received in emergency situations
CONCEPTS RATED AS INNOVATIVE	
FIRST WORKSHOP SERIES	SECOND WORKSHOP SERIES
• none	• huddle (see Section 7.4.1) • use of a combination trolley, containing materials per nurse • disease specific, pre-packed material sets
CONCEPTS WITH MIXED CLASSIFICATIONS	(FUNDAMENTAL AND INNOVATIVE)
F IRST WORKSHOP SERIES	SECOND WORKSHOP SERIES
• integration of medicine scanners and Bluetooth connection for measuring appliances in mobile device • the diet plan is the responsibility of the doctor • software needs to control the “expire date” of patient information and send reminders • patient (phone) call goes directly to the responsible nurse or “buddy” • pop ups should indicate changes in the digital patient records • system links nurses with the patients/rooms they are responsible for • patient has the option to either call a nurse or a nutrition assistant	• huddle (see Section 7.4.1) • use of a combination trolley, containing materials per nurse • disease specific, pre-packed material sets

Fundamental or innovative concepts

In a further effort to analyse the design results the researcher, the MST project managers, and the project commissioner each independently identified decisions that were, according to them, fundamental to the further development of the work processes and design results that were particularly innovative. Design outcomes that had a significant influence on the new working processes and appliances, but were not innovative, were defined as fundamental. These outcomes had not to be surprising or a change of the current way of working, but had to form an important basis for the overall result (Example: When designing a new car, the decision to develop an automatic car would be fundamental, but not innovative). Innovative outcomes were defined as outcomes that were not anticipated by the three parties and formed significant changes to the current working processes (Example: When designing an new car, the decision to give it a joystick instead of a steering wheel would be innovative and form a significant change to the current driving process). The number of fundamental and innovative outcomes could then be compared between topics and between workshop series, in order to e.g. see if there was a shift from fundamental to innovative outcomes between workshop series, or specific topics led to more innovative ideas than others.

Table 7.13 shows the results that were rated fundamental and/or innovative by at least two of the three assessors. Full results can be found in Appendix 4.

The hospital manager and the project commissioner agreed on six classifications, the project commissioner and the researcher on five, and the researcher and hospital manager on four. The project commissioner appointed the highest number of fundamental concepts (35 versus 13 and 17) and the most concepts overall (45 versus 28 and 21). The researcher had classified the largest number of results as innovative (11 versus 10 and 9).

Design workshop series one versus two

Even though series one and two had the same four topics, the first series resulted in more results overall than the second series. More specifically, the first series led to more fundamental concepts, more bottlenecks, more attention points for the management, more responsibilities (even when leaving out the results from the catering workshop in the first series, which focused on rules/regulations and responsibilities), and more rules/regulations. However, the second design workshop series resulted in more innovative concepts and more changes to the activity flow.

Comparison by topic

Because some topics might naturally lead to more results than others might, a comparison between the results of different topics is not straightforward. For example, more sensitive topics, such as the catering topic, were expected to lead to less ground-breaking results, while topics that were treated in highly structured workshops, such as the ICT topics, ore broader topics, such as “nursing processes”, might lead to a great number of more detailed results. The topic “nursing processes” indeed resulted in the most results in both workshop series. Since the workshops on nursing processes were more suitable to produce activity flow results than other topics, the situation was analysed with- and without activity flow results. However, even when leaving out the activity flow results, only the highly structured extra workshop for the topic ICT & communication (workshop one-b) had more results. When excluding the extra workshop one-b about ICT & communication, the most innovative concepts were generated for the topics nursing processes and material logistics. The topic with the most fundamental concepts appointed was also nursing processes. In both workshop series, the topic material logistics scored the lowest in terms of number of results. In case the activity flow results are left out, ICT & communication scores the worst in the first series and catering scores the worst in the second series.

Results for important properties per topic

As every topic had specific focus points (see workshop descriptions in Section 7.3.2 & 7.3.3), it was controlled, whether the number of results in the categories responding to these focus points were higher than in other categories. The following properties were marked relevant for specific topic but scored low in actual results (low meaning one or no results) in those topics:

- “new activities” in all workshops, except in the second workshop about nursing processes,
- “responsibilities” in first extra ICT & communication workshop (1b), in the second material logistics workshop, and in the second ICT & communication workshop,
- “appliances & tools” in the first material logistics workshop and the second catering workshop, and
- “rules & regulations” in the first extra and second ICT & communication workshops (1b and 2).

Properties that were not indicated as relevant for specific topics, but scored surprisingly high (two or more results) were software related results in the first catering workshop, and appliances & tools, software, and responsibilities related results in second nursing processes workshop.

Interpretation

While the first workshop series resulted in more overall results than the second series, the second series generate more innovative results. One way to look at these results is that the first series created the basis for the results of the second by familiarizing participants with the design problem, identifying a number of fundamental concepts and bottlenecks in combination with the current work processes that could be used to find innovative results.

The ICT & communication workshops were the most structured workshops. However, that did not lead to the most results. The highest number of results was achieved in the workshops about nursing processes. This might be because the topic had the broadest focus. Logistics was the narrowest and the least favourite topic among participants, and resulted in the lowest overall results, but interestingly with the most innovative results (if the additional ICT & communication workshop (1b) is omitted form the results for ICT & communication).

Catering was the most sensitive topic among the participants. Taking a closer look at this topic, the higher score in series 2 (incl. activity flow) is due to the request to build the nutrition assistant activity flow next to the nursing activity flow. Excluding the results from developing the nutrition assistant activity flow next to the nursing activity flow, it had the lowest score in the first workshop series and the second lowest in the second series.

Overall, there were few new nursing activities generated during the workshops. These results could probably have been anticipated, because the new situation will not lead to completely new activities for nurses, just slightly different execution of existing care and treatment activities due to the new building. Interestingly, the category responsibilities was only addressed when it was explicitly addressed in the workshop setup, as with the first catering workshop.

Furthermore, there was a slight disconnect between what categories that were expected to be relevant for a topic and what the results actually were. For instance, the category software was not expected to be a relevant category for the catering workshop, but the choice for a digitalized meal order system proved otherwise.

7.8.7 CONCLUSION

The game technique was evaluated as very positive by the participants and a large number of effects that were intended with the technique were explicitly named by the participants. Furthermore, interviewees recommend to use the design game for future projects, albeit perhaps in a less comprehensive fashion.

The majority of interviewees confirmed the effectiveness and attractiveness of the game. However, there was no clear indication of the game's efficiency, because even though most of the interviewees indicated that the game was efficient and agreed that it positively influenced the quantity of the project results, the reasons they provided did not really deal with efficiency. The results from the two workshop series show that the first series was needed to pave the way for innovations in the second workshop series. Furthermore, the results show that the broader a workshop topic, the more results were generated. More focused and structured sessions led to fewer results. Overall, there were few changes to the work processes in SWING, only different execution of existing nursing activities.

7.9 DISCUSSION

SWING was a participatory design project that illustrated the value of the HEAD game to enable participants to envision future situations and participate in the design process. The participatory design approach based on the HEAD game was effective in the generation of useful results regarding the future nursing activity-flow. The main success of the SWING project was, however, the facilitating an organizational change process by fostering staff commitment and involvement with the building project.

7.9.1 WAS SWING PERCEIVED PARTICIPATORY?

SWING was perceived by the project members as participatory with respect to the scope and number of decisions, the solidarity among participants, and the willingness to contribute. Furthermore, the interviewees thought that they benefitted from the project personally by learning, exchanging experiences, being listened to, and getting a better insight into their own work. Interviewees had, however, concerns about whether the MST would use and follow-up the project results from SWING. A flaw of project SWING was that the decision makers, though having signed the project plan, were not actually engaged with the project. This led to uncertainty among the project members about whether the results from their participation would be taken seriously and perhaps used in practice. Since participants repeatedly expressed their concern before, during and after SWING, the management of MST risk demotivating participants for future projects, if they do not follow-up on SWING. Even more so, the commitment for the building project generated in SWING might be lost, if the management decides to not pay attention to the design results generated during SWING.

7.9.2 THE VALUE OF THE SWING PARTICIPATORY DESIGN APPROACH

The majority of interviewees had a positive stance towards project SWING and thought the general approach to be worth repeating, albeit perhaps in a less comprehensive fashion. According to interviewed participants, the participatory design approach of SWING produced direct benefits for the organization such as useful design results, the stimulation of a thinking process about the new situation among the staff, the willingness to change, involvement of the staff in the building project, and the generation of a platform that can be employed in follow-up projects.

Usability

While project SWING did not deliver the innovative results that some interviewees had been hoping for, it was rated to be an effective approach to produce useful input for the future nursing processes. One of the reasons why the project worked more towards detailed, practical results than innovative concepts may have been that the planning of the building had been already completed.

The effectiveness of the project approach was confirmed during the interviews and via the questionnaires, but participants were undecided in regards to the efficiency of SWING. Only a slight majority of interviewed participant thought that the costs and benefits were balanced or could be if the results were actually used by MST. This indecisiveness may be explained by the lack of experience of the participants with extensive projects and participatory design, the qualitative nature of the project results, and the lack of a benchmark/reference for comparison.

Results show that project SWING provided a satisfying way for participants to engage with the future nursing work processes. This can be contributed to the open atmosphere in the workshops.

The two design workshops

Both workshops series in SWING showed to have had their own value in the project. The first workshop series led to a number of results and addressed a number of important fundamental concepts and bottlenecks related to the current work processes with the new building, while in the second series two more innovative ideas were generated. However, in participatory design projects not only the workshops are important, but also the analysing and processing of the design results in between workshops. In SWING there was little time spent in analysing the results in between workshops and adapting the project course to the results. Results from one series of workshops were nearly directly used as input for the next series. This was done in order to minimize the influence of non-stakeholders (mostly the researcher). However, validating results with additional parties such as doctors and giving feedback about this validation in the successive workshop could have added a valuable iteration to the design project.

Project management and course

Two steering group members had the idea that they themselves had not invested enough time in the project. According to Bødker et al. (2004, p. 28), it is realistic to spend 15-25% of a project group's total time on project management in participatory ICT projects due to the high degree of uncertainty in such kind of projects. While SWING was only for about 30% an ICT project, there was high level of uncertainty involved in the other 70%. About 20% of the total project time was spent (time, not man-hours) for management tasks. The high demand for management tasks may explain why the steering group members believed that they did not spend enough time on content-related tasks.

When is a participatory design project finished? According to Bødker et al (2004,p.64-65), it is finished *"when the project group gets the sense that it is not gaining any significant new knowledge from its information gathering and analysis and when the group and other actors involved believe that the desired results have been sufficiently captured* *in the design proposals"*. It could be concluded that this was the case with SWING. SWING resulted in a large number of design results at different levels of detail. The evaluation workshop did not lead to additional results. The results will be used in a number of smaller follow-up projects that further the proposals and evaluate different design concepts at MST in practice, e.g., in prospective risk analysis and lean projects. Since the four SWING topics are interrelated, it is recommended that the management regularly oversees these projects and ensures their coherence.

7.9.3 THE VALUE OF THE HEAD GAME

Usability

The HEAD game technique was rated very positively by the participants during the evaluation interview. They rated the game as effective, appealing, and applicable for MST. As with the participatory design approach, the verdict regarding the efficiency was inconclusive. However, interviewees saw that the game provided a good overview of the situation and enabled participants to contribute without much effort. This influenced the quantity of the project results in a positive way. The HEAD game is self-documenting; it records the design results in the activity-flow and different types of game cards. However, it was observed that many useful comments in SWING were made as side-remarks and were not documented in the workshop material. Furthermore, the argumentation behind specific design choices is not written down. It is therefore strongly recommended to document the workshops by video recordings and/or written observations.

Dealing with uncertainty

The HEAD design game was designed to compensate for the practical experts' lack of experience with the use of design tools. The game has proven to enable them to envision and manipulate the future situation. However, many project members were observed to have a hard time to deal with the uncertainties and iterations in the SWING project, which are common to design processes. Professional designers learn to deal with these aspects during their education, and the importance of diverging/converging solutions and iterating in order to deal with uncertainties is emphasized in what is currently called "design thinking". Design thinking seems to be needed on top of envisioning future situations in order to deal with uncertainties and eventually come up with innovative concepts. Since it is impossible to avoid uncertainty in the design process, it might prove useful to familiarize project members to design thinking before starting with the actual project problem.

Innovative ideas

Several project members believed that SWING delivered less innovative concepts than expected. Since the project managers had to deal at the start of SWING with a number of concerns about decisions that had already been made in the past, the plan was to get participants as quickly as possible engaged with finding solutions instead of discussing concerns. Furthermore, participants needed to see that there are solutions possible. Therefore, the chosen design game disembodied the big design problem into a number of smaller problems by the use of topics, focus points, different steps in the design game and guiding questions. Besides focusing on their concerns, the participants were constantly changing gears between stating that the project boundaries were too open and stating that there had already been too much decided beforehand. While the structured approach of the HEAD game in SWING provided the necessary grip on the design problem, it unfortunately left little room for participants to question existing assumptions and less room for innovative thinking and serendipity.

On a more detailed level, the game step "exploration of the new premises" might have led to a problem-oriented approach, instead of an opportunity oriented one: Nurses were asked to play the current workflow on the game board depicting the new building, in order to familiarize with the building design and detect problems that would occur in the combination of the current workflow with the new building. This step might have stimulated workshop members to solve the problems they encountered in this process, instead of looking at the opportunities the new premises offer. However, it is unclear whether the participants would have been able to directly design a new activity flow without the initial step and dealt with the uncertainty without the structured approach. It is likely that participants would still have played the current workflow on the game board depicting the new building in order to create grip on the problem for themselves.

A design phase executed by experienced designers between the first and second workshop might have been a good idea to come up with conceptual re-designs and to stimulate participants to look further beyond the current practice during their search for solutions in the second workshop series. The designers could have profited from their less biased view, to make a number of conceptual re-designs of the nursing workflow, employing the results from the first design workshop series. These could then have been presented to the SWING participants in the second workshop series, to react to and use to further build their own ideas upon. However, such an approach would have made project SWING less participatory and might have resulted in less positive commitment and involvement effects.

When gaining commitment and involvement are less important, and one wants to focus on design results, performing the HEAD design game with designers instead of stakeholders might lead to more innovative results. While designers lack practical experience in healthcare practice, they are less biased towards existing solutions, which might prevent them from using the conflicts between the current approach and the new situation (problem solving) as a point of departure. Furthermore, their design thinking might lead them to look more at the opportunities in the design problem. However, designers might also come up with ideas that are not feasible or less acceptable for the practice experts. The reason not to work with designers, but with practice experts was after all their practical knowledge, which designers lack. In the next chapter, this challenge is addressed by the application of the HEAD game in two different situations a) with practice experts who, in contrary to the participants in SWING do not have any stakes in the project, and b) with designers, who are neither practice experts, nor have any stakes in the project.

8 THE MOBILE HOSPITAL PROJECT

8 THE MOBILE HOSPITAL PROJECT

8.1 INTRODUCTION

The motivations for doing a second design project, the mobile hospital project, after SWING were to explore the relevance of the design game outside of a genuine participatory design approach, to reconfirm the design game's usability and ability to empower the development of feasible design solutions for a distinct design problem, and to provide insight about the relevance of the design game outside of a genuine participatory design approach. To this aim, two design game workshops were held (a) with a group of medical experts as participants, and (b) with trained designers.

The design problem of the mobile hospital project involved the design of the layout of a mobile hospital and work processes dealing with the treatment of patients for disaster situations. The project was organized in cooperation with Holland Medical Services, a Dutch company. It was significantly smaller in scale than SWING and took several months to complete. While the HEAD game proved to be successful in terms of usability and effectiveness during the SWING project, having another data set available to crosscheck previous results is valuable. An important difference between SWING and the mobile hospital project is that the former design project was embedded in a participatory design project approach, while the latter was not. In SWING the HEAD game participants were practitioners and stakeholders, i.e., implementations of design results might affect participants' future. In the mobile hospital project, none of the participants were actual stakeholders.

Section 8.2 describes the background of the mobile hospital design project and the project organisation in more detail. Section 8.3 continues with an explanation of HEAD game customization and structure of the workshops. Afterwards, Section 8.4 summarizes the design results of the workshops before Section 8.5 turns to the research methods and results. Section 8.6 presents a discussion of the mobile hospital project.

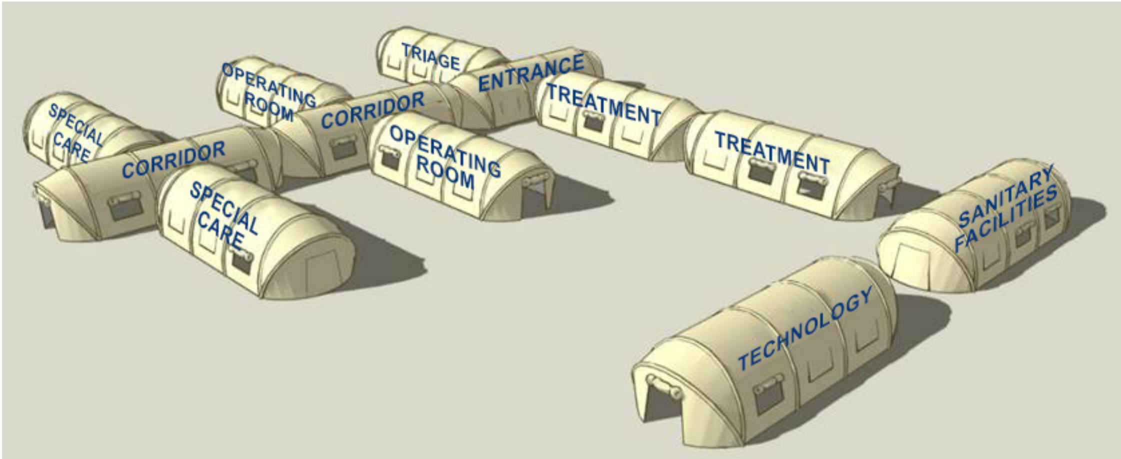


Figure 8.1: A blueprint of the layout of the different tents of the mobile hospital concept.

8.2 PROJECT DESCRIPTION

8.2.1 DESIGN PROBLEMS AND PROJECT GOALS

The Dutch company Holland Medical Services (HMS) is currently developing a modular mobile hospital for disaster relief situations such as the aftermath of high-impact earthquakes and floods. Currently, disaster victims often receive the needed treatments too late due to organizational and logistical problems. The new mobile hospital is intended to minimize these problems. The hospital can be transported by helicopters so that it can always be placed close to the disaster site and victims can be treated within the first 24 hours after the disaster. It is transported via two freight containers that are then unfolded to offer two operating rooms and eight additional tents that can be used for reception, examination, treatment, storage, and intensive care (see Figure 8.1). The hospital is supposed to be operational within six to eight hours after arrival and self-supporting in terms of appliances and materials for the first 48 hours. A team of medical experts flies directly with the hospital to the location of a disaster. The intended capacity is twelve operations and five-hundred polyclinic treatments a day, and thirty intensive or medium care beds. Potential clients for the mobile hospital are organizations such as UNICEF, the WHO, NGOs, and the military.

The work processes in mobile hospitals at disaster sites are characterized by unscheduled arrivals of patients but structured procedures, once a patient has entered the treatment path. At peak hours the staff needs to do triage and make fast treatment decisions with the aim to save as many patients as possible with the capacities available.

After an exploratory visit to the Dutch MOGOS ("Mobiel Geneeskundig Operatiekamer Systeem", a mobile hospital of the Dutch military that has, e.g., been used in Afghanistan) at the Peregrine Sword exercise in 2012 and in agreement with HMS the following four project goals for the two HEAD game workshops were defined:

1. Developing the procedure for the triage and the treatment of patients with injuries of different severity,
2. Evaluating and redesigning the purposes and arrangement of the tent modules,
3. Developing requirements for the equipment of the different tents with respect to material, appliances and information distribution, and
4. Evaluating and redesigning the arrangement of the operation room interior.

The fourth goal was of low priority and would only be addressed if extra time was available at the end of the workshops.

The participants for both workshops did not have to start from scratch but used an existing concept design developed by HMS. This concept was used as a point of departure for the HEAD game; similar to the how the hospital building design was used as the point of departure in the SWING project. The concept design included the number of tents, containers, beds, the arrangement of the different tents, and the setup of the operating rooms. In contrast to project SWING, the building design was still changeable.

Given the nature of the design problem, there are a number of technical constraints that reduce the space of feasible design solutions. Naturally, there is an upper bound on total weight that limits what medical facilities and equipment can be taken along. E.g., it is practically impossible to take a magnetic resonance imaging (MRI) scanner along because its proportionally high weight would leave little room for other essential material such as water and fuel. While HMS did not provide specific weight constraints, they stressed that the final design had to be as light as possible. The project developer provided other constraints during the game workshop whenever workshop participants needed the information.

8.2.2 GAME WORKSHOPS AND PARTICIPANTS

The mobile hospital project involved two separate HEAD game workshops that took place in 2013. The first workshop was executed with a group of medical experts relevant to the context of the design problem, while the second workshop involved a group of professional designers, working in academia and in consulting, without practical experience in healthcare. The researcher and the HMS project developer facilitated both workshops. The project developer was included to provide background information about the project, answer questions, discuss any project constraints, and collect the design results from the participants first hand. The role of the facilitator was to explain the procedure of the HEAD game and to keep the participants focused on the actual workshop topics as well as following the structure of the game. The workshops were planned to take in total two hours, allowing for 1.5 hours net gaming time.

The participants of the expert workshop included an anaesthetist, a surgeon, and a former doctor, working for an international company. All three of them had relevant knowledge and experience in healthcare. They formed no community beforehand and had no direct stakes in the mobile hospital project, because they could not expect to work in the mobile hospital or further participate in its development in the future. The experts were informed about the hospital project and the hospital concept design by an invitation letter, as well as a by a short oral presentation of the project developer at the beginning of the workshop. They were rewarded for their participation by a tour of the Virtual Reality lab of the University of Twente that included a number of demonstrations of how the virtual reality tools work.

The designers in the designer workshop are all working in design research, one designer has years of practical experience in product design practice, and two are active as design method consultants. They all had no relevant practical experience with hospitals and disaster relief at the time of the workshops and no stakes in the mobile hospital project. While they were colleagues of each other (in a department of more than sixty people), they did not form an actual community beforehand. Due to the designers' lack of experience and knowledge in the area of healthcare and disaster relief, the intended use situation of the hospital, typical treatments, appliances, and the concept of triage were explained to them by the facilitator in more detail than to the medical experts at the beginning of the workshop. In particular, the following points were presented to them:

- The fact that the mobile hospital needs to be transported quickly by air to the disaster site puts weight limitations on the hospital design. As a result, the number and type of equipment that can be taken along and the available space inside the hospital units is severely limited, which in turn affect the type of treatments that can be offered, the overall treatment capacity, and the logistics inside the hospital.
- The design solutions should take into account that social conflicts can quickly arise in disaster situations due to cultural differences (e.g., when western healthcare organization staff works in an Arabic culture) and the emotional effects of the extreme situations.
- The mobile hospital and its staff will likely need protection against weather conditions, raids, and aggressive patients and/or family members.

The project developer addressed any additional questions by the designers during the workshop.

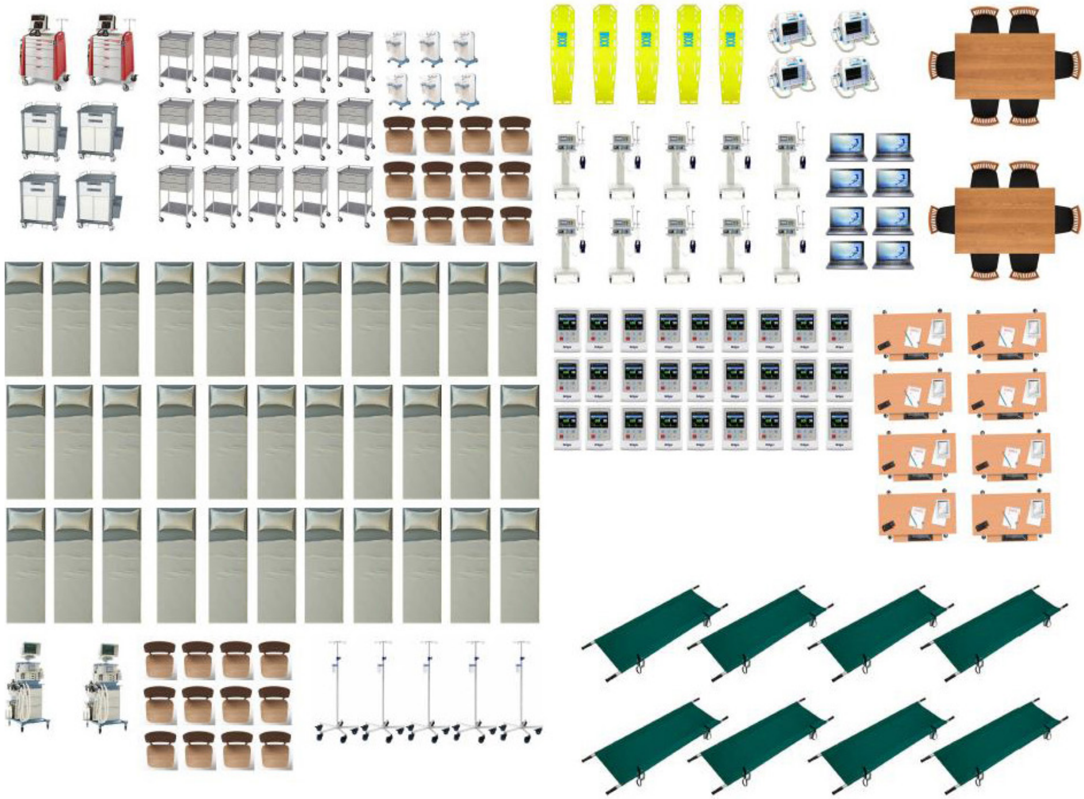
Figure 8.2: Initial arrangement of the game pieces on the game board for the mobile hospital HEAD game in the session with the practice experts.

8.3 HEAD GAME CUSTOMIZATION

Recall that the HEAD game is a combination of task flow analysis and role-playing of work processes in a miniature game environment (see Chapter 6 for more details). The central feature of the game is that it enables participants to get a complete overview of complex work processes by structuring them according to chronology, location, and information flow. As a result, participants can access their experience, practical knowledge and otherwise tacit knowledge during the game play and imagine novel design ideas within the concrete context of the miniature environment. Since the HEAD game was created as a general game that can be used for almost any healthcare environment and activity design problem, it requires a case-by-case customization of the (1) miniature game environment and (2) the task flow cards, and (3) the start scenario and/or events. Here the customizations for the mobile hospital project are defined.

8.3.1 MINIATURE GAME ENVIRONMENT

The miniature game environment comprises a central game board and a collection of game pieces. In the HMS HEAD game, it was chosen to use a picture of a sandy deserted field as the game board. The collection of game pieces consisted of three main groups. The first group included flat playing pieces that represented the tents and operation room containers. These pieces could be placed and rearranged on the game board by the game participants (see Figure 8.2). The second group of game pieces consisted of medical appliances (e.g., respirators, defibrillators, and monitoring equipment), furniture (e.g., beds, stretchers, and chairs), and persons (e.g., doctors, nurses, and patients with injuries of different severity, indicated by different colors). The third group of game pieces was reserved to blank game pieces that could be assigned a meaning by the participants. See Figure 8.3 for exemplary



templates of the game piece representations.

While predominately the two-dimensional miniature game environment was used for the mobile hospital project, also a three-dimensional scaled model for evaluating and redesigning the arrangement of the operation room interior (see project goal four) was applied. This more complicated representation was needed to receive detailed feedback on the appliance arrangement in the operating room. Similar to the two-dimensional scale model, game participants could modify the initial arrangement by adding, removing, and rearranging appliances represented by blocks.

Figure 8.3: One of the templates for the game pieces of furniture and appliances for the Mobile Hospital HEAD game.

8.3.2 TASK FLOW CARDS

The task cards used in the game had fields for a description of the task, the person who fulfils the task, the location of the task, and the needed information. In contrast to the SWING design project, the "needed information" field was added to the task cards. In the mobile hospital design project, all aspects of the activity flow of the mobile hospital were analysed together, whereas in the SWING project, the information distribution was a specific part of the ICT & Communication workshop, and hence not included in the general task cards.

8.3.3 SCENARIOS AND EVENTS CARDS

In order to facilitate direction and focus, the players were confronted with patients they had to treat to inspire use scenarios. "Patient case cards" that summarized the patient situation were used in the workshops. An example of such a patient case description is given by

> *"Earthquake: A 29 year old man is transported to the hospital entrance by his family on a provisional stretcher. The seriousness of the situation and language difficulties cause the family to panic. The man has been found unconscious in his demolished house and is still unresponsive upon arrival."*

In addition to patient case cards, "event cards" dealing with the occurrence of extreme events that would affect the mobile hospital were used. The purpose was to stress test the proposed hospital and work process design. An example of an event card is

> *"An explosion causes many victims with severe burns. There are heavy tropical rainfalls and no treatment facilities within a 20-kilometre radius, except for the mobile hospital. 48 patients arrive at the hospital at the same time."*

8.3.4 WORKSHOP PROCEDURE

The HEAD game workshops in the mobile hospital project followed, similar to the SWING project, a predefined and well-structured procedure consisting of eight steps (see Table 8.1 for an overview of the procedure).

After the introduction to the hospital concept and the HEAD game (1), participants were asked to familiarize themselves with the concept design of the mobile hospital and ask any questions if needed (2). Next, they were introduced to patient case cards, and after picking a card at random, were instructed to start "treating" the patient (3). The imaginary treatment involved filling out the task flow for each step in the treatment procedure (4), installing the staff that was needed (5), and arranging the tent facilities optimally and equipping them with the needed appliances and furniture (6). These steps were repeated for several patient cases until the participants agreed on a design. After that, the chosen design was stress-tested by confronting the players' hospital design with randomly chosen event cards (7). As a final step, each player was asked to reflect on the final design and to place three stickers on the game material that they believed to represent the most important aspects of the design (8).

While the procedures of the HEAD game workshops were very similar in the SWING project and the mobile hospital project, more guiding questions were used in the mobile hospital project. This had two straightforward reasons. Firstly, that the mobile hospital project dealt with all aspects of the design problem in a single workshop, led to more guiding questions. In the SWING project, the problem was divided into four different topics that were tackled in separate workshops.

MOBILE HOSPITAL WORKSHOP	
WORKSHOP STEPS	GUIDING QUESTIONS
1. Introduction presentation 2. Familiarizing with hospital design 3. Playing patient cases 4. Filling in tasks on task cards 5. Creating chronological task flow, installing staff 6. Rearranging hospital layout and placement of tools on game board 7. Playing event cards, adjust chosen tools and task-flow if needed 8. Prioritizing	• Does everybody need to go through the administration procedure, even if lifesaving interventions are needed, or does the triage room offer possibilities for this? • Should it be possible to do lifesaving interventions in the triage room? • If there are many patients, could the triage be done in the administration room? • What kind of treatments should be possible in the examination rooms (e.g., should suturing and amputations be possible)? • Should we try to care for as many patients as possible in the IC, and if so, what kind of concessions could then be done with respect to monitoring the patient? • Is one observation post enough for three tents?

Table 8.1: Overview of the workshop steps and guiding questions in the mobile hospital design project.

Secondly, there was little reference for the organization of the activity flow in the mobile hospital available. The project regarded the development of a completely new situation without a "current situation" of a specific mobile hospital to refer to. This led to many additional questions about the organization of activities. See Figures 8.4 to 8.7 for an impression the HEAD game workshop for the mobile hospital project with the designers.

Figure 8.4: A snapshot during the HEAD game workshop for the mobile hospital project with the designers in which the project developer explains the initial hospital design concept.

Figure 8.5: A snapshot during the HEAD game workshop for the mobile hospital project with the designers in which the participants fill in the yellow task cards.

Figure 8.6: A snapshot during the HEAD game workshop for the mobile hospital project with the designers in which we see the participants move the playing pieces representing the staff around the game board.

Figure 8.7: A snapshot during the HEAD game workshop for the mobile hospital project with the designers in which we see the participants rearrange the hospital tents.

8.4 DESIGN RESULTS

This section presents a summary of the design results of the two HEAD game workshops. The results are divided into six separate groups:

1. hospital layout,
2. staff,
3. tools,
4. rules and regulations,
5. information distribution, and
6. tasks.

The focus is on the most significant changes to the initial hospital concept by HMS as well as the differences between the expert and designer group.

8.4.1 HOSPITAL LAYOUT

The designers made changes that were more radical to the layout of the existing hospital concept than the experts. They removed the reception tent and placed the administration in front of the hospital entrance. Furthermore, they rotated the triage tent by 90 degrees and added an entrance and an exit, opposed to the entrance, to the tent. As a result, the triage tent now had an entrance area. The decision was based on the observation that the reception tent was quite big and a waiting area with seats for patients inside the hospital was not needed. The designers also decided to place crush barriers in front of the hospital, create a waiting line, and place an entrance tunnel to prevent that dirt (from shoes etc.) is carried inside the hospital. Furthermore, the designers increased the size of the hallway between the operating rooms and the examination/treatment tents, to create more room for the stored medical appliances. Finally, they decided that the mobile hospital should be modular in the sense that non-essential modules (e.g., a mortuary) could be delivered and appended later on to the essential core modules.

The first alteration the experts made to the hospital layout was to add a cooling unit to be used as a mortuary and for the preservation of blood products. Next, they added docking stations to the hallway tent for the placement of appliances to prevent cluttered walking routes. Interestingly, the designer group identified the same problem but chose to increase the size of the hallway tent instead. The experts continued by adding a low budget nursing station tent that was placed next to reception and connected to it. The experts also decided that a tent dedicated to patients who cannot be saved, a “T4” tent (“4” is a common triage label for these type of patients), should be added. In case the hospital would have to deal with a large number of patients, physical barriers should be used to hold the patients and family back from the hospital (similar to the designers’ crush barriers) and it was decided that in this scenario triage should take place “in the field” in front of the

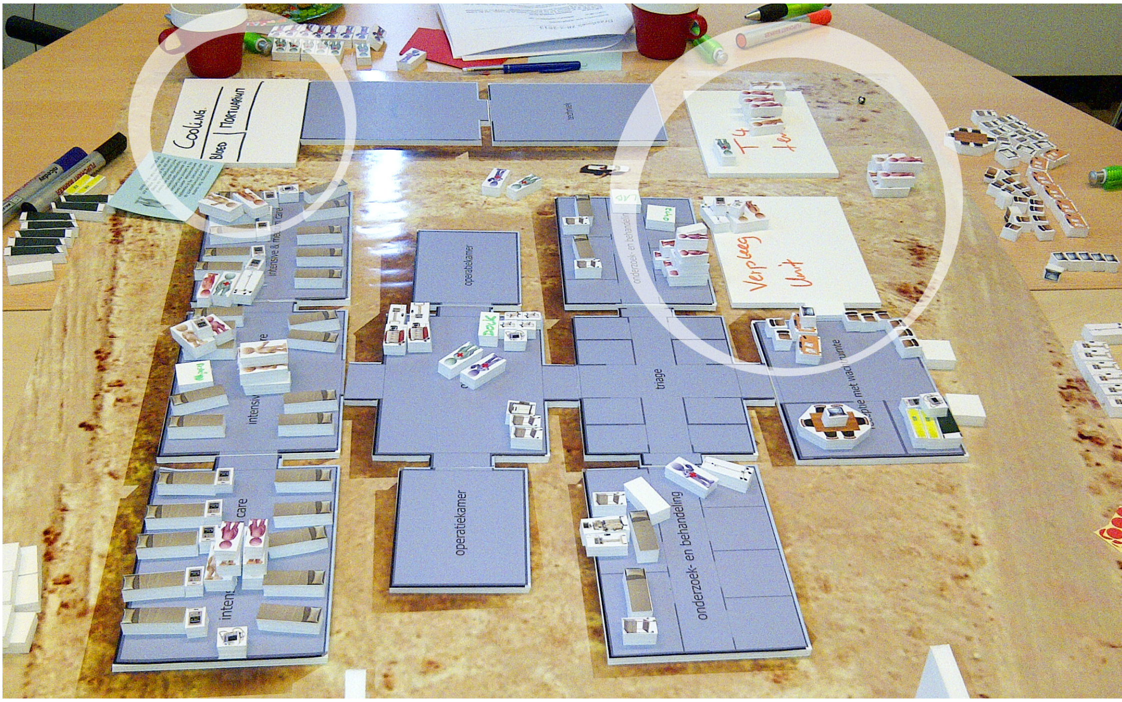


Figure 8.8: Mobile Hospital HEAD game workshop: end situation of experts with cool unit, low budget nursing tent and T4 tent.

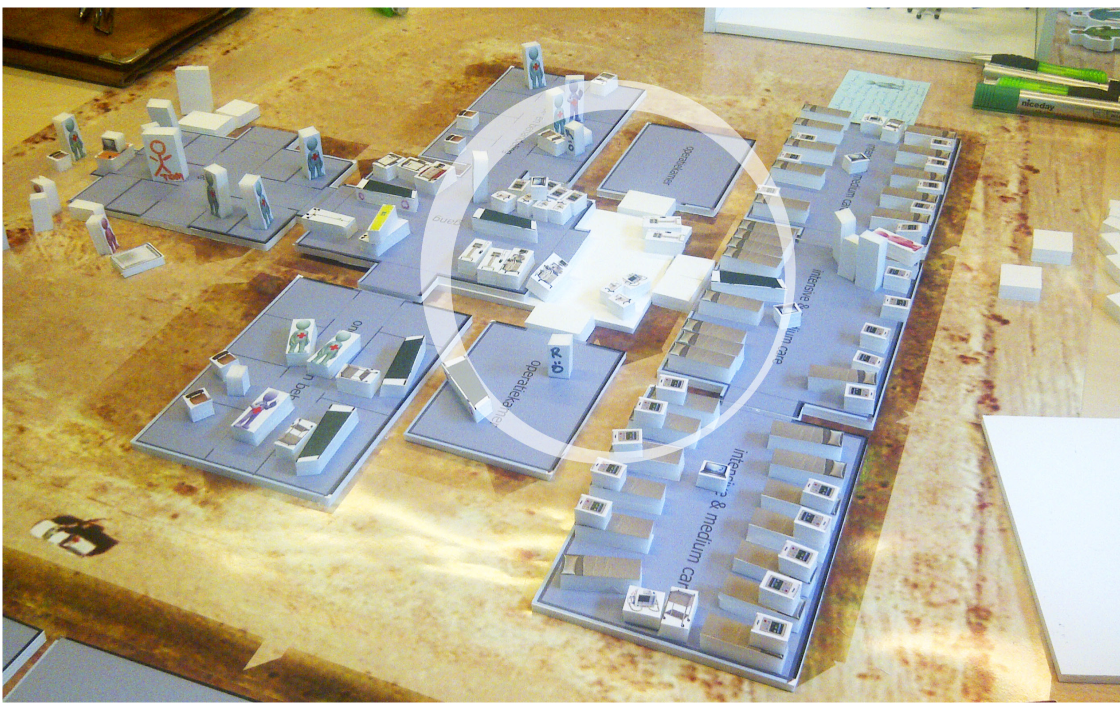


Figure 8.9: Mobile Hospital HEAD game workshop: end situation of designers with altered hallway tent.

hospital, instead of inside the triage tent.

Both groups agreed that an outside "waiting area" dedicated to the patients' family members should be added to the hospital layout to allow them to stay close but out of the way of the treatment procedures. See Figures 8.8 and 8.9 for the end situations of the layouts of both workshop groups.

8.4.2 STAFF

The designers made more decisions than the experts with regard to the hospital staff. Curiously, they gave "names" to staff classes. As a first step, they decided to place a security guard ("Rashid") at the hospital entrance. Next, the designers decided they needed four staff members, the "Toms", responsible for patient logistics (e.g., ensuring that patients are guided to an examination & treatment room and family members are guided to the exit after delivering all relevant information). Furthermore, they placed a doctor and a nurse in every examination and treatment tent, hired a local receptionist, and a laboratory technician to do the blood tests.

The only two explicit decisions with respect to staff made by the experts were that security personnel would be needed on the location even before the mobile hospital would be assembled and that a nurse was needed in the T4 tent to provide palliative care.

8.4.3 TOOLS

The experts made more decisions with respect to appliances and material requirements than the designers. They placed a fast echography appliance, two lab appliances for blood testing (in the examination and treatment area and in the IC area), small respirators in the examination & treatment rooms, and x-ray appliances. Furthermore, they decided that mobile monitoring equipment should be located in every hospital area but should not leave the area it belongs to. The experts thought that for the first forty-eight hours two or three sets of linen for every bed should be available.

The designers only decided that the stretchers should have wheels and that the staff should have smart tablets to keep track of the patient records.

8.4.4 RULES AND REGULATIONS

Only the experts decided on a policy for the mobile hospital. They believed that the patients should be treated for a maximum period of three days. After three days patients either should have recovered enough to leave the intensive care or should be given up in favour of patients who can be saved.

8.4.5 INFORMATION DISTRIBUTION

The experts decided that the administration inside the mobile hospital should be digital to facilitate fast information distribution. The designers agreed on this issue implicitly by requiring the use of smart tablets. For information distribution outside the hospital, the experts agreed that the hospital should be able to produce printed copies of the data.

8.4.6 TASKS

The experts worked out the treatment task flow for three different patient cases, the designers for one case. The task flows from the experts consisted of seven, five, and eleven different tasks respectively. The task flow the designers created was more detailed and consisted of thirteen tasks. The task flow of the designers is reproduced in Appendix 5. Whereas the designers were more detailed about the procedural route the patient and family members should take through the mobile hospital, the experts put more emphasis on the types of treatments for the different patients.

8.5 RESEARCH RESULTS

8.5.1 MOTIVATION

The motivations for doing a second design project, the mobile hospital project, after SWING were to explore the relevance of the design game outside of a genuine participatory design approach, to reconfirm the design game's usability and ability to empower the development of feasible design solutions for a distinct design problem, and to provide insight about the relevance of the design game outside of a genuine participatory design approach. Two design game workshops were held to compare the results of (a) a group of medical experts as participants, with those of (b) a group of professional designers with no healthcare or disaster relief expertise, to analyse the value of specific expertise versus general creativity and design skills. It was expected that the designers, due to their skills in solving design problems, would come up with more innovative albeit less in-depth ideas than the experts. Furthermore, an important characteristic of the game participants in the mobile hospital project was that they were, in contrast to SWING, not stakeholders, i.e., implementations of design results would not affect the participants' future self. In SWING, the HEAD game participants were practitioners and stakeholders. Being an actual stakeholder or not might affect the actions of the participant during the HEAD game workshop. In particular, having no stakes in the project might increase the participants' willingness to propose more radical design changes since they do not have to adopt them themselves. On the other hand, the motivation to contribute might be lower because non-stakeholders would not directly benefit from any design improvements. This is also the experience of Brandt et al.(2008) who wrote that design games are only fruitful, when everyone has something at stake in the game.

8.5.2 METHODS AND DATA

Similar to the SWING design project study qualitative research methods were used. In particular, to analyse the quality of the HEAD game and the differences in gaming behaviour and design results between the two groups of participants the research primarily relied on (1) first-hand observations by the researcher, (2) video analysis, (3) the design results of the two workshops, and (4) a group evaluation of the game with the designer group.

First-hand observations of the workshops were required to get an impression of the motivation and willingness of participants to play the game. Both workshops were video recorded and the researcher coded the actions observed in the videos. This analysis was intended to reveal differences between the experts' and the designers' behaviour and results in a structured way. The actions (speaking and doing) displayed in the videos were categorized for each workshop according to the previously discussed topics: (a) tasks, (b) staff, (c) tools, (d) hospital set-up, (e) information distributions, and (f) rules and regulations. Furthermore, each action was classified as either (1) decisions, (2) discussions, or (3) shared stories (see Appendix 6).

Let us illustrate each action category with an example. A story with respect to the category staff that was told during the expert workshop was that a well-known aid organization was feared by the local population of Haiti for amputating limbs too quickly. The story was told to underline the need to add local people to the hospital team to calm the patients if needed and explain the approach of the medical staff to them in their own language. A good example for a discussion in the category hospital set-up from the designer workshop involved the question whether the staff room should be in the reception tent or not. In the expert workshop, a decision in the category tools involved the availability of blood analysis appliances. They decided that there should be two of blood analysis appliance, one in the part of the hospital where the intensive care station and the operating rooms are located, and another in the examination/treatment rooms. Besides these categories, there were also actions dealing with topics that were beyond the goals of the project. E.g., the experts discussed potential buyers of the mobile hospital. These items were registered in the beyond goals category.

In addition, the number of interventions from the facilitator and the number of times the project developer gave input during the workshops were recorded. The ratio between discussions and decisions per category was used to identify controversial categories within each group. Furthermore, we used the feedback of the designers regarding their impressions of the workshops. In particular, we asked the designers to evaluate the HEAD game directly after the game workshop. This evaluation unfortunately was not possible with the experts due to time restrictions. Extensive experience with different design tools, techniques and methods enabled the designers to place the design tool in perspective. Video recordings from the evaluation discussion with the design team were used to transcribe the statements and hence evaluate the designers' satisfaction with the game's efficiency and effectiveness.

8.5.3 USABILITY OF THE HEAD GAME

While it is difficult to objectively assess the effectiveness and efficiency of the HEAD game in the mobile hospital project for the same reasons mentioned in the SWING chapter, the impressions are presented with the help of the design results and the satisfaction of the participants and the project developer. Unfortunately, a comparative analysis of the design results between the mobile hospital project and SWING cannot be made due to the different design problems, participants, and session approaches.

While the project developer preferred the results of the designer group due to their level of innovation, the design results from both workshops were rated very highly by him, since both workshops produced feasible design solutions. This assessment agrees with evaluation of the designers, who concluded that the HEAD game was an attractive approach to envision the design of the hospital and that it works for that purpose. The designers were very satisfied with the number and type of changes they had made to the concept, even though beforehand they were afraid that they, as non-experts, would not be able to contribute to the design. However, the presence of the project developer as expert to answer questions and test ideas was perceived as essential to the success of the workshop with respect to creating useful design results. This is also reflected in the fact that the project developer gave much more input to the workshop with the designers (41 vs. 19 times, see Appendix 7). Even though the hospital design appeared to be finished to the designers in the beginning, they concluded that they were able to come up with a great amount of improvements within a short amount of time. However, according to the designers the HEAD game provided less overview over the total number of people needed and the capacity of the intensive care unit in proportion to the two operating rooms. Furthermore, the designers reflected that the aspect of time, which is important to determine capacities, was not included optimally in the game and that designing the treatment procedure step by step was useful for them but might not be necessary for experts. However, they also conceded that treatment procedures designed in such a detailed fashion might be more rigorous.

Even though the participants had no stakes in the project, both groups were very engaged to contribute to the development process. In both workshops, there was at least one participant, who, unasked for, told that he enjoyed the workshop. While this satisfaction might be attributed to many different factors, it seems safe to say that the HEAD game itself played a major part in it. This can be said because when the designers were presented with the design problem, they were at first not very eager to work on the design due to their unfamiliarity with the subject. Only by playing the HEAD game, they found out that they actually could contribute a lot and only then they became really engaged with the topic. Hence, the game enabled the designers to contribute to the project in an enjoyable way.

8.5.4 EXPERTS VERSUS DESIGNERS

The second goal of the mobile hospital project from a research perspective was to analyse how different backgrounds of the game participants affect the characteristics of the proposed design results in terms of level of detail and innovativeness and the game-play behaviour. Here the major differences in design results, attitudes, game-play behaviour, and key topics between the two groups are discussed.

Design results

The experts made overall more design decisions than the designers (49 versus 38 decisions). With respect to the innovativeness, both workshops produced different results. The project developer preferred the design of the designers, which was a bigger change to the preliminary design, and was perceived more innovative by him. While the comparison of only two workshops does not provide enough evidence to rule out other confounding factors, the difference could be explained by the more "professional" design approach of the designers. Designers usually learn to question the point of departure and the assignment and are good at interrelating different contexts in order to find solutions (reframing and associating). Furthermore, the designers' lack of reference in the field of healthcare could have been an advantage for the generation of more innovative solutions.

While the results from the expert workshop were rated less innovative, they were still useful and feasible solutions according to the project developer. Interestingly, this outcome is in line with the results from SWING. The design results produced by the practice experts also resulted in feasible but less innovative ideas.

Attitude

The participants of both workshops were generally positive towards participating in the game. However, the first reaction to the game material differed between the groups. The experts started with the expected remarks about the "childish" tools upon seeing the playing board and the playing pieces. In contrast, the designers, who are more familiar to hands-on techniques and modelling, expressed their desire to start using the game material. The designers, however, had concerns about being able to contribute to the design problem, due to their lack of expertise in the field of hospitals and disaster relief. However, after the short introductions and starting with the game, both groups were able to actively engage in the game. The average frequency of actions in both workshops, including the actions of the facilitator and the project developer, were nearly the same: 100 actions per hour in the expert workshop and 101.3 actions per hour in the designer workshop (see Appendix 7). Both groups were surprised when the scheduled time was over. The experts were so enthusiastic that they did not want to stop playing. In total, they played one hour and fifty-two minutes. The designers played for one hour and thirty-six minutes. In neither of the two workshops the step was reached to prioritize decisions or work with the 3D model of the operating room.

Game play behaviour

The researcher observed that the experts enjoyed sharing stories from their experience, which was underpinned by the video analysis (twenty-nine stories, versus two stories the designers shared with each other, see Appendix 7). Especially the surgeon, who had been in Haiti after the earthquake of 2010, contributed a large number of stories and his experience with disaster relief. As a result, he dominated the workshop and many decisions were based on his experience.

When looking at the sequence of the actions (see Appendix 6), we see in both workshops in the first half more discussions and in the second half of the workshops more decisions. The participants in both workshops switched all the time between categories. The experts performed on average 2 actions, before they switched to another category, the designers switched with a higher frequency between topic categories, on average after 1.6 actions.

While the designers kept neatly to the procedure, the experts were prone to digress from the game towards telling stories from their experiences and engage in more general discussions about how the design process of the mobile hospital could be organized. Hence, the facilitator made many more interventions in the workshop with the experts than with the designers (27 vs. 11, see Appendix 7). The facilitator decided not to use the task cards with the experts. This decision was based on the consideration that the experts were very confident and quick in deciding upon the different tasks. It was expected that leaving out the time-consuming task of writing down cards would be in favour of the total number of results generated from the workshop. In other words, it was decided to go for better design results than research results.

The experts progressed through the different procedure steps very quickly and were less active in touching and using the game material. The rearrangement of the game material was in the beginning of the workshop mostly done by the facilitator, whereas in the second half of the workshop the participants took over. In contrast, the designers played with the game material from the beginning. A curious difference was that the designers put the playing pieces that represented staff and patients on the game board in an upright (standing) position, whereas in the expert workshop, all persons were "laid" down. Furthermore, the designers even gave some of their staff names.

Key topics

The experts shared many stories from their experiences and were interested in the detailed equipment of the hospital. They did not have many discussions about the staff or the procedures. Likely, these aspects are obvious to them. The ratio of decisions per discussion is extraordinary high for the "task" category for the experts; they needed only three discussions to make 23 decisions (see Appendix 7). Furthermore, the experts approached the problem by finding general solutions for the different patient categories, and aimed to establish how to proceed with every category and were very rationally discussing the procedures for "stacking bodies in the mortuary". From this process, also the only rule that was generated in both workshops emerged. Even though the experts were occupied with a lot of storytelling, they managed to play three patient cases and one event.

The designers approached the procedure in more detail, and were very focused on all the different staff members, who were needed to fulfil the tasks. This was likely, because they are not familiar with the typical procedures in mobile- or other hospitals. They were touching the game material more than the experts were, and played with the game pieces without threshold. They named their staff, which provided for some pleasurable jokes, but probably also helped to remember the different staff types. Furthermore, the designers were able to make alterations that were more radical to the preliminary design of the hospital, than the experts were.

The designers paid a great amount of attention to the staff requirements, whereas the experts almost neglected the issue. This was the only category, in which the designers made more decisions than the experts (9 versus 3 decisions, see Appendix 7). The designers made big changes to the hospital layout but did not contribute much to the information distribution or tools categories. They had six discussions with respect to information distribution, but made no decision in this category. Another category producing many discussions amongst the designers (13), but few decisions (2) is the tools category (see Appendix 7). This seems a surprising result as the working field of industrial designers deals with appliances and not so much with architecture and work processes. However, probably the designers focused on the unknown process first, to create sufficient insight for themselves with the aim to generate products fitting the processes as a following step. If they had had more time available, designers would probably have engaged with the appliances as well.

8.5.5 IMPLICATIONS

Choosing the right participants for the right goals

While both design projects confirm the quality of the HEAD game to enable participants to get a complete overview of complex work processes, access their knowledge and experience during the game play, and imagine novel design ideas no matter the type of participants, project managers need to pick the right group of participants for the pursuit goals. If the goal is to verify and slightly improve a basic design blueprint, then a group including several practice experts seems to be the right choice. However, if the goal is to generate more innovative and novel design results, using a group of mainly designers seems to be more promising. Probably, a mixed group approach (as advocated within Participatory Design) or a sequential project approach would work best. In a sequential approach, first, a group of designers could be selected for the HEAD game to generate the big picture ideas and afterwards a HEAD game workshop could be organized with a group of experts, probably in combination with designers, to change or improve the concepts and finalize the details of the design.

The HEAD game and professional designers

The HEAD game was originally developed to make non-designers envision future situations and in this way enable them to make informed design choices. The motivation to include non-designers in the design process was to make use of their extensive practical experience and knowledge. While the design project confirmed that the designers were as capable as the experts to generate useful ideas about the mobile hospital design, it is not obvious that the HEAD game has direct value for professional designers. Product designers are used to prepare themselves for the design process by doing research regarding the problem field and envision future situations in their own way, e.g., by writing scenarios, sketching, and prototyping. In other words, they do the same basic steps that are implemented in the HEAD game. However, the HEAD game might still be a useful addition to the repertoire of tools, techniques and methods of any designer for three reasons:

- the HEAD game allows designers to include other designers, who may not be working on the same project without the need to give them an extensive introduction to the topic,
- the HEAD game allows designers to include an expert in the workshop (similar to the project developer in the mobile hospital design project) to concurrently develop ideas and verify their feasibility, and
- designing and producing the HEAD game itself is a form of model making that can help the designer with the understanding the design problem and reveal areas that need improvements.

8.6 DISCUSSION

The second design project was initiated to explore the relevance of the design game outside of a genuine participatory design approach, to reconfirm the design game's usability and ability to empower the development of feasible design solutions for a distinct design problem, and to provide insight about the relevance of the design game outside of a genuine participatory design approach with (a) participants with knowledge and expertise relevant to the use context, but no stakes, and with (b) designers who possessed design skills, but had no expertise relevant to the project. The first result was that the HEAD game proved to be successful in terms of effectiveness and satisfaction about the use of the game in the mobile hospital project, as it did during the SWING project. Both workshops lead to useful design results and all participants judged the procedure of the HEAD game very favourably. Even though both participant groups did have no stakes with respect to the subject of the game, the game's results were fruitful. However, the participants might have had indirect stakes with respect to participating in the game, that might have influenced their intensity of participation: Participants might have had stakes with respect to demonstrating their expertise in front of peers (especially in the expert session) and with respect to showing the researcher that they are of good will to her personally. However, it is safe to conclude that the HEAD game can be used to great effect in both a participatory and non-participatory context to elicit excellent design results. A condition might be, that the participants have stakes with respect to the game workshop.

As a second result, it was found that there were significant differences in design results, attitudes, game-play behaviour, and key topics discussed between the designer group and the expert group. While the design results from the expert workshop were useful, they were judged less innovative than those of the designer group according to the project developer. Initially the expert group was sceptical about the game but quickly changed their mind during the workshop and ended up enjoying the gaming. The designer group took to the gaming approach from the start. While the designers kept neatly to the HEAD game procedure, the experts were prone to digress towards telling stories from their experiences and engage in discussions that were more general rather than the design issues at hand. The designers paid a great amount of attention to the staff requirements and the hospital layout, whereas the experts focused more on issues regarding equipment and materials.

While the comparison of only two workshops does not provide enough evidence to rule out other confounding factors, the results of the mobile hospital project together with the project SWING allow us to draw some conclusions about the use of the HEAD game in projects. Firstly, the project managers need to align the choice of the participants with the expected type of design results. The mobile hospital project and SWING showed that practice experts tend to focus more on the details and less on the big picture changes, while the designers in the mobile hospital project went the other way. Secondly, it is expected that the HEAD game is also a useful addition to the repertoire of tools, techniques and methods of professional designers because it especially allows for efficient collaboration.

Interesting future research avenues are a more detailed analysis of optimal group compositions for different project goals as well as the value of a sequential project design approach including different groups of participants, consecutively.

9 CONCLUSION & REFLECTION

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9.1 INTRODUCTION

The aim of this research was to support healthcare organisations and in particular hospitals in reorganising themselves by supporting the design of healthcare environments and activities.

Under the pressure of a changing patient population and higher competitiveness, hospitals are forced to change the way they work, introduce new IT technology, build new facilities, and optimize their work processes. However, the design and implementation of improved work processes, products, and environments in the healthcare sector is a challenging task, since the stakes are high, work processes are complex and spread over different specialist areas, and resistance to change among staff is common.

In this thesis a holistic design approach to developing and implementing new work processes, work environments, tools, and appliances for healthcare providers was developed that addresses the challenges. The contributions of this research are fourfold: (1) the development of the Healthcare Environment & Activity Design (HEAD) game to enable practice experts from healthcare to explore complex design problems, elicit tacit knowledge, and derive creative design solutions, (2) showing that the developed game has a high overall usability and ability to empower the development of feasible design solutions, (3) assessing the usability and benefits of a participatory design approach and showing that by carefully implementing the HEAD game in a participatory design project approach convincing staff commitment can be achieved, (4) verifying the value of the design game for applications outside of a genuine participatory design approach and to develop guidance about which kind of participants are suited for different project aims.

Healthcare Environments and activities are a rather complex subject, including the scheduled and unscheduled activities of the activity flows and the components of healthcare environments that are participating in these activities. The components are (a) persons with various roles and (b) tools and appliances, and the (3) space and the locations were activities take place. Currently, healthcare environment and activity design is typically divided among different specialists. However, healthcare environment and activity design would benefit from a less fragmented, holistic design approach in - at least – the early design phases. A holistic approach in the early design phases should generate an overview of how the involved elements are linked in daily practice, to prevent unconsidered effects from design efforts from one specialist area to the other.

To acquire a good overview about how the different elements are linked in healthcare environments and activities, practical knowledge and experience from the healthcare domain are essential. To furthermore prevent difficulties when developing and implementing changes in the way people do their daily work, staff should have a say in how these changes are shaped. The need for practical knowledge and experience in healthcare as well as for commitment to implementing changes, calls for inclusion of practitioners in the design process. Therefore, a Participatory Design approach was proposed. To enable practitioners to participate in the design process and to provide a holistic approach, the use of a design game was put forward. To include all the elements of healthcare environments and activities and take account of the specific characteristics of the healthcare domain, a dedicated design game was proposed. The developed HEAD game offers such a dedicated approach and is still flexible enough to be applied to different design problems in the context of healthcare environment and activity design. Two real-world projects within the context of healthcare environment and activity design were used to (1) analyse the developed design game's overall usability and power to enable the development of feasible design solutions, (2) assess the usability and benefits of a participatory design approach, in particular with respect to staff commitment and (3) explore the relevance of the design game outside of genuine participatory design approaches.

To conclude the research this chapter starts with a summary of the findings (Section 9.2), followed by a discussion of the research approach taken (Section 9.3), before discussing the design game and the participatory design approach and proposing future research directions (Sections 9.4 and 9.5). The thesis closes with a brief summarized conclusion about this research (Section 9.6).

9.2 FINDINGS

Both the two real-world healthcare environment and activity design projects conducted within this research were used to analyse the developed design game's overall usability and power to enable the development of feasible design solutions. Project one was set up as a participatory design project to assess the perceived benefits of such an approach. It was about the redesign of the nursing work processes for a new building of a major Dutch hospital. The project, referred to as SWING, was a large project with 54 project members, who all had relevant knowledge and expertise as well as stakes in the project. The project included over thirteen workshops and was completed over the course of two years.

The second project dealt with the design of a mobile hospital for disaster situations and was set up for Holland Medical Services, a Dutch company. It was used to explore the relevance of the design game outside of genuine participatory design approaches, to reconfirm the game's benefit for a distinct design problem and to develop guidance about which kind of participants are suited for different project aims. To this aim, two design game workshops were held with (1) participants with knowledge and expertise relevant to the use context, but no stakes, and with (2) designers who possessed design skills, but had no expertise relevant to the project.

First the findings with respect to the HEAD design game will be summarized, second the findings about the Participatory Design approach.

9.2.1 DESIGN GAME

This research made three contributions with respect to design games for healthcare environment and activity design: (1) a dedicated game design, (2) testing the game's usability in different projects addressing different kind of design problems, and (3) testing the game's usability in different contexts with varying groups of participants.

Game Design

The HEAD game was developed for an application in generative workshop sessions. In such HEAD game sessions a group of users is asked to use the game materials to develop, alter, and re-enact use scenarios in order to solve an assignment regarding a new product or work environment. In the design of the game the use situation properties "activities and their chronology", "roles", "responsibilities", "tools and appliances", "space and location", and "chronology" are included. The game aims to provide a holistic overview of a (future) use context and the corresponding activity task-flow. The newly developed HEAD game achieves this by a novel combination of task-flow analysis and role-playing of work process scenarios in a miniature game environment. The miniature environment is a physical representation of the people and places involved in the work environments and the scenarios. The task-flow keeps track of the chronology and timing of tasks with the help of task-flow cards. The game employs basic scenario's as well as events, which aim to disturb the basis scenarios. Together, scenario's, events and the game material provide for a concrete context of a healthcare environment to simulate and evaluate ideas. The game provides tangible game elements as boundary objects which enable the participation of diverse stakeholders and to elicit tacit knowledge. The analogue version of the game is relatively cheap to produce and mobile.

Usability of the game in different projects

The usability of the developed HEAD game for the design of healthcare environments and activities was tested in the two projects, each addressing different design problems. Both projects convincingly showed the effectiveness and quality of the HEAD game for the generation of novel and feasible design solutions. In both projects, there was a focus on the design of the work procedures including scheduled and unscheduled tasks together with the requirements for tools, staff, rules, and information management.

In project SWING the game was used to develop products, task flows, and software for four different problem areas that focused either more on scheduled or on unscheduled tasks. The majority of participants in SWING evaluated the HEAD game as effective, appealing, and useful in the evaluation interviews. This positive evaluation could be attributed to a bias of the participants: They got a lot of attention in the project and probably were therefore generally positive about the project and everything in it, also the game. Yet, in addition, interviewees pinpointed specific advantages of the game, e.g., that the game provided a realistic overview of the total use situation and made it easy to contribute. In the mobile hospital project the focus was on developing the hospital layout and the corresponding task-flow. According to the number of design results and testimonials of participants, the HEAD game again performed favourably in terms of effectiveness and user-friendliness.

The designers in the designer workshops of the mobile hospital project were right to observe that the game does not cater for a good overview of needed capacities of personnel and appliances. The game currently focuses on the activity flow of one person, or of a limited number of people around one treatment. The design of a procedure from the perspective of one person, either the nurse in the SWING project, or the patient in the mobile hospital project, is very good supported by the HEAD game, because the game evolves along the tread of the task flow. Design questions with respect to logistical capacities, which deal with parallel processes, and the resulting needs for capacities should be answered by the use of different approaches. They require a specific expert approach, which generally cannot be expected to be delivered by healthcare practitioners. However, the healthcare and activity design game can deliver practice proof input scenarios for such an approach.

Usability of the game in different contexts

The HEAD game was applied with different groups of stakeholders to explore their way of doing in the game play and results. It was applied in a participatory context with (1) real stakeholders in project SWING, and in the mobile hospital project with (2) practice experts without stakes and with (3) designers. Overall, the results indicate that the HEAD game is highly useful to elicit usable design results for both scheduled and unscheduled use situations for different problem context as well as with different groups of participants (stakeholder, practice experts but no stakeholders, and designers).

However, differences were observed between designers and non-designer practice experts with respect to design results, attitudes, game-play behaviour and the topics discussed. The expert groups in both, the SWING project and the mobile hospital project were sceptical about the gaming approach at first but quickly changed their mind during the workshops. The designer group took to the gaming approach from the start. While the designers kept neatly to the HEAD game procedure, the experts were prone to digress towards telling stories from their experiences and engage in more general discussions rather than the design issues at hand. The designers in the mobile hospital project paid a great amount of attention to the staff requirements and the hospital layout, whereas the experts focused more on issues regarding equipment and materials. The mobile hospital project and project SWING showed that practice experts tend to focus more on the details and less on the big picture changes, while the designers in the mobile hospital project went the other way. Hence, while the design results from the expert workshops were useful, they were judged to be less innovative than those of the designer group.

9.2.2 USABILITY AND BENEFITS OF THE PARTICIPATORY DESIGN APPROACH

Besides testing the HEAD game, project SWING was set-up to evaluate the usability and benefits of a participatory design approach (including the HEAD game) for healthcare environment and activity design. The present research showed that combining the HEAD game with a participatory design project approach was effective in increasing stakeholder commitment. It was also evaluated as an effective and satisfying approach to produce useful design input for the future nursing situation.

To verify the actual realisation of participation, the degree of participation in SWING was evaluated with project participants. SWING was perceived as a genuine participatory project with respect to its impact (the evaluation scope and number of decisions), agency (the solidarity and willingness of participants), and the benefits it delivered to participants. Interviewees had, however, concerns about whether the organization will follow-up on SWING and will use the project results from SWING. These are concerns with respect to the unknown future, but as the new housing project manager has expressed her intentions to take along the recommendations from SWING, we consider SWING as it is covered by this research as a genuine participatory design project.

Benefits of the Participatory Design approach

The main success of the participatory design approach was the channelling of an organizational change process, providing commitment and involvement to the building project. These benefits expressed themselves through the stimulation of a thinking process about the new situation amongst the staff, the willingness to change, more commitment of the staff to the building project, and the generation of a participant platform group that can be employed in follow-up projects.

Besides these benefits for the organization, interviewees in SWING considered that they individually benefitted from the project. They learned about the work practices of other stakeholders or at other departments and about the possibilities of new technologies, they exchanged experiences with fellow colleagues from other parts of the hospital, they felt that their ideas and concerns were listened to and they got a better insight into their own work and a new, critical perspective of it.

Usability of the Participatory Design approach

The majority of interviewees in the SWING evaluation interviews had a positive stance towards the project and think the approach is worth repeating, be it in a down-sized version. In project SWING the workshops were conducted in two series that each had their own value in the project. The first workshop series, intended for the development of first concepts, resulted overall in more results and laid the base by identifying a number of important fundamental concepts and find bottlenecks in the combination of the current work processes with the new building. In workshop series two, intended for the detailing of initial concepts, more innovative ideas were generated.

Project SWING was rated to be an effective approach to produce useful input for the future nursing processes, even though the results were less innovative than some interviewees had been hoping for. Interviewees furthermore confirm that project SWING provided a satisfying way for project members to engage with the future nursing work processes. Interviewees were content with their role in the project and enjoyed the games and the exchange of experiences. With respect to efficiency, a slight majority of interviewees in the evaluation interview think that the costs and benefits are in balance, or can be in balance, if the results are used by the organization. This not unambiguous rating of the efficiency of SWING is not surprising, as there is no comparable approach and hence no benchmark to compare SWING to. Furthermore, SWING had many participants, and this high number was probably not necessary for idea generation. However, the need for many participants is inherent to the aim to generate commitment and bring in different perspectives into the project.

It is difficult to measure the long term effects of the participatory engagement on a project and its implementation, but the gained commitment and signalling problems in an early design phase due to the inclusion of practitioners points toward a clear benefit of a participatory design approach.

9.3 DISCUSSION OF THE RESEARCH APPROACH

The research approach of this thesis can be characterized as applied field research, employing two real world design projects. Mixed data collection methods were used to collect mainly qualitative data about the two projects.
The advantages of research based on real life projects are that "conditions" such as participants with real stakes only exist in the real world and that some effects, e.g., commitment effects and unexpected disturbances, can only be observed in real life. However, since real-world design projects are usually time consuming, it was not feasible to do a significant number of design projects within the timespan of the present research project. Hence, while the generalizability of the results of this research is limited by the number of projects conducted, it is furthered by the fact that the conditions for the workshops were not controlled; they represent real world situations.

Accordingly, a disadvantage of using real world projects for research is that conditions cannot be controlled as in a lab setting. Effects can be observed but cannot conclusively be linked to causes, due to uncontrolled variables. However, the internal validity as well as reliability of the research was supported by triangulation between the different data sources.

This research had to end before the design results from the projects got implemented. Hence, it was difficult to measure the success of the design outcome, since the quality of design results can best be assessed after implementation. An indirect evaluation approach was chosen in which design results were rated by the researcher, by participants and in SWING also by the project manager and the project commissioner, and the outcomes were compared. It would be interesting to assess the project results once more, after implementation in a few years.

Besides the general challenges of the chosen research approach, three points for discussion regarding the research approach can be identified: (1) Evaluation interviews in SWING were only conducted with participants who had participated in all workshops and were selected randomly. A limitation of the present approach is that the interviewees were all participants who had completed the project. Participants who left the project early were not interviewed for their reasons. This might result in a positive bias of the appreciation of SWING and the HEAD game. (2) In SWING it was an aim to let every project participant fill in a questionnaire after each workshop to achieve comprehensive sampling. However, the number of workshop participants decreased over time due to cancellations, and participants did not fill in their identifiers consistently, which resulted in decreased internal validity and the need to use an between subject analysis. (3) For practical reasons, it was not possible to use a control group for the questionnaires. Therefore confounding effects cannot be ruled out in the questionnaire results. However, questions about the work situation were included next to questions aiming at participants' evaluation of the project and their self-efficacy and creativity, to rule out events outside the project influencing the responses.

9.4 THE DESIGN GAME: DISCUSSION AND FUTURE RESEARCH

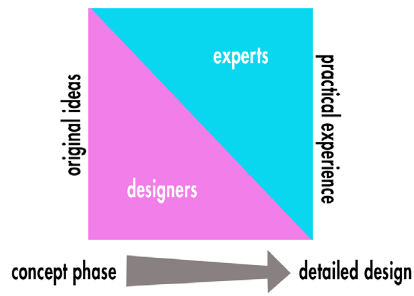
The research findings indicate that the HEAD game is usable for defining design proposals in healthcare environment and activity design. In this section, limitations and recommendations with respect to the game, its applicability and the game participants will be discussed and future research directions will be proposed.

9.4.1 PARTICIPANTS

Separating game quality from participants' ingenuity
The quality of the HEAD game was verified with an analysis of the workshop results with real-world participants from practice. From a research perspective this implies that it is very difficult to identify which results of the game can be credited to the ingenuity of the participants and which to the characteristics of the game. Vice versa it cannot be clearly discriminated, if lack of innovativeness in the experts group is also due to deficiencies of the game for use with that specific participant group. While the workshop results of different groups of participants were analysed, the overall number of sessions was not high. Furthermore, it was not possible to control the conditions for the workshops for practical reasons. However, future research might address these issues with a higher number of smaller-scale projects.

Practice expert participants ability to deal with uncertainty
The HEAD game was designed to compensate for the practice experts' lack of experience with the use of design tools. The game has proven to enable them to envision and manipulate the future situation. However, in the SWING project, most project members were observed to have a hard time to deal with the uncertainties and iterations, which are common to design processes. Dealing with these aspects are typical qualities professional designers learn to deal with in their education. The importance of diverging and converging solutions and iterating in order to deal with uncertainties is emphasised in what is currently called "design thinking". Designers use a random looking approach of familiarizing themselves with the (use) situation and explore the problem by gathering information from various sources to inform new frame creation (Dorst, 2011). This process is enabled by skills such as to act even when there is a complete lack of information, the ability to communicate with people from other specialist fields and to integrate their input, as well as "retaining focus on realising the product throughout the process", (Stappers, 2007, p.83). This way of "design thinking" seems to be needed on top of

Figure 9.1: The qualities of designer and expert participants in relation to the different phases of the design process



envisioning the future situation in order to deal with uncertainties and eventually come up with innovative concepts. As it is impossible to circumvent uncertainty in case participants are expected to produce any design results by themselves instead of only filling in an already described concept, it might be useful to spend effort on familiarizing project members to "design thinking", before starting with the actual project problem. However, grasping the "design thinking" concept takes time and experience and it is unclear whether this can only be achieved by people who have specific talent. It would be interesting to explore whether a "serious game" with the goal to the introduce practical experts to dealing with uncertainties by diverging, converging and iterating, would have an effect on their ability to deal with design problems with many variables and enable them to come up with more innovative ideas.

Practice experts versus designers

The analysis showed that practice experts and designers play the design game differently and come to different types of design results. The differences in their game approach and outcomes suggest that it could be useful to include these types of participants in different phases of the design process. If the goal is to verify and improve a basic design blueprint, a group including several practice experts seems to be the right choice. However, if the goal is to generate more innovative and novel design results, using a group of mainly designers seems to be more promising. Designers could be included in the beginning of a design project to develop original overall concepts, and the experts could be included in the detailing phase to use their experience to detail the design and remove flaws that are expected to mismatch practice (see Figure 9.1). Alternatively, a mixed group approach or an alternating approach are possible as well.

In SWING, a design phase, executed by experienced designers between the first and second workshop might have been useful to stimulate participants to look further beyond today's practice in their solution generation. Designers could have profited from their less biased view to generate a number of conceptual re-designs of the nursing workflow, employing the results from the first design workshop series. In the second workshop series, these designs could have been presented to the SWING participants and used as a starting point for their own ideas. However, this approach would have made project SWING less participatory, which might have affected the positive commitment and involvement results. Interesting future research avenues regarding this issue are a more detailed analysis of optimal group compositions for different goals of the HEAD game as well as the value of a project design approach in which sessions with designers and practitioners alternate.

The properties stakes, practical knowledge and experience, and designer skills represent a small number of participant characteristics. Especially, when including real stakeholders in a design project, their function and position in an organization are also relevant properties to consider. A differentiation based on this property has not explicitly been made in the present research. In SWING employees working at the wards, within facilitating services as well as middle managers participated in the workshops. Differences in areas of interest and approach were noted during the workshops, but not systematically analysed. More elaborate exploration of the differences between participant approaches to the HEAD game based on their function and position is recommended to provide further guidance to participant selection.

9.4.2 GAME ACTIVITIES

Individual activities

In order to prevent exposing any weaknesses of participants, no individual activities were requested during the design game workshops of project SWING. This precautionary measure was used because some participants voiced their concern during the SWING visioning workshops about their own ability to contribute to the project. While a reasonable approach at the time, some brainstorming studies indicate that results from creative group sessions generally benefit from starting with individual activities to help participants sort out their own ideas before they have to listen to others (Mullen et al., 1991). Whether adding individual activities to the procedure of the HEAD game improves the final design results requires more research, since design games are different from the brainstorm sessions mentioned in the literature.

Estrangement

The desire of the participants for clarity, clear aims and boundaries in the process, asked for a linear and focused approach in SWING. As a result, the HEAD game did not contain an estrangement component to explicitly stimulate participants to consider ideas that diverge from the current situation. While the second workshop series used a brainwriting technique for that purpose, it came rather late in the project, as it was decided to first get the participants used to the idea of participating. In the mobile hospital project, the workshops with practice experts might also have benefited from an estrangement phase. However, as an additional estrangement phase also means additional effort, there is most likely a turning point where too much effort goes into trying to make practice experts think and act as professional designers instead of concentrating on their quality, which is contributing their practical knowledge and experience. However, the question whether an earlier and more intensive estrangement phase may lead to more innovative results is an interesting issue that would need to be investigated in future research.

9.4.3 DESIGN PROCESS

Capacities

The capacities of facilities, staff, tools and appliances are an important element in the design of healthcare environments and activities, in order to ensure that scheduled patients and emergency admittances can be treated. While the HEAD game does allow for a holistic overview of the use scenario from the perspective of a single role (e.g., the nurse in project SWING) or with the focus on a single treatment procedure (Garde & van der Voort, 2009), it is very difficult for the HEAD game to keep track of procedures happening in parallel on a whole department or even hospital level at the same time. Instead, these procedures must be accessed sequentially. As a result, the HEAD game does not directly deliver insight into the capacities needed for the proposed solutions. This issue was echoed by the designers in the mobile hospital project. Design problems that deal with parallel processes and ask for capacity requirements need different approaches. Here results from an operations research approach could be used and then validated with the HEAD game. Another idea is to use a virtual version of the HEAD game to automatically keep track of specific movements of people and material through the building and other relevant variables that can then be used for calculations (as has been done with the walking distances in SWING). Further research into how the idea generating HEAD game could be combined with a quantitative, capacity focussed assessment approach seems promising.

Problem solving versus opportunity searching

Starting with the current use situation as the point of departure for the design game can lead to a problem-solving approach instead of an opportunity searching approach. In SWING, nurses were asked to start by playing the current workflow on the game board depicting the new building to familiarize with the building design and detect problems that would occur in the combination of the current workflow with the new building. This step might have stimulated workshop members to mainly solve the problems they encountered in this process instead of looking at the opportunities the new building had to offer. However, it is unclear whether the participants could have dealt with directly designing a new task flow and would not have performed this step by themselves anyway to become familiar with the problem.

Iteration and serendipity

Design is not a linear process, but a back and forth of idea creation and an exploration and re-framing of the problem. The HEAD game was developed to immediately engage participants in the game, draw their attention away from delving into discussing concerns, and produce practical results. As a result, the employed approach was very structured and divided the complex design problem in a number of smaller problems by the use of topics, the focus points, different steps in the design game, and the use of guiding questions. While the structured and linear approach of the HEAD game in SWING helped the participants to gain access to the complex problem, the approach left less room for iteration and for serendipitous findings. However, every step in the game does allow for iteration, and to what extent this is actually achieved depends on the participants and the skills of the facilitator to stimulate reflection. Serendipity in the design process might not be explicitly catered for by the game setup, but variety in ideas was ensured by bringing together various stakeholders with different perspectives.

Degree of freedom

A general challenge in design, but especially when including non-designers in the design process, is that participants must on the one hand be facilitated to come up with creative solutions, and on the other hand be restricted by boundaries to ensure that created solutions are feasible. It is, therefore, important to find an appropriate degree of freedom which does not hinder creativity but still leads to useful results. In the SWING workshops a set of game-rules was used to ensure that the created concepts would be in line with decisions that had already been made in the building process. More research on balancing the two dimensions in the context of the HEAD game might improve the game structure.

9.4.4 OUTCOMES

Predictability

The type, number, and usefulness of outcomes are hard to predict in any creative endeavour, but especially when design outcomes rely on stakeholders instead of trained designers. Stakeholders own agendas, motives, and inability or unwillingness to let go of the current situation affect the design process. Furthermore, as the area of healthcare environment and activity design is broad, it usually is not clear in advance in what area a solution can be found, i.e., will it be a new product or a change in a work process. These uncertainties could be decreased by formulating more concrete, measurable use effects that a design solution should accomplish (see, e.g., Hertzum & Simonsen, 2011). These effects do not describe how a solution should work, but what a solution should achieve. However, this approach seems to be especially usable in improving a current situation. Projects that include large changes (going from multiple- to single person rooms) or setting up something completely new (a new treatment facility) miss reference points and introduce a great deal of uncertainty that make it difficult to define such effects in advance. Future research may be able to address this issue.

Design rationale
The HEAD game is developed as a self-documenting game that captures the design results in the task card flow and a number of different cards. Yet, the game does not always make explicit the motivations individual participants have for their decisions. When using a practical approach in which boundary objects encourage participation, all stakeholders can relate to the practical demonstrations, and advantages and disadvantages are weighed by everybody implicitly or internally. This may be a drawback, because explaining and analysing is replaced by an internal process and the need to make reasons for decisions explicit becomes less pressing. Every participant will possibly contribute to developing the optimum solution with a different priority of goals in mind. These goals could be, e.g., efficiency of the treatment, best treatment for the patient, costs or maintenance of existing structures. The bottlenecks revealed by the game while defining the solution can only give some indirect insight in these priorities. Although it might be interesting to further investigate the individual priorities, from a design perspective it is more important to know the boundaries of feasibility of a design for the whole team of participants.

Furthermore, it was observed that many useful ideas in SWING were voiced as offhand remarks, and were not documented in the workshop material. Therefore, documenting HEAD game workshops by video or written observations should become an obligatory part of the game.

9.4.5 APPLICATION OF THE HEAD GAME

Using the HEAD game with professional designers
The HEAD game was originally developed to make non-designers envision future use situations and in this way enable them to make informed design choices. One of the motivations to include non-designers in the design process was to make use of their extensive practical experience and knowledge. However, to evaluate the game's broader applicability and to explore differences between participant groups, the game was tested in different contexts with varying groups of participants. One of the groups consisted of designers. While the project confirmed that the designers

were as capable as the experts to generate useful ideas about the mobile hospital design, it is not obvious that the HEAD game has direct value for professional designers. Product designers are used to prepare themselves for the design process by doing research about the problem field and envision future situations in their own way, e.g., by writing scenarios, sketching, and prototyping. In other words, they do the same basic steps that we implemented in the HEAD game. However, the HEAD game may still be a useful addition to the repertoire of tools, techniques and methods of any designer for three reasons:

1. the HEAD game allows designers to include other designers, who may not be working on the same project without the need to give them an extensive introduction to the topic,
2. the HEAD game allows designers to include an expert in the workshop (similar to the project developer in the mobile hospital project) to concurrently develop ideas and verify their feasibility, and
3. designing and producing the HEAD game itself is a form of model making that can help the designer with the understanding the design problem and reveal areas that need improvements.

It might be interesting to see whether these benefits of using the HEAD game for trained designers materialize in the real world.

Using the HEAD game in other fields

The HEAD game was developed as a dedicated design game for the healthcare domain. However, there are other domains that deal with similar design problems and hence might benefit from the HEAD game. The HEAD game should be useful for any design problem that includes various stakeholders, appliances, information flows, and various locations, centres around procedures, but involves dealing with many unforeseen events, could benefit from a more holistic perspective, and needs to bring together different perspectives. Hence, possible application areas are aviation, the hotel and catering industry, public transportation, and event management. After having shown the applicability and usability of the HEAD game in healthcare, it seems promising to test the applicability of the HEAD game in other fields.

9.5 PARTICIPATORY DESIGN PROJECT: DISCUSSION AND FUTURE RESEARCH

This research indicates that a Participatory Design approach in the design of healthcare environments and activities provides benefits to organizations and individual participants and is effective and satisfying. In the next section the limits of Participatory design as well as recommendations with respect to participation, project organization, project management and application areas will be discussed and future research directions will be proposed.

9.5.1 PARTICIPATION

The intentions of this research to apply participatory design were not based on the ideal that everybody should be able to co-develop their own work situation, but on practical motives and the belief that stakeholders actually have relevant expertise to contribute to the design process of healthcare environments and activities. To bring together different views and to gain commitment, participants from all wards were included in the SWING project. This made the project possibly more extensive than would have been strictly necessary to gain useful design outcomes. While commitment effects of SWING were good, one may argue that they could have been achieved by, e.g., combining fewer participants with designers in the workshops, a better project promotion within the organization, and an open appeal to everybody to contribute to SWING during the project.

Practical challenges to the participation in project SWING included the limited time that healthcare professionals had available (from their own perspective) for projects that run next to their core tasks and the limited amount of hours the participants were actually cleared for the project by the management. This was overcome by organizing the project in a number of compact workshops. Several project members in SWING were replaced due to reorganizations, and a number of people left the project for other reasons such as illness, pregnancy, and retirement. However, the large participant group left enough people to continue the project.

The management style in MST hospital was of a top-down nature and so project SWING was also initiated in top-down manner from the middle management. This evokes the question whether the project participants actually rated the project important, or saw it as yet another task imposed on them by the management. Several project participants cancelled workshops or simply stayed away and did not participate in the project questionnaires. This raises doubts about the state of their motivation for the project. Although, participation of employees in the shaping of their own work situation is mostly assumed to be beneficial for job satisfaction, Smith & Carayon-Saintfort (1989) stressed that there has to be done more research on one potential negative effect of participation, e.g., increased workload. In project

SWING participants could participate during working hours to avoid potential additional workload. More research about possible negative effects of participation and the motifs for project dropouts is needed.

The SWING project was initiated by the middle management and one of the aims was gaining commitment amongst staff working at the nursing wards to a change process. Yet, gaining commitment from top management for the ideas generated in a participatory design project should also receive attention. While it seems not necessary that top-management takes part in all workshops, their participation in one session, keeping them up - to date and presenting results in an engaging way (e.g., supported by video footage) are promising ways towards top-management commitment.

For research purposes the researcher did not engage in design activities herself during the workshops. This lessened the mutual learning experience between designers and practice experts, an acknowledged benefit of participatory design. However, as the possibilities of, e.g., new technologies were introduced in special presentations during the workshop sessions and different stakeholders were brought together, there were some opportunities for mutual learning between other actors.

9.5.2 PROJECT ORGANIZATION

Visioning phase

Every project needs a goal or a vision. In SWING, a visioning workshop was used to start the project. Participants were asked to bring two items that symbolize their concerns and their visions with respect to the new building project. Discussing participants concerns was a crucial step to pave the way towards working at solutions for the project. The extracted visions did deliver guidance for developing solutions, however only on a very general level. The visions were rather generic, e.g., stating that the patient should be the focus of attention. As described above, the formulation of more concrete "effects" that should be aimed for, based on these vision statements, might have delivered more guidance for the participatory design project.

Analysis and testing in-between workshops

Project SWING was built around four series of workshops. In a participatory design project a designer or researcher can, besides running the workshops, also engage in the analysing and processing of design results in-between workshops. However, in order to leave the design outcomes completely up to the participants, in the SWING project little time was spent on analysing the results in-between workshops. Outcomes of one series of workshops were nearly directly applied as input for the next series. What did happen in-between workshops though, was adjusting the plans for the setup of a following workshop due to questions and comments of participants and results from the previous workshop.

Validating outcomes with additional parties such as doctors and giving feedback about this validation in the successive workshop could have added a valuable iteration to the design project, but would also have required more resources. If resources had been more extensive, it would also have been possible to prototype intermediate results and test them in hospital practice between the design and evaluation workshops. Such intermediate testing could have been used to find problems that do not emerge in the miniature roleplaying context, e.g., due to the scale, and to give the project more presence at the hospital. However, this approach would have needed an appropriate duration of testing in order to achieve useful results, which was not available. For SWING, the piloting and evaluation of the resulting design concepts will take place after the completion of the project. An evaluation workshop within SWING was used to select the concepts that should be tested in practice.

Project management

The project management of project SWING was led by the researcher in cooperation with a project manager from the hospital. Decisions with respect to the project were discussed with the steering committee. Meetings were prepared by the researcher, in consultation with the hospital project manager. Two steering group members indicated that they felt that they themselves had not invested enough time in the project. They had been more busy with organizational, than with content-related tasks, which did not favour the project. Content-related tasks were therefore for the most part executed by the researcher. This did increase the workload for the researcher, but the major disadvantage was that the hospital intern managers' knowledge about the hospital practice was not applied more extensively to the determination of the project content and direction.

The combination of roles (researcher, designer, and project manager) in Project SWING did bring about conflicts. Sometimes choices benefited the research side more than the design project and vice versa. For example, the researcher chose not to actively participate in creating solutions during the workshops, because that could have biased the research results. Yet, in participatory design projects that are not intended for this type of research, active engagement of the designer in the workshop is advisable.

9.5.3 APPLICATION OF PARTICIPATORY DESIGN

Application for professional- VS consumer products

Participatory design lends itself very well for application in designing in a situation, where stakeholders are clearly identifiable. Only if stakeholders are clearly identifiable, the ideal of participatory design that aims at "equalizing power relations" can be fulfilled. This makes the application of the participatory design approach for consumer products problematic, as in consumer product design it is usually not clear which individuals will be the actual users. This makes it difficult to include actual future users. Besides this practical difficulty, the democratic ideas become less relevant, because a consumer product is less "imposed" on a consumer than a work tool on a worker.

However, the design principles from participatory design, the "tools and techniques to help participants to express their needs and visions" and the "situation-based design" are applicable in consumer product design. Design tools from the participatory design context can be applied for idea generation outside of a participatory design context in creative sessions with consumers that are representative for a product target group (e.g., co-design). Results of the present research with respect to the proposed design tools, although developed, evaluated and improved within a participatory design context, can also be valuable for the consumer product design process.

Application for usability VS styling related product design aspects

Participatory design, when engaging in the development of new products, aims predominantly at discussing and fulfilling the needs of stakeholders with respect to functionality and usability. Little attention is given to product appearance aspects such as "styling" (determining the physical appearance of e.g., a product) (Lee, 2008). This might be because (a) most reported participatory design projects originate from human-computer interaction design, and (b) participants' practical knowledge and experience is considered more relevant to functionality and usability than to styling.

However, styling and usability are not separate entities of a (physical) product. Product properties with respect to styling cannot be completely separated from functionality properties; product topology, look, feeling, smell etc. affect product use, product experience, and usability. Therefore, creating the physical appearance of a product must not be considered an activity that is predominantly taking place in the product detailing phase to give the product a nice cover, but should be incorporated in the design process by making product appearance concrete through mock-ups, prototypes, and virtual reality.

However, designing product appearance in an entirely participatory approach by (1) letting participants design product appearance by themselves and (2) letting them immediately experience their designs in context in order to provide for iteration is very difficult. While the first step is difficult due to the lack of styling skills in participants, which cannot be coped for easily by design tools, the tools needed to achieve the second step could become very extensive to enable an immediate experience of designs including, e.g., colour, size, feel and weight. The more design freedom the tools and techniques need to offer, and the completer the product experience they need to provide, the more complex the tools will become. From an efficiency perspective, this again raises questions about how much effort should be put into trying to make users designers and what advantage this effort can be expected to deliver for a specific design project.

Including stakeholders and users in the evaluation of product styling is already common practice in early concept evaluation. Virtual reality can be used to let prospective users experience futures that do not yet exist or physical working prototypes with the appearance of finished products can be evaluated in the actual use context. Increasing the amount and frequency of such evaluation steps with physical or virtual representations developed by designers in the of a design project can bring more attention to styling aspects into participatory design processes. However, this is only possible, as soon as it is clear what type of solution is needed (e.g., a product or a redesign of the workflow).

Application by designers in design industry

Participatory design seems not widely applied in product design industry. Participatory design research is mainly conducted by *"experts such as psychologists, sociologists and anthropologists, who are more concerned with the effects and influence of designing than its forms"* (Lee, 3008, p.32). A consequence is that trained designers who work in practice are less likely to adopt and apply the research findings due to scepticism about the practical applicability of the research (Lee, 2008). However, the reason that participatory design is not widely applied by design professionals in practice might also have a more practical reason: The participatory design approach is not purely a design method but an idealistic approach that tends to go beyond the typical core activities of designers from an art or engineering background and probably also beyond the area of interest of most designers. It can include areas such as process-design and touches upon organizational politics, areas that designers are not commissioned for, traditionally. However, the holistic "designerly" approach of professional designers could provide benefits to these areas, if designers would take on the challenge.

9.6 CLOSING

The present research supports healthcare environment and activity design through the development of a dedicated design game, which can be applied within a participatory design approach. The developed HEAD game proved to be a usable new combination of scenario based miniature roleplaying and task flow design for holistic healthcare environment and activity design, that helps to overcome the current the fragmented view on the design problem. The game allows for accessing stakeholder knowledge and experience, and applying it in the design and the evaluation of new products, processes and spaces. Both conducted projects convincingly show the effectiveness and quality of the HEAD game for the generation of novel and feasible design solutions.

Project SWING showed that involving stakeholders in the design process in a participatory design project not only generated commitment to the building project among staff, but also produced significant secondary benefits for individual participants. Interviewees reported that they welcomed learning about the work practices of other stakeholders/departments and the possibilities of new technologies, critically thinking about their own work, and generally having a voice in the project. Overall, the majority of interviewees had a positive stance towards the project and thought the approach was an effective approach to produce useful input for the future nursing processes.

Project SWING delivered design results that were useful but not highly innovative. The research revealed that the composition of the participants affects the type of design results generated. Using the HEAD game with trained designers without practical experience in healthcare and without stakes in the project, as in the mobile hospital project, resulted in highly innovative solutions but on a rather low detail level. In contrast, the design results of the group of healthcare experts without stakes were very in-depth but lacked in innovativeness.

Overall, the thesis's conclusion is that the HEAD game is a useful combination of tools and techniques for the design and implementation of new and improved work processes, environments, and/or appliances in the healthcare sector. While the game lends itself very well to be used in a participatory design project approach to facilitate change management process, it can also be used purely for generating design ideas with professional designers.

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APPENDICES

APPENDIX 1:
SWING PROJECT: QUESTIONS INTERVIEW SERIES 2

Q1: What was the added benefit of these workshops for MST?

Q2: What were the most relevant outcomes/of what type were the outcomes?

Q3: What did you expect from the workshop and to what extent did the workshop comply with your expectations?

Q4: Did anything happen that surprised you?

Q5: What did contribute to let the workshop succeed/fail?

Q6: What were the most useful/redundant elements of the workshop?

Q7: Which people (in function) did propel ahead/impede the workshop?

(Q8: Which topics did/did not work well?)

Q9: How do you experience the cost-benefit ratio?

Q10: What should be the next step?

APPENDIX 2:
SWING PROJECT: QUESTIONS INTERVIEW SERIES 3

IQ1: What is your general stance towards the building project?

IQ2: What will be advantages?

IQ3: What will be disadvantages?

IQ4: What is your general stance towards the plans for the new ward?

IQ5: What will be advantages?

IQ6: What will be disadvantages?

(Questions 4 till 6 were left out after two interviews, because interviewees did not discern between the building project and the wards in their answers.)

IQ7: What is your general stance towards the project SWING?

IQ8: What kind of positive expectations did you have with respect to project SWING?

IQ9: To what extent have these been fulfilled?

IQ10: What negative expectations did you have with respect to the project?

IQ11: To what extent have these been fulfilled?

IQ12: Did things happen, that surprised you?

IQ13: How do you evaluate the quality of the project results?

IQ14: How do you evaluate the extent to which of the project results meet the project goals?

IQ15: How do you evaluate the quantity of the project outcomes?

IQ16: Were there results that did surprise you?

IQ17: What have according to you been the benefits/advantages of the project?

IQ18: Have there been, according to you, additional costs besides man-hours, materials, room rent etc. for the project? (E.g., stress, reputation, other projects in repression…)

IQ19: To what extent are the costs and benefits in balance?

IQ20: What are according to you the conditions to make a project like SWING succeed?

IQ21: What are according to you important aspects to enable participants to make a useful contribution to a project like this one?

IQ22: How comfortable were you with your own role in the project?

IQ23: To what extent could you bring your own ideas in?

IQ24: To what extent have you been heard?

IQ25: What do you think to what extent the in SWING gathered information will be used by MST?

IQ26: To what extent was the influence scope of the decisions that could be made in SWING broad enough?

IQ27: To what extent was there solidarity in the group of participants?

IQ28: To what extent were participants willing to contribute to the project?

IQ29: To what extent did participants personally benefit from their participation?

IQ30: To what extent did the participants get a better insight/overview of their own work?

IQ31: Were there conflicts of interest in the project, and if so, which?

IQ32: To what extent is it according to you to let employees participate in such a project?

IQ33: In what kind of activities should employees be included and in which not?

IQ34: To what extent is it according to you important, that participants benefit personally from their participation?

IQ35: To what extent is it according to you important, that participants get a better overview/insight of/into their own work?

IQ36: What is your opinion about the duration of the project?

IQ37: What is your opinion about the composition of the project group?

IQ38: What is your opinion about the composition of the participant group?

IQ39: What is your opinion about the information distribution in the project?

IQ40: How did you like the set-up of the workshops?

IQ41: How did you like the activities in the workshops?

IQ42: What is your opinion about the division of the workshops into the four topics?

IQ45: What are, according to you, the advantages of the applied game technique?

IQ46: What are according to you the disadvantages of the applied technique?

IQ47: To what extent has the use of the gam technique contributed to achieving the project goals?

IQ48: To what extent was the game technique efficient (to what extent has the technique with relatively little effort contributed to achieving the set goals)?

IQ49: To what extent do think the game technique is appealing?

IQ50: Did the use of the game technique influence your willingness to participate?

IQ51: Did the use of the game technique influence the scope and number of the decisions in the project?

IQ52: Did the use of the game technique influence the quantity of the project results?

IQ53: Is the in project SWING used approach worth repeating for MST?

IQ54: If yes, under which circumstances?

IQ55: Is the game technique applicable for other questions at MST?

IQ56: Would you advise to use the technique more often at MST?

IQ57: Can such a project be set up without extern consultant/researcher?

APPENDIX 3:

SWING PROJECT: QUESTIONNAIRE STATEMENTS

(The order of the questions was different in every questionnaire. Furthermore, not every question was in every questionnaire)

QQ1: I love to think up new ways of doing things.

QQ2: I love to read challenging material.

QQ3: I avoid difficult reading material.

QQ4: I try to avoid complex people.

QQ5: I am interested in theoretical discussions.

QQ6: I have a vivid imagination.

QQ7: I like to solve complex problems.

QQ8: I am not interested in abstract ideas.

QQ9: I know how things work.

QQ10: I formulate my ideas clearly.

QQ11: I let others determine my choices.

QQ12: I can think quickly.

QQ13: I never challenge things.

QQ14: I can handle complex problems.

QQ15: I do have a good imagination.

QQ16: Have excellent ideas.

QQ17: Let myself be directed by others.

QQ18: I am quick to understand things.

QQ19: I know what we are going to do in SWING.

QQ20: I got information about SWING in advance.

QQ21: I think that we will have a big influence on the new building project with SWING.

QQ22: With project SWING we can make an important contribution to the new building project.

QQ23: I expect, that project SWING will be a positive experience for me.

QQ24: I have negative expectations with respect to SWING.

QQ25: I expect that we will do pleasant activities during SWING.

QQ26: I expect that we will get arguments in SWING.

QQ27: I am attached to MST as work environment.

QQ28: There is little difference between departments at MST as work environment.

QQ29: I am proud to work for MST.

QQ30: There is little difference between large regional hospitals ("topklinische ziekenhuizen") as work environment.

QQ31: In the last weeks there are positive developments at work.

QQ32: In the last weeks unpleasant things happened at work.

QQ33: It is important to me to be involved with new developments concerning my work.

QQ34: The ward staff ("werkvloer") must be included in decisions concerning changes in the daily work.

QQ35: My experience is valuable for the developments of the work processes for the new building.

QQ36: I think that my knowledge can contribute a lot to the plans for the new wards.

QQ37: I am afraid, that I cannot contribute much to the plans for the new building.

QQ38: I trust the architects and planners to well set-up the new building for MST.

QQ39: I participate in this project because…

QQ40: If you have participated in a project before: The positive aspects of participating in a project team were…

QQ41: If you have participated in a project before: The negative aspects of participating in a project team were…

QQ42: I have additional comments…

QQ43: I know for which topic I am scheduled for the following workshop.

QQ44: I am content with the topic I am scheduled for the following workshop.

QQ45: I visited the SWING website.

QQ46: I reviewed the results from the previous SWING workshop on the website.

QQ47: I visited the test room for the single-person rooms.

QQ48: The boundaries for this project, which were established in advance, leave still much room to design new work processes.

QQ49: It is clear to me, on which questions we will work in SWING.

QQ50: I already knew about the boundaries for the project.

QQ51: I know how things work at MST.

QQ52: Project SWING is a relevant project for the new MST.

QQ53: In the last weeks unpleasant things happened at work (unpleasant things that are common in a hospital with sick people excluded).

QQ54: The boundaries for this project that were established in advance are worrisome.

QQ55: If you answered “agree” or “totally agree” to the previous question, please elaborate on your answer.

QQ56: I miss attention towards one or several aspects in SWING.

QQ57: If you answered “agree” or “totally agree” to the previous question, please elaborate on your answer.

QQ58: I visited the SWING website since last month.

QQ58: The boundaries for this project that were established in advance offer enough freedom for contributions by the SWING project group.

QQ59: If you answered “agree” or “totally agree” to the previous question, please elaborate on your answer.

QQ60: I think that my knowledge contributed much to the plans for the new wards.

QQ61: Please elaborate on your answer to the previous question.

QQ61: It is clear to me, on which questions we worked on in SWING.

QQ62: I missed attention towards one or several aspects in SWING.

QQ63: If you answered “agree” or “totally agree” to the previous question, please elaborate on your answer.

QQ64: My participation in SWING was a pleasant experience.

QQ65: Project SWING was a positive experience for me.

QQ66: Please elaborate on your answer to the previous question.

QQ67: With project SWING we will make an important contribution to the new building project.

QQ68: I have negative expectation with respect to the implementation of the results from SWING in the development around the new building.

QQ69: If you answered “agree” or “totally agree” to the previous question, please elaborate on your answer.

QQ70: We did pleasant things during SWING.

QQ71: Do you have additional comments?

APPENDIX 4:

SWING PROJECT: OUTCOMES PER WORKSHOP & ANALYSIS

Markers for coding innovative and fundamental concepts:

Fundamental: green

Innovative: red

Project commissioner: 1 1

Project manager MST: 2 2

Researcher: 3 3

Results Design Workshop Series 1 per workshop

	ICT & communication	Catering	Nursing process & visitors	Material logistics
Changes to nurse task flow	Group A:12 tasks (more detailed), change: more tasks at patient room instead of other rooms than currently Group B: 7 tasks	Group A: no changes Group B: one task added	Group A: two tasks moved, 3 task added (more detailing) , 3 red dots Group B: 2 tasks moved, 3 task added (e.g., talk about family contribution to care), 2 red dots	Group A: fixed moment talking to family removed, due to flexible presence of family, one task added nutrition assistant Group B: no change, no task added for nutrition assistant
tasks	- bundle tasks per patient			-daily refill of materials in patient rooms 1
Decisions w.r.t. appliances/products.	-every staff member a (half I-pad size) mobile device for phoning and viewing and editing digital patient records 1 2 2 3 -mobile device with integrated medicine scanner and Bluetooth connection to measuring appliances 2 2 - typing in patient room on cow OR docking station in patient room and on medicine- and breakfast trolley - pc's in staff room and hallway Large screen in staff room for group		-terminal in medication room -medication as much as possible prepared by pharmacy 1 -Bed-pans in the patient rooms 2 -disposable cleaning towels 1 -label printer in the utility room to print labels for blood/urine samples 1 -do not disturb sign at patient room door 1	-small stock of materials for critical situations at the patient rooms 3 -1or 2 trolleys for restocking patient rooms -cows - 5 dynamap trolleys - 3 bandage /needles etc. material trolleys - 5 laundry/ trash trolleys - 4 medication trolleys

	-Screen with information about planning which patient per room etc. at team post 2			- linen trolleys
Decisions w.r.t. software	-patient information available for all staff members who need it 1 2 -overview page in digital patient record	-nutrition plans in ICT system - intake in ICT system -ICT system/ordering can be blocked in case patient needs to fast		
Decisions w.r.t. responsibilities		-nutrition condition \of patients resp. nurse 1 2 3 -diet plan resp. doctor 1 3 -bringing food assistant (with spec. competence) 3 -feeding of patients resp. nurse, can be delegated to nutrition assistant or family 3 -assistant and nurse register patients intake 3 -ICT needs to control expire date" of patient information and send reminders 1 2 -ICT alarms if patient has not ordered or been offered food 1 -patient can order food according to nutrition plan 1 3	-responsibility for nurse to organize visiting in the interest of the patient 1 2 3 -visitors arrange for their own food themselves 1	

Rules/regulations		**-patients are not prohibited by ICT to eat unhealthy food** 3 **-fixed eating periods to provide time for control moments** 2 3	**-extended visiting hours, but not 24/7** 1 2 **-resting hour after lunch time** **-staying overnight in consultation with the responsible nurse** 1 **-visitors need to leave room during nursing procedures** **-nurse has the right to restrict visiting time or number of visitors** **-Visitors are not given care** **-nurse communicates at first with patient** 1	
Questions for organizers/management/other		-currently difference between formal responsibilities and execution differ	-training for nurses in dealing with visitors 1	-medication concept? 3 -storage primo matrasses? 3 -storage measuring equipment? 3
Bottlenecks in case of handling current processes	-staff room too small for transfer 1 2 -longer walking distances with paper patient record -limited space for talking through ward rounds -no room for working on patient records *-physiotherapist is always searching for materials to mount patient out of bed etc.* *-visiting hour and physiotherapy are at the same time now* 1	-lack of overview about which patients have ordered or what patients eat	-accumulation of tasks in the early morning even harder to realize 3 -cleaning -visitors during eating times may not be advisable 1 -changes to plans as a result of ward round often very late	

ICT & communication 1b

Changes to nurse task flow	No change
tasks	-nurse can put through call to buddy, if she cannot answer it 1 -buddy system 1 2 3
Decisions w.r.t. appliances/products.	-reserve tablets -personal tablets to take home 1 -hands-free calling (voice recognition) 1 -headset 1
Decisions w.r.t. software	-patient call goes to responsible nurse or "buddy" nurse (phone call) 1 2 -reanimation call goes to everybody (sound, text: room number) -calls from extern parties go to secretary -nurse needs assistance call goes to ward assistant and 4 nurses closest to situation (sound, text: room number) 3 -doctor calls go to responsible nurse -pop ups with changes in digital patient record 1 2 -difference between assistance and emergency call (sound etc.) 1 - address book -system links nurses patient/rooms they are responsible for 2 3 -"gps"for tracing tools and staff 1 - screen at secretary desk to see whereabouts of staff (only on request) -patient can make difference in calling nurse or nutrition assistant 1 2 -emergency call patient goes to 2 nurses 1 -video calling (one sided: nurse sees patient, patient sees photo of nurse) - do not disturb function on tablet, put through calls

Decisions w.r.t. responsibilities	
Rules/regulations	
Questions for organizers/management/other	-will there be wired phones in the patient rooms
Bottlenecks in case of handling current processes	

	Nursing process	Catering	Material logistics	ICT & communication
Changes to task flow	Group A: 16 tasks, e.g., Huddle new added 2 3 Group B: 18 tasks (more organizational tasks added such as organizing home care) ,tasks below (task section) added, 9 tasks marked as only by nurse, 2 as in some situations by assistants, 7 as by nurse or assistant	Group A: 7 tasks added for nutrition assistant, 4 needed information cards Group B: 5 tasks added for nutrition assistant	Group A: not changed Group B: not changed	No changes
Tasks	-retune planning for the next day at the end of the evening, based on care pressure + adjust next morning based on night 1 3 -more flexible individual planning with the patients for nursing tasks 1 3		-refilling of combination car by logistics or nurse 1	
Decisions w.r.t. appliances/products.	-additional cushion and blanket in patient room 1 -safe in patient room -hire cooler/other services		-Combination trolley, containing medication and sterile material per nurse 1 3 measuring appliances in patient room -disease specific material packages 1 3	-patient has portable call-unit, e.g., in wrist band, a keyboard, a remote control 1 3 - speech feedback to patient 2
Decisions w.r.t. software	-group care paths -site with personal information	-nutrition page in digital patient records, that nutrition assistants can access		-patient can view day schedule on smart TV 3 -during ward rounds controls, liquid in/outtake, appointments, medication list, lab results and nursing report etc. are immediately accessible -pharmaceutical compass & pump protocols can be

				looked up -medication scanning with tablet 1
Decisions w.r.t. responsibilities	-more tasks should be delegated to ward assistant -have patient organize home care with transfer point themselves 1 -flexible nurses who can work in the whole hospital be distress -STIP nurse (layer between ward manager and nurses, organizing and flexible available) 1 3			
Rules/regulations				
Questions for organizers/management	-how to receive emergency medication 1 3 -Will there be a bed pan cleaner in the isolation rooms 1	-patient oriented nutrition - keep nutrition assistants connected to ward: preserve expertise 3		
Bottlenecks in case of handling current processes	-discharge is not good organized			

Overview coding per category DesignWorkshop Series 1

	nursing processes	catering	material logistics	ICT & communication	
Changes to nursing activity flow	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
new tasks	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1/0
Appliances/ products	0 0 0 0 0 1 2 2 2 0 2 2 0 0 0 0 0 3	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 1 1 1 2 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3	5/8
software	0 0 0 0 0 1 0 0 0 0 0 2 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/2
responsibilities	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 1 0 1 1 1 2 0 0 0 0 2 3 3 3 3 3 3	0 0 0 0 1 1 0 0 0 0 0 2 3 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3/13
rules/ regulations	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 3 3	0 0 0 1 1 1 0 0 0 0 0 2 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/7
points of attention management	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 3 3	1/3
Bottlenecks in case of handling current processes	0 0 0 0 1 1 0 0 0 0 0 2 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 3	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/5
important fundamental concepts	Project commissioner: 4 MST project manager: 4 Researcher: 1 Sum: 9	Project commissioner: 3 MST project manager: 2 Researcher: 8 Sum: 13	Project commissioner: 9 MST project manager: 2 Researcher: 1 Sum: 12	Project commissioner: 0 MST project manager: 0 Researcher: 4 Sum: 4	Project commissioner: 16 MST project manager: 8 Researcher: 14 Sum: 38
innovative concepts	Project commissioner: 0 MST project manager: 3 Researcher: 0 Sum: 3	Project commissioner: 2 MST project manager: 1 Researcher: 0 Sum: 3	Project commissioner: 2 MST project manager: 1 Researcher: 1 Sum: 4	Project commissioner: 1 MST project manager: 0 Researcher: 0 Sum: 1	Project commissioner: 5 MST project manager: 5 Researcher: 1 Sum: 11

Overview coding per category DesignWorkshop 1b

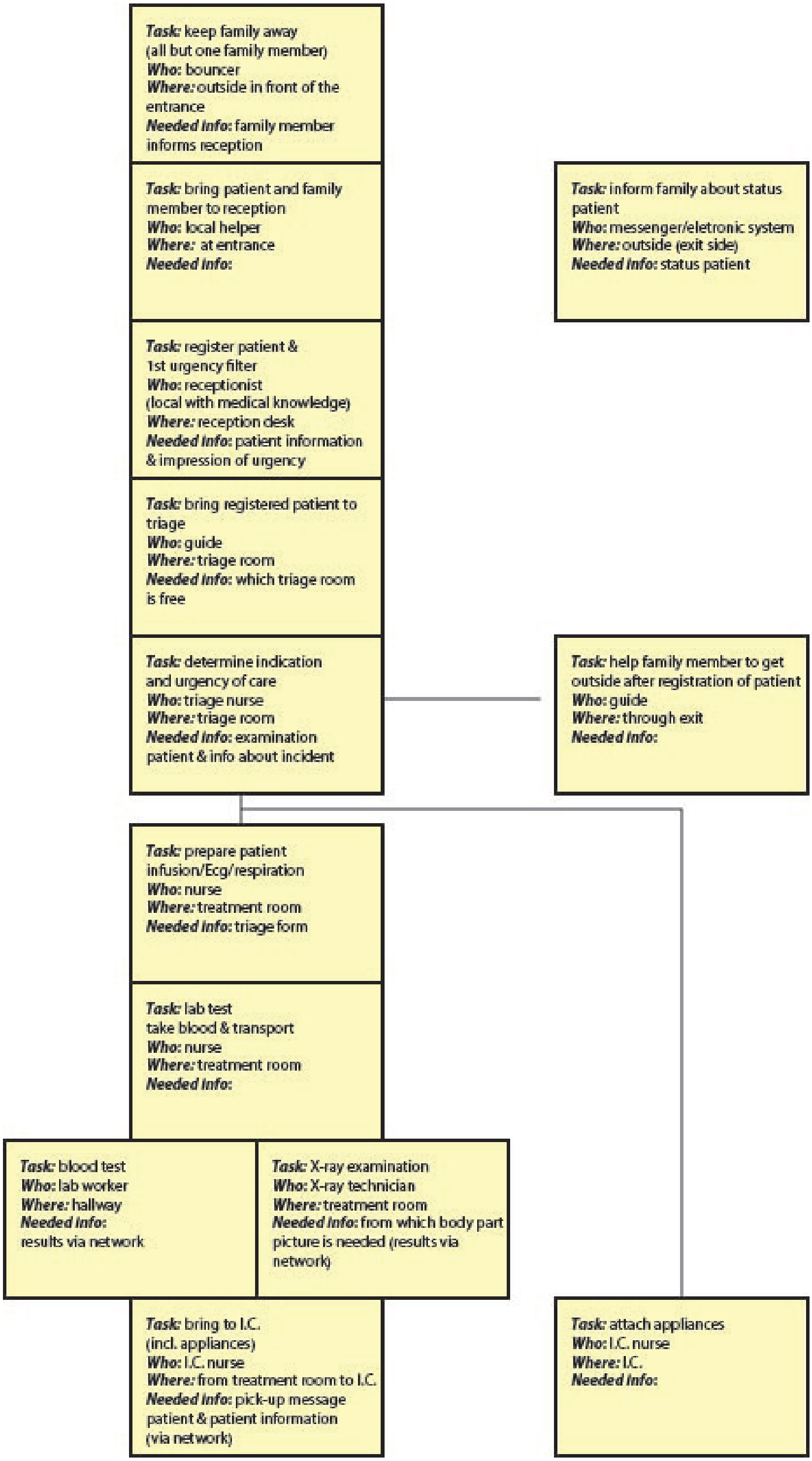
	ICT & communication	
Changes to nursing activity flow	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
new tasks	0 0 0 0 1 1 0 0 0 0 0 2 3 0 0 0 0 0	1/3
Appliances/ products	1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0	1/2
software	1 1 1 1 1 1 2 2 0 0 2 2 3 3 0 0 0 0	5/7
responsibilities	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
rules/ regulations	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
points of attention management	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
Bottlenecks in case of handling current processes	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
important fundamental concepts	Project commissioner: 9 MST project manager: 3 Researcher: 0 Sum: 12	
innovative concepts	Project commissioner: 2 MST project manager: 2 Researcher: 3 Sum: 7	

Overview coding per category DesignWorkshop Series 2

	nursing processes	catering	material logistics	ICT & communication	
Changes to nursing activity flow	0 0 0 0 0 0 2 0 0 0 0 0 3 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1/0
new tasks	0 0 0 0 1 1 0 0 0 0 0 0 3 3 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2/4
Appliances/ products	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 1 0 0 0 0 0 0 0 0 0 0 3 3 0 0 0 0	0 0 0 0 0 1 2 0 0 0 0 0 3 0 0 0 0 0	6/2
software	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 1 0 0 0 0 0 0 3 0 0 0 0 0	1/1
responsibilities	1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 3	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1/2
rules/ regulations	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
points of attention management	0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 3	0 0 0 0 0 3 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/4
Bottlenecks in case of handling current processes	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0/0
important fundamental concepts	Project commissioner: 6 MST project manager: 0 Researcher: 2 Sum: 8	Project commissioner: 0 MST project manager: 0 Researcher: 1 Sum: 1	Project commissioner: 1 MST project manager: 0 Researcher: 0 Sum:1	Project commissioner: 2 MST project manager: 0 Researcher: 0 Sum: 2	Project commissioner : 9 MST project manager: 0 Researcher: 3 Sum: 12
innovative concepts	Project commissioner: 1 MST project manager: 1 Researcher: 3 Sum: 5	Project commissioner: 0 MST project manager: 0 Researcher: 0 Sum: 0	Project commissioner: 2 MST project manager: 0 Researcher: 2 Sum: 4	Project commissioner: 0 MST project manager: 1 Researcher: 2 Sum: 3	Project commissioner : 3 MST project manager: 2 Researcher: 7 Sum: 12

APPENDIX 5:

MOBILE HOSPITAL PROJECT: DESIGNER TASK FLOW



APPENDIX 6:

MOBILE HOSPITAL PROJECT: ACTIVITY ANALYSIS TABLE

Designer session

Legend:
Q= Question
S= Story
D= Discussion
CH= Change/ Decision
Facilitator action
Project developer action

Number of cases played: 1
Number of extreme cases played: 1

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
Explanation why more nurses than doctors are needed						
Explanation about weight hospital						
It is hard to have an opinion as a healthcare layman						
				Triage in front of waiting area?		
Explanation about treatment rooms and triage						
				Stricter pre-selection and removal of reception?		
				Should a staff room be in the reception tent		
				Removal of reception tent		
				Administration in front of hospital		
				"Eftelink" barriers		
				Roof for barrier area?		
				Keeping tents clean without extension tent?		
				Corridor in front of entrance		
		Staff in front of corridor				

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
			Chairs needed in reception?			
				D: bottleneck in corridor, additional entrance needed?		
				Turn triage tent 90 degrees		
				Entrance right and left of triage tent		
				Should all tents be of equal size, or can the triage tent be smaller?		
2 triage rooms can be removed						
				City hall principle with waiting numbers		
				Separated triage rooms needed?		
Yes, triage must be done per individual, without spectators						
Explanation: triage is done by nurse						
		One nurse per room?				
Four nurses are enough						
	Where does the patient go from the reception?					
Nurse escorts patient						
	Triage nurse picks up patients?					
		More or less nurses than triage rooms?				
On nurse can work several triage rooms						
	Who brings the patients?					
That does not need to be a nurse						
		TOM: patient escort				
There must be administration why someone needs to go to O.R.						
Triage cards?						
Shows short movie that explains triage						
	What to do, if everything is full, but serious cases are brought in? queue in front of O.R.					
But appliances are standing there in the hallway						
			Missing stretchers?			
These are stored in the technic room						
	Were to leave seriously ill patients on stretcher?					
Explanation about types of stretchers						
			Mobile stretchers (wheels)			
			Car needed to transport patients from O.R. to I.C.?			
Think we need 3 per O.R.						
				Where is the cleaning?		
In the hallway						
				Can the hallway be bigger? Two bigger units for triage and hallway?		
Will we also get problems with the size of the IC?						
			Number of beds needed hard to estimate			
If it is not enough can't a helicopter bring additional material?						

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
You want that the whole hospital as a unit is attuned.						
Explanation about facilities for first 48 hours.						
There are also people, who must be kept for observation.						
What to do with patient that cannot be treated anymore						
				Unit for patient that cannot be treated anymore		
				Observation can be done in IC		
There are also people who must be kept for observation						
			So we do not have enough beds			
Story about American hospital ship						
			Stretchers as emergency beds			
			Bunk beds?			
			Storage room idea: push beds together			
			How much room is needed in-between beds?			
Satisfied with this set-up?						
First patient: earthquake, 29 year old unconscious with many family members						
		Picking up person game pieces: bouncer needed				
	Keep family outside					
	On family member accompanying?					
	On family member accompanying					
		Need someone for guiding patient				
		Logistics people (TomToms)				
	Brings patient and family member to reception					
	Brings family member outside, after registration					
					Keep family up-to date about developments?	
			Bench outside for the family			
		messenger				
			“Schiphol” digital info board			
				Where is the best place for the family		
	Inform family					
		Should receptionist be a local?				
Receptionist must also assess medical situation						
	Register patient and first filter for urgency					
		receptionist (local)				
Patient with broken arm will be treated!						
	Bringing registered patient to triage room.					
	Determine indication & urgency care					
Now you sent off the family member, who knew what happened						
					Type ticket at reception?	
	Letting family member inside?					

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
I think that that is important here						
	Tom keeps on walking hence and forth, should he also do security tasks?					
	Tom should also do security tasks					
		Need for two Toms				
			Place patient on a cart			
		4 Toms				
	You want to know for sure, that family has left hospital					
	Use family member for transport patient					
Family member must leave as soon as possible						
		How many Toms				
You do not always think in worst case scenarios						
Explanation stretchers						
	Examination of patient with echo					
		Nurse and doctor in treatment room				
2 doctors, one in each treatment tent						
			Appliances needed			
	Prepare patient					
Explanation about labelling patient						
Explanation about nurse's tasks						
If patient is not breathing, should he first go to triage?						
Patient is not breathing						
Explanation: patient can go from triage to O.R.						
Explanation about laboratory test						
	Lab test: take blood					
		Lab worker				
	Blood test					
Explanation about X-ray						
				Location lab		
Explanation: Lab also for IC						
					Information transmission from lab	
Explanation about duration blood test						
Suggestion digital information distribution						
					Digital information distribution possible	
Processes						
			Smart tablets			
	X-ray examination					

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
Explanation X-ray appliance and numbers						
					Tracking appliances with network	
Story about X-ray test with phantom						
Story about bodies exposition						
Asks project developer to suggest a condition for the imaginative patient						
Project develop names condition						
	What must happen with the patient					
Explanation treatment possibilities						
	Bringing patient to IC, inclusive appliances					
Then you have to go through triage again						
Is position of treatment rooms good?						
				Triage tent gets position in front of hospital		
				Larger hallway between tents and O.R.		
		Here is what staff located?				
		Farther on in hospital only medical staff				
					Information distribution between staff	
Question to facilitator, if patient case is closed						
Yes						
Positioning appliances can also on IC						
	Positioning appliances on IC					
				Back exit for people who do not make it		
				Emergency exit		
Extreme situation: several people die in first few days without clear indication why						
				Where do we put people that cannot be treated anymore		
Is task of the hospital?						
Question to facilitator, whether this is task of hospital						
Facilitator gives example how specialist group dealt with the problem						
Comment about the quality of the game						
What are we going to do about people dying without obvious reason?						
Story about cholera in Haiti						
				Should parts of the hospital be separable for quarantine		
				Option to create a lock		
				Use of lock		
				Should the mortuary be taken with the hospital in the first flight		

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
I would take it, it is part of the medical process						
				Bodies can be placed somewhere else, the hospital should usually be placed close to a developed area, mortuary is a waste of weight capacity		
Story about Mogus						
				Modular system, essential elements in 2 containers, mortuary, T4 tent etc. in optional container.		

Expert session

Number of cases played: 3
Number of extreme cases played: 1

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
Explanation of mobile hospital						
			Story about Haiti			
				Biggest problem is transport hospital		
Let's go to the design problem						
Explanation of scenario step in the game						
				Mortuary is missing		
			Cooling needed for blood products			
			Cooling blood products in Afghanistan			
			Use cell safer			
			Walking blood bag approach in the US			
Explanation about altering the hospital and the playing pieces						
				Addition of mortuary and cold store for blood products		
		Where to put into action specialist doctors				
		AMC uses locals and a minimal team of doctors				
		Americans do lots of amputations, therefore locals are needed to explain, that the Dutch have a different approach				
Explanation of plans for mobile hospital						
Target group of local hospital						
UN, we need to work together						
fast transportable system is needed, there is a market for the mobile hospital						
What is the team needed						
		Depends on the capacities aimed for				
Explanation of capacity of mobile hospital						
		Aim for operations VS of supply injured people				
Concurrence between Israelis and Americans for Media exposure in connection with financing						
Potential mobile hospital						
			Water cleaning system			
Story about visit of MOGOS						
Story about amputations by doctors sans frontiers						
Let's go back to staff deployment and set up the ideal team						
		Due to raids locals as guards				
Introduction first patient case: pregnant woman						
What country are we Islamic or not						
Picks playing pieces of people						
	Tag patient and register with system					
	Patient to examination room					
Who is joining?						
	A basic doctor and a nurse are joining					
Moving playing pieces of persons						
	Check if child is alive					
			Need ultrasound			
			X-ray or ultrasounds			
			Mini-ultrasound			
			Ultrasound			
				Part to develop pictures is missing		
Explanation about digital x-ray pictures						
			Availability of electricity for appliances			
			Often no electricity available			
			Transport x-ray			
			Need for several mobile x-ray units			
Explanation that appliances are stored in the hallway						

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
				Appliances in docks		
				Appliances are kept out of walking zones by docks		
Builds dock in the model						
				Where can blood be tested		
			One test appliance in examination part, one in O.R. and I.C. part			
Builds figures, asks player to build test appliance						
					Printing results, where are records stored?	
How about digital system						
					Advantages/disadvantages digital system	
			Electricity for all appliances			
			System gets flooded			
					On paper	
					Electronic does not work for disaster sites, but maybe in hospital digital and outside on paper	
					Keep administration of opiates for NL	
					Double system	
					Double system with digital information inside hospital and printed outside	
O.R. team away-> general hospital loses a few hundred thousand Euros						
Back to the patient						
What is the result of the examination of the man, he needs to go into O.R.						
Imagine all O.R.'s are in use						
	Patient goes to examination room for operation					
				Rebuild examination room to clinical setting		
How does the patient get anaesthetics						
	Infusion and respiration					
			Small respirator in treatment rooms			
Picks game piece as respirator						
				utilization examination room		
Ketamine etc.						
				Examination room also setting for small operations		
				2 times small set-up for operations in examination part of hospital		
Should there be a higher air pressure						
				Higher air pressure only in O.R.'s		
	After several days it will be cleaning infections					
New situation…						
But patient is not ready yet						
	Patient goes to recovery room					
What happens in the meantime with the accompanying person?						
	accompanying person gets send away during operation, can come back afterwards					
Hence, we need a place for the family?						
				Family does not need to stay next to the entrance		
				Locals must stay out of the system, at some distance outside the hospital area a sunroof and water (built with the playing pieces)		
Next patient: Flood, old man and child						
Places playing pieces of persons close to the entrance						
	Triage is not needed, we have enough capacity					
		But then we have two teams occupied				
		Specialist team for the man, a nurse and a AMA for the child				
Puts playing pieces in place						
What is the condition of the man						
	Make thorax picture of man					
	Ultrasound of lungs can be more sensitive than x-ray					

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
			X-ray and fast ultrasound available			
	Vital functions of man and child need to be monitored by appliances					
Picks appliance game pieces						
			Fixed or mobile connection for O^2			
explanation O^2 generator						
			PVC bottles for O^2			
What is the condition of the man						
	Man goes to IC					
			Monitoring appliances must belong to hospital part, but must be mobile within that part			
	What to do with the child					
	Ultrasound of the head					
				Where are the nursing wards		
These are flown in later						
				MC/IC gets full fast, so there must be a low budget ward, which must be accessible from inside the hospital		
				Addition low budget ward		
Builds ward						
				Set-up of other mobile hospital		
				I.C./M.C. getting full -> additional ward		
				Ward accessible from inside the hospital		
				Haiti operation part and separate tent		
				Exit for patients to ward in examination part or close to reception		
					Must be kept information about where every patient	
					At military they must always go by the reception	
				Attaching tent to examination part, what about family who wants to get in		
Suggestion to combine the examination tents and place a ward at the other side						
				Loss of compactness for placement at location		
Suggestion for location ward tent						
				Placement of ward tents next to reception with connection		
				On day 14 you cannot treat all patients anymore		
				Capacity and placement wards		
				Revalidation camp		
				Capacity I.C./M.C.		
30 I.C. beds available						
		Staffing I.C.				
				Capacity I.C.		
What to do with chanceless patients						
How long to go on with treatment						
						Restriction _ after 3 days patients must leave
				I.C. bed costs lots of many a day in NL		
				Dhow many I.C. beds considering the costs		
Depends on the client						
						after 3 days patients must leave
Children are hard to deal with, 3 day rule does not work when patients are children						
						Treatment max. 3 days
Next patient:: Man with panicky family						
Picks playing pieces						
	Local helps with communication					
	No need for triage					
	Need infusion and ultrasound					

Session	Task (new/who/ chronology)	Staff	Material/ appliance	Set-up/tents	Information	Rules
	Man hoes to examination room with basic doctor and nurse					
	Taking blood, making ultrasound, connecting to monitoring appliances					
		Security personnel must be in place before setting up the hospital				
				Tent/ physical barriers to hinder people		
Creates barriers						
What is the condition of the patient						
			Need CT, but that is impossible			
	What treatment					
Hospital ship of the Americans						
treatment						
	Place man on M.C./I.C.					
Neurological injuries are difficult to treat, just monitor						
Hospital ship of the Americans						
Extreme situation: Many patients (48)						
				Triage in the field or inside the hospital		
				Triage in field		
Facilities for chanceless patients and people who are not allowed inside the hospital						
				Place for peaceful dying (T4 tent)		
					Register T4 people or not	
					Register T4 people, but do not create a complete record	
Let them get into hospital or not						
				T4 tent		
Creates T4 tent						
				Location tent close to family place		
		One nurse at T4 tent				
	Other patients go into special triage					
	T1: stabilize either in examination tent or on I.C.					
	T2: in the other examination tent					
	T3: first aid in the field					
Nice to have practical experience and nice to share it						
Finish the patient treatment						
	Worst cases go from I.C. to O.R.					
			How about linen			
Bringing along linen for 24 hours						
			How much linen to bring			
			Linen for 2-3 times use of the beds			
			Sanitary facilities			
			garbage			

APPENDIX 7:

MOBILE HOSPITAL PROJECT: ACTIVITY ANALYSIS OVERVIEW OF NUMBERS

Expert Session

	beyond goals	tasks	staff	tools	hospital set-up	information distribution	rules/regulations	sum
stories	8	2	4	8	5	2	0	29
discussions	13	3	4	13	21	6	2	62
decisions	0	23	3	7	12	3	1	49
sum ->	21	28	11	28	38	11	3	140
ratio decisions/ discussions	0,00	7,67	0,75	0,54	0,57	0,50	0,50	0,79

Facilitator actions 27	Project developer actions 19	46
Facilitator stories 0	Project developer stories 1	1
27	20	47

Designer Session

	beyond goals	tasks	staff	tools	hospital set-up	information distribution	rules/regulations	sum
stories	1	0	0	0	1	0	0	2
discussions	8	12	8	13	18	6	0	65
decisions	0	15	9	2	12	0	0	38
sum ->	9	27	17	15	31	6	0	105
ratio decisions/ discussions	0,00	1,25	1,13	0,15	0,67	0,00		0,58

Facilitator actions 11	Project developer actions 41	52
Facilitator stories 1	Project developer stories 4	5
12	45	57