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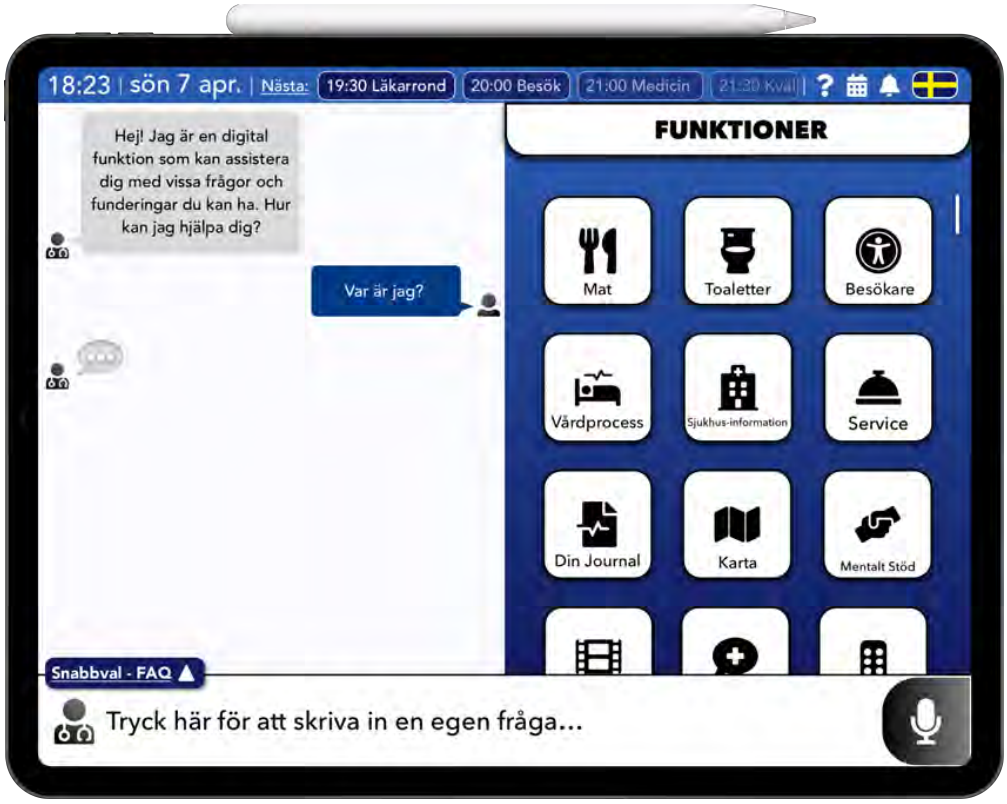

A chatbot-based graphical user interface for hospitalized patients

Empowering hospitalized patients with a patient-centered user experience and features for self-service in a bedside tablet

Master's thesis in Interaction Design and Technologies

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Gothenburg, Sweden 2019

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Cover: Embedded screen of interactive Hi-Fi prototype in an iPad Pro

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Abstract

Hospitalized patients often feel left out and uninformed during their treatment. Published scientific research and statistics points at several factors where digitization is able to make way for a better and foremost patient-centered healthcare. In order to promote a healthcare that is considered patient-centered it is furthermore of importance to make them participants in their healing. The findings of a performed design process promotes the fact that it is not only vital to thorough understand their needs and expressed requests, but also provide features for comfort. Furthermore, six categories of features have been defined in: *Accessibility*, *Amenities*, *Hospital Services*, *Modularity*, *Privacy* and *Treatment Services*. Suggestions have been provided for each category and are motivated by published scientific research as well as findings from the performed design work.

Keywords: bedside tablet, chatbot, features, graphical user interface, healthcare, hospitalized, interaction design, patients, prototyping.

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Johan Levin, Gothenburg, June 2019

Contents

List of Figures

List of Tables

1
Introduction

The phenomena of digitization is becoming increasingly prevalent through the rapid integration of digital technology into diverse aspects of both professional and personal life (Konttila et al., 2018). Its progressive transformation of all industries is providing new facilities to change the way value is created, transferred and defended against competitors (Gastaldi and Corso, 2012). This is in particular no exception regarding the digitization of healthcare where digital tools are considered central to healthcare innovation (Habran et al., 2018). Digitization is not only contributing to organizing our lives and influencing how we communicate and work, it also influences how we use healthcare (Lee and Meuter, 2010). While healthcare systems worldwide are becoming financially unsustainable and technological innovations become inseparable from healthcare there is an imminent paradigm shift (Meskó et al., 2017).

The complexities of today's healthcare demands, regulatory requirements and rising expectations from consumers' are continuously met from healthcare providers through adoptance of various technologies (Lee and Meuter, 2010). Furthermore, the technologies and digital innovations applied within healthcare are most often categorized by the technological device being relied on or the embedded technology (Habran et al., 2018). Digitization is in its essence the integration of Information and Communication Technology (ICT) and within healthcare most of the literature is focused on the factors of benefits, barriers and determinants of adoption without exploration of how it is accomplished (Gastaldi and Corso, 2012).

Hence, digitization of the health sector is more than a passaging trend and potentially very beneficial for all stakeholders, especially enabling a major change in how doctors and patients communicate (Menvielle et al., 2017). The enhancement of hospital performance through digitization could not only be beneficial in increasing the cost-effectiveness, but also improving the quality of care (QoC) as well as enabling personalised patient care (Konttila et al., 2018).

Supplying both caregiver and caretaker with essential health information is of high importance and a report made by Inspektionen för vård och omsorg (IVO) in 2014 implies that in many cases the flaws of the information transfer has led to critical consequences for the patients (IVO, 2018). IVO also suggests that in order to overcome the current flaws in communication a major focus has to be put on providing patients with better information.

Historically, prior the advent of digitized healthcare, the treatment of healthcare

data was exclusive to the relationship between patient and doctor, characterized by information asymmetry due to the patient's lower sensitivity and uncritical entrustment of the doctor's management of personal data (Tuzii, 2018). The patient was hence not involved in the decision making about their own health and disease management, but with the emergence of digital health the roles are now being redefined for both patient and caregiver (Meskó et al., 2017).

It has been shown that the optimal approach for delivering care and improving its outcomes is achieved by engaging patients in their own healthcare (Maher et al., 2016). Digital tools that provide patients with more control over their health and reduces administrative burden for healthcare professionals, can ultimately support a shift from an institution-centric to patient-centric model (Vassilakopoulou et al., 2016). In order to reduce information asymmetry, promote transparency and increase engagement the patients' should hence be provided with access to their own healthcare data (Maher et al., 2016). However, engagement preferences should not be seen as universal, and it is of importance to take patients' individual preferences for engagement into consideration (Jerofke-Owen and Dahlman, 2018).

A shared decision making should be seen as the foundation of a patient-centered care, and in order to achieve this the critical barriers between clinicians and patients must be broken down by educating patients about the essential role they play in decision (Barry and Edgman-Levitan, 2012). Nonetheless, the act of engagement is a dual responsibility of both provider and patient (Jerofke-Owen and Dahlman, 2018).

What patients' have shown to be of value is having easy access to their electronic health records (EHR) in order to make appointments, request refills, check medication lists, access laboratory and test results, as well as asking non urgent medical questions (Jerofke-Owen and Dahlman, 2018). Meanwhile, the report *A journey towards smart health - The impact of digitalization on patient experience*, made by Deloitte in 2018, shows several indicators of how patients want to be engaged, informed and connected to all stakeholders within the healthcare system, further stating that mobile solutions will play a crucial role (Deloitte, 2018).

Digitizing health services is a relational, co-creative process between service actors that goes beyond the design of interactive artefacts (Vassilakopoulou et al., 2016). Furthermore, the form factor of information devices and the design of user interfaces affects the doctor-patient dialogue (Alsos et al., 2012).

1.1 Problem Description

The company *ÅF Consult AB* and its division *ÅF Digital solutions* is investing in a research project that is based on developing a chatbot for improving communication between hospitalized patients and institutional healthcare. The project is performed in collaboration with *Verklighetslabbet* at *Sahlgrenska University Hos-*

pital (SU), which is a facility for testing healthcare innovations in daily practice. Furthermore, Verklighetslabbet aims at creating space for collaboration between patients, healthcare staff, enterprises and academic institutions (Innovationsplattformen.vgregion.se, 2018).

Verklighetslabbet has enabled access to a department at SU for researching and testing, which is further referenced in this thesis as *department [xx]*. The reason of making this specific reference is made as a means of considering potential privacy related issues. However, information about Verklighetslabbet and its activities are publicly available since it is funded by the Swedish government's innovation fund *Vinnova* (2019). Further ethical considerations are presented in the subsection *1.6 Ethical Issues*.

ÅF Digital solutions is hence in need of help in the next iteration of the project, where the chatbot is supposed to be implemented as an application on a tablet attached to a hospital bed. At the moment the chatbot missing a well designed graphical user interface (GUI) and most of the interaction is done through text typing in a chat window on a desktop browser. Hence, they are searching for assistance in designing a GUI and a user experience that allows patients to gather information through self-service and having the requested information visualized properly.

Sveriges kommuner och landsting (SKL) states the fact that a well working and safe healthcare requires a well working communication between patient and caregiver, listing several important factors in the guide *Råd för bättre kommunikation - mellan patient och vårdpersonal* (english: Advice for better communication - between patient and caregiver) (SKL, 2018). The relevance of a patient-centered digital tool for automated communication between hospitalized patients' and institutional healthcare is linked to the aim and research question of the thesis, suggesting features to consider in a patient-centered GUI.

1.2 Stakeholders

Chalmers University of Technology - conducts research and offers education in technology, science, shipping and architecture with a sustainable future as its global vision (Chalmers University of Technology, 2018). The university is liable and credited for the academic outcome and scientific results of the performed master´s thesis.

Johan Levin - the student performing the master´s thesis. Aiming at contributing to research within the field of interaction design and delivering a proposed solution to the given problem in the shape of a *High Fidelity* (Hi-Fi) prototype. The developed prototype will involve a graphical user interface that aims at empowering patients to self-service of information from institutional healthcare.

ÅF Consult AB - ÅF is an engineering and design company based in Europe with business and clients all over the world. The company is separated into four divisions: Industry, Infrastructure, Energy and Digital solutions. The divisions' are offering

engineering and consulting services across three main sectors: energy, industry and infrastructure (ÅF Consult, 2018). The thesis is being done as part of a project at ÅF Digital solutions that is based on developing a graphical user interface for a mobile chat bot application to be used in institutional healthcare by hospitalized patients.

Sahlgrenska University Hospital (SU) - provides emergency and basic care for the Gothenburg region, and its 700,000 habitants, and highly specialised care for West Sweden, with 1.7 million inhabitants (Sahlgrenska, 2018). SU will primarily be acting as a possible site for research and user testing.

1.3 Research Question

This thesis explores how patients experience hospitalization and how they are able to participate in their healthcare. The work has furthermore been based on the process of design thinking and performance of research through design. Hence, the research question of this thesis is:

What features should be considered when designing a chatbot-based graphical user interface for hospitalized patients?

As a clarification the concept of a *feature* is considered to be based on the following definition by Chen et al. (2005): *"a product characteristic from user or customer views, which essentially consists of a cohesive set of individual requirements".*

1.4 Aim

This thesis aims at presenting research from scientific literature and user studies in how hospitalized patients experience various communicative aspects within institutional healthcare. In a more narrow scope this thesis aims at exploring how hospitalized patients are able to participate in their own treatment and the experienced implications of digital automated communication. Hence, the main focus of the work has been put on patient-centered care and how digital technology plays a role in communicative aspects for hospitalized patients.

Research and prototyping will provide deeper design insights that are of importance for digital automated communication between hospitalized patients and institutional healthcare. Hence, a Hi-Fi prototype in the shape of a GUI will be designed and tested in order to validate the essential features that should be considered in a digital tool that enables hospitalized patients with self-service of information.

1.5 Delimitations

This thesis will provide guidelines and suggested features for a patient-centered GUI that is based on a backend involving a chatbot and artificial technology (AI). However, the thesis will not involve any research or prototyping that examines or discusses implications of use of AI in the form of algorithms or applied machine learning (ML). This specific delimitation is also considering data processing and the thesis will be limited to information visualization in regards of the patient-centered GUI.

The work has as described a patient-centered focus, hence other stakeholders within institutional healthcare will not be the primary focus. However, data gathering was done through the performance of interviews, surveys and user tests with hospitalized patients and staff within institutionalized healthcare. The outcome of the data collection is limited to the chosen methodologies and the access to stakeholders and departments.

The prototype will not be fully functioning and connected to the backend in order to generate any real data. Its structure, however, will be presented for the purpose of illustrating the logic behind the GUI. Hence, the visualized information on the GUI will represent real data that could be presented in real life to patients with different illnesses. The prototype is not considering any specific hardware or software, but is created as a touch interactive application on a tablet of general size (9,7 inches). Hence, the GUI is restricted regarding the responsiveness, in part due to its attachment onto the hospital bed next to the patient.

1.6 Ethical Issues

Due to the fact that the work is reliant on access to patients it is of high importance to consider ethical issues regarding private data and security. The data collection that was performed at *department [xx]* at SU were in all phases done with consideration of full anonymous identity. Hence, the participants in interviews, surveys and user tests were never asked about any personal information, therefore also not published.

The student performing the master thesis, Johan Levin, has signed a non disclosure agreement in regards of confidentiality with the stakeholder ÅF Consult AB. The work will raise questions regarding accessibility and communicative struggles when implementing a GUI with the purpose of automating the communication between hospitalized patients and institutional healthcare. Hence it was of importance to take this into consideration during the research and in the design of the prototype.

2
Background

Based on findings from scientific literature, reports, and related work, this chapter will provide a context in relation to the problem description as well as research support to the upcoming theory chapter. Initially, a brief description of dialogue systems and chatbots is given. Further is a presentation of the current state and research area in how digital technologies assist the communication between hospitalized patients and institutionalized healthcare. Lastly, it is of importance to study what kind of interactive digital technologies and related work that has been developed for the specific purpose of automating the communication between hospitalized patients and institutional healthcare.

2.1 Interactive Dialogue Systems and Chatbots

The expanding field of Human-Computer Interaction (HCI) research have brought about multiple concepts of multimodal interaction and artifacts are progressively being based on intelligent adaptive interfaces in contrast to action or command based, and active in contrast to passive interfaces (Srinivasan and Madheswari, 2018). GUIs on digital gadgets have until today mostly been interacted with hand-gestures or external hardware, for instance by clicking a button, scrolling, or swiping. However, the recent proceedings in development of interactive dialogue systems and chatbots enables interaction through strings of text in natural language, often in the context of messaging applications (Følstad and Brandtzæg, 2017).

In its essence, chatbots belongs to the class of software that is considered to be intelligent and conversational, involving the capability to interpret text, voice, or both (Radziwill and Benton, 2017). According to Pereira et al. (2016) chatbots are often related to the term dialogue system, but differs in its application where chatbots has its main focus on mimicking the conversation and not on the underlying technology to perform natural language processing (NLP). Chatbots are nonetheless able to perform and execute tasks, being activated through the input of natural language, hence they are not just capable of providing conversational output as response (Radziwill and Benton, 2017).

Designing and developing a chatbot is a matter of qualifying it to the seemingly impossible task of outputting plausible answers to the user's requests and interactions. However, the designers and developers of chatbots can take advantage of numerous tricks to simulate intelligence and understanding toward the user (Pereira et

al., 2016). Furthermore, many chatbots on the market are implemented in GUIs of various messaging services while the possibilities for self-service through pure voice interaction are steadily becoming the reality (Følstad and Brandtzæg, 2017).

2.2 Research Area

In relation to the area of health a wide range of digital communication systems have been developed during the last two decades (Griffiths et al., 2018). A systematic use of digital technology within healthcare can bring a lot of value to health management by supplying individuals with new tools that enables access to relevant information and analytics (McKinsey & Company, 2016). Furthermore, by adapting the information to the individual needs, it is possible to support patients in their decision making and preparing for consequences of treatment while increasing adherence as well as improving trust and satisfaction (Stuij et al., 2018). Respecting patients privacy preferences is of high importance and ultimately decides the realization in whether digital technologies has a positive impact on the healthcare (Caine et al., 2014).

Digitizing healthcare is a transformation creating new roles for both patient and caregiver, conclusively making differences in traditional and modern healthcare appear more clearly (see *Table 2.1* collected from Meskó et al. (2017)). However, even though digitization has been fast-paced during the last two decades, the introduction of digital technology for interactions between patient and healthcare provider has been slow (Vassilakopoulou et al., 2016).

Traditional Medicine	**Modern Medicine**
Point-of-care is the clinic or lab	Point-of-care is the patient
Based on populations	Based on the individual
Hierarchy	Partnership
Prescriptions and orders	Collaboration
Data owned by institutions	Data owned and shared by the patient
Individual experience dominates	Limitless data analyses
Physicians as authority	Physicians as guides
Ivory tower	Social media
Expensive	Costs driven down by Moore's law

Table 2.1: Differences in traditional medicine and modern medicine - (Meskó et al., 2017).

2.2.1 Experienced Problems

Within the institutional healthcare there are issues reported in the recent years that, directly or indirectly, affect communication. The access to viewing test results, looking up medication, managing appointment times and asking non urgent medical questions are a few examples of services not always offered and described for hospitalized patients (Jerofke-Owen and Dahlman, 2018). Management of medical records is described as a major general issue due to supporting systems that are of bad quality and burdened with information (IVO, 2018).

Today, medical records are defined as EHRs (Electronic Health Records) that digitally collect and disperse patient health information to a variety of recipients, often without informing the patient about the content and its distribution to different stakeholders (Caine et al., 2014). Hospitalized patients have expressed the wish of knowing more about what is going on behind the scenes and taking an active engagement in information seeking for continuous discussion with the healthcare team (Jerofke-Owen and Dahlman, 2018).

A major challenge for maintaining quality and safety is to engage patients routinely in the decision making, and in order to handle it, critical barriers between caregiver and patient must be broken down (Barry and Edgman-Levitan, 2012). According to a study made by Jerofke-Owen and Dahlman (2018) on how patients experience their engagement in healthcare while hospitalized, patients feel confusion and frustration when individual preferences for engagement are not assessed.

A potential issue is considered to be that healthcare professionals do not have the competence to incorporate new digital solutions into clinical practice (Konttila et al., 2018). A major risk within critical communication is the transfer of information where, for instance, the responsibility of the patient and the patient's information is transferred to new staff (IVO, 2018). If the patients trust to the healthcare giver is low regarding privacy of their health information, they are likely to engage in risky behaviours affecting their own health by, for instance, refusing to discuss problems openly, delaying care, lying to their providers, and skip seeking care (Caine et al., 2014). Hence, the administrative challenges and digital competence affects the communication, eventually affecting care and treatment of the patient (Alsos et al., 2012).

2.2.2 Benefits and Possibilities

Digital interaction between patient and caregiver can not only contribute to improvement of health, enhancement of quality, and reduction of costs, but also provide the patient with more control and reduce the caregivers administrative burden (Vassilakopoulou et al., 2016). Today, the communication itself can be done on a range of digitally connected devices through the use of various applications such as e-mail, text messaging, social media, websites or video calls (Griffiths et al., 2018).

However, most digital services that have previously been launched are focused on the

patient side without the connection to institutionalized healthcare (Vassilakopoulou et al., 2016). Hence, the new digital technologies and applications offered, does not necessarily mean that all of them are suited as tools for communication between patient and healthcare provider, making it important to decide a format that fulfill each stakeholder's preferences (Jenssen et al., 2015). In order to diminish the risks within communication and transfer of information it is important to not just follow a set of rules for digital implementations, but also to establish a well founded culture of how communication should be practiced (IVO, 2018).

McKinsey & Company (2016) declares that an important aspect of this work is to increase the cooperation and information exchange between caregivers in municipalities and counties in order to establish an integrated chain of caring around the patients. Institutionalized healthcare is knowledge-intensive and only operates at its best when communication and transfer of information is fully functioning, and if not it can result in unintended and difficult consequences (IVO, 2018).

Digital technologies that enable connectivity, automation and advanced analytics will contribute to a sustainable cost efficiency that can meet the future demands of healthcare, besides just increasing the quality of care and making it patient-centered (McKinsey & Company, 2016). One of the experienced benefits with digital technologies has been its contribution to timely communication, making improvements for both patients and staff, with their respective priorities and preferences, in engaging with the right person at the appropriate time in order to enable effective condition management (Griffiths et al., 2018).

Regarding automated communication within institutionalized healthcare there are three specific areas that could benefit from digitization: integrated journal systems, optimization of flow of patients and staff allocation (McKinsey & Company, 2016). Automating these areas while making the patient well informed, for instance about planned procedures, test results, diagnostics, and medication, ultimately makes them participants and an asset in the care while reducing many risks.

2.3 Related Work

In regards of work related to the purpose with the thesis and its established research questions, the scientific community and commercial products contribute to the process in separate ways. Several related scientific studies have mainly tried to explore the effects of digital interaction on communication and quality of care while the commercial products on the market are not connected to institutionalized healthcare.

However, both fields make a contribution in trying to answer the research questions. By providing scientific insights about what factors that are of importance during the design phase and how the commercial products are publicly received the outcome will provide more extensive answers on the subject of matter.

2.3.1 Related Studies

Regarding access and security of EHRs, Caine et al. (2014) performed a study where thirty patients with data stored in an EHR were interviewed. This was done in order to derive user needs of patients in the design of a user interface (UI) that records patients' preferences of data accessibility for other stakeholders. Stated as an experienced problem, patients rarely knew what the EHR was containing, but wanted to be able to control the accessibility of their personal information and be notified when it was accessed. Based on the interviews the authors were able to derive six implications for designing a patient-centered digital tool that enables individual management of disclosure in their EHRs:

- Easy Patient Access to EHR Data
- Summary of What is Currently Shared With Whom
- Provide Granular, Hierarchical Control
- Time-Based Controls
- Contextual Privacy Controls
- Access Notifications

It has also been shown that the choice of digital interactive tool predetermines how communication between patients and caregiver is constructed. Alsos et al. (2012) researched the effect of user interface and form factor on communication between doctor and patient, resulting in the identification of three components of successful collaboration and communication: **(1)** *face-to-face communication*, **(2)** *non-verbal communication* and **(3)** *action visibility*. The components identified will be affected by the choice of information device as seen in *Table 2.2* down below, where a comparison was made between a paper chart, PDA and a laptop on wheels. Furthermore, the authors (Alsos et al., 2012) concluded their findings in three factors that rests on the ability to configure awareness: **(1)** *the physical form factor*, **(2)** *the UI of the information device* and **(3)** *the physicians communication practice*.

Information device	Face-to-face communication	Nonverbal communication	Action visibility
Paper chart	**High:** Easy to reestablish eye contact	**High:** e.g. closing chart signals end of ward round	**High:** Actions are highly visible for the patient
PDA	**Medium:** Requires more attention, but easy to re-establish eye contact	**Low:** Very little nonverbal communication observed	**Low:** All actions appear similar.
Laptop on wheels	**Low:** Physician turn away from patient during usage	**Medium:** e.g. moving trolley signals end of ward round	**Low:** All actions appear similar

Table 2.2: Implications on components by choice of information device (Alsos et al., 2012).

Regarding hospitalized patients the authors (Alsos et al., 2012) further discuss the properties and affordances of digital information devices at the point of care. The term affordance, in the stated scenario of communication between hospitalized patients and healthcare staff, is declared by Gibson (Ware, 2013) as what an environment and its related objects offer as possibilities of action to the person acting in it. Since the term hospitalized patient implies the patient is being tied to a hospital bed the affordance is lying, but it also affords a place to put tools on for the doctor when needed, while the table next to the bed affords a place for nurses to put medicine on

as well as affording a place to keep belongings for the patient (Alsos et al., 2012).

When designing a digital tool for communication it is not only important to analyze and design an interface and the physical form factor, but also to take the surrounding environment and factors outside the tool itself into consideration. Vassilakopoulou et al. (2016) performed research on digital interaction between patients and healthcare providers from a service design perspective, bringing valuable insights from two cases based on designing tools for digital appointment management.

When designing digital interactive tools that involve interactions between patient and caregiver there are some factors that are of difference for it to be sustainable and inclusive. Based on the data collection and analysis of the two cases Vassilakopoulou et al. (2016) managed to identify four different design directions from a service design perspective where technical capabilities :

- **Do not need to be "all inclusive":** *shift attention beyond the digital touchpoints.* Digital capabilities do not need to cover all information exchanges, but it is of importance to analyze what parts of the service that will be electronically supported and what parts that will not be.
- **Do not need to be fully predefined:** *adopt a dual design perspective.* Flexibility is important in order to support the evolution of a digital service over time and the technology should be developed for enabling tailoring by the end users.
- **Need to be open to emerging needs:** *support continuity in user involvement.* During all stages of the service's lifecycle users should be involved in the design process.
- **Do not need to be stalled by regulation:** *exploit regulatory constraints.* It is important to view regulatory provisions as opportunities for going beyond well-established solutions.

Integration of IT into healthcare has enabled new directions for gathering, delivering and sharing data while revealing hidden potential in developing cost-effective and patient-centered digital applications (Maher et al., 2016). Based on these insights it is of importance to understand how to engage patients and caregivers while striving for a patient-centered care. In order to extend the previous work on identifying information needs and challenges, Maher et al. (2016) developed and designed a digital tool to be used in the setting of a hospitalized patient, ultimately resulting in three important themes that emerged during the design process; **(1)** *affirmation of usefulness of core features*, **(2)** *designing the user interface to reflect patient experiences* and **(3)** *tailoring the user experience to support patient needs.* Acting upon these themes as a roadmap could be beneficial for both patient and caregiver during the design process.

2.3.2 Related Products

Regarding related products to this thesis and within the field of digital automated communication between patients and healthcare, some services offer integration to other software platforms such as Skype (Skype, 2019), Facebook Messenger (Facebook Messenger, 2019) or Slack (Slack, 2019), while some services are independently offered to the operating systems of various digital devices.

2.3.2.1 Care to Translate

In regards of accessible communication, translation and interpreters are important factors for successful communication between patients and caregivers with foreign backgrounds. The aim of *Care to Translate* is to primarily work as a complementary tool for interpreters during conversations and is accessible on a digital device that is based on the operating systems of iOS and Android as an embedded smartphone application. The tool can be used for immediate communication before, during or after the conversation, in situations of emergency as well as in regular work of caregiving. As seen in *Figure 2.1* the user can pick a language, choose a specific category and then be presented with various translations. The company behind the application strive to cherish the integrity of the patient and offer communication that is considered to be medically safe for use within healthcare (Care to Translate, 2019).

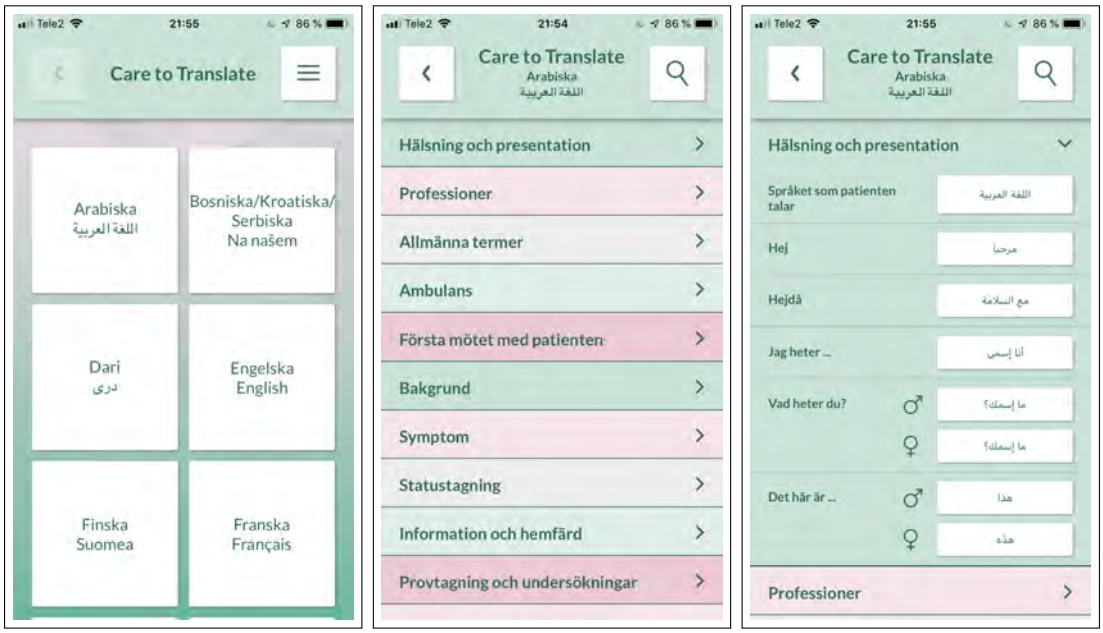


Figure 2.1: Screenshots from the application (Care to Translate, 2019).

2.3.2.2 Kry

The application *Kry* is primarily a digitally embedded smartphone application for making healthcare appointments through the use of video calls on preferred digital device that is based on the operating systems of iOS and Android. The company behind the service claims that users of the service have access to experienced doctors and legitimized psychologists during most hours of the day and with a short amount of waiting time (Kry, 2019). As seen in *Figure 2.2*, the patient identifies itself using a mobile identification service called *BankID* (BankID, 2019), and based on the individual need the patient can for instance request advice on specific health issues or get prescriptions through video calls.

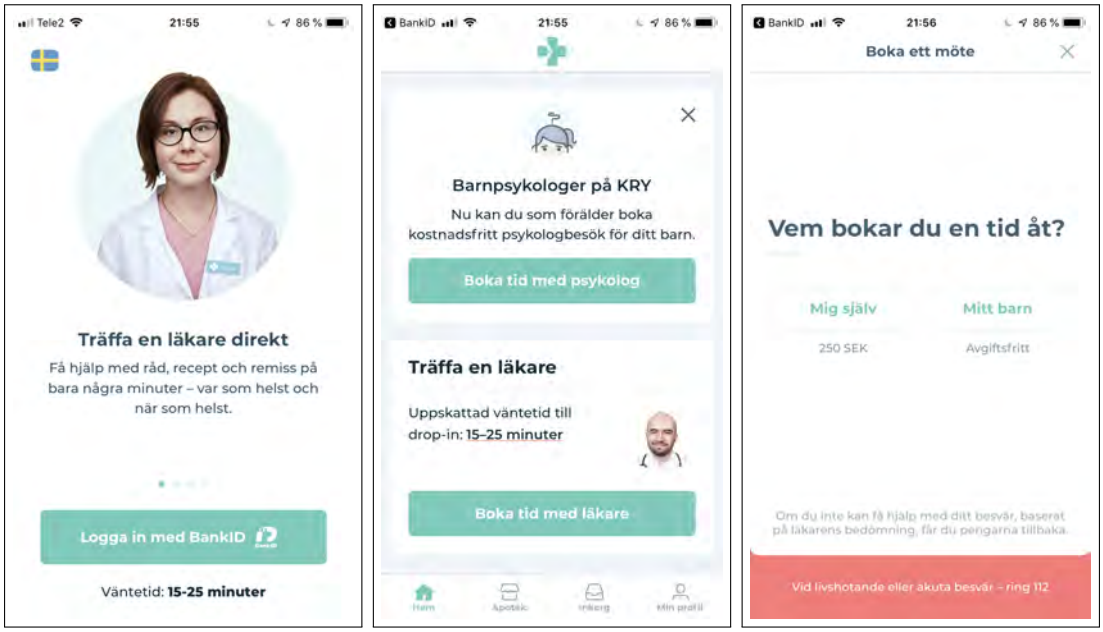


Figure 2.2: Screenshots from the application (Kry, 2019).

2.3.2.3 Your.MD

The application *Your.MD* works primarily as a symptom checker exploiting the technology of artificial intelligence (AI) and offers an included service of a chatbot (as seen in *Figure 2.3*) to provide answers based on user input. The application has five primary sections which is representing profile, OneStop Health™ (a guide to finding doctors and services for your health), encyclopedia, chat window and information page. The company's core values are honesty, integrity and transparency, further declaring that "*information is the key to being healthy*". The company states that they continually strive to deliver evidence based information that is accurate and easy to understand (Your.MD, 2019).

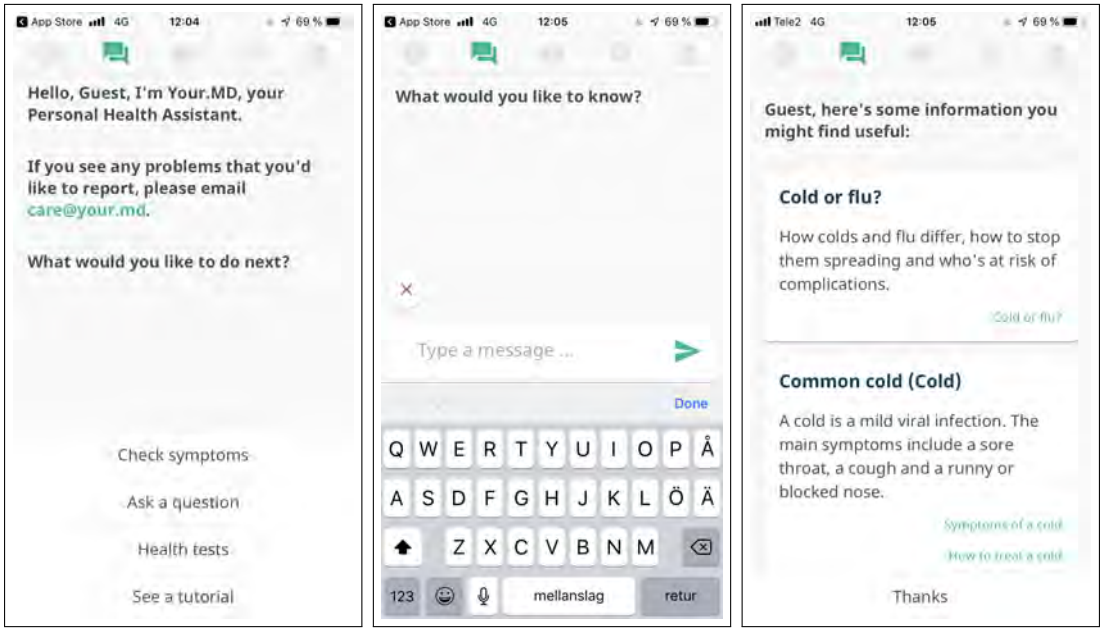


Figure 2.3: Screenshots of the integrated chatbot service in Your.MD (2019).

2.3.2.4 Conversa Health

Based on the argument that the modern patient is an active participant in their own care with the need of timely access to personal and important health information for itself and loved ones, *Conversa Health* (2019) aim at improving communication to support the patient's decision making. The platform provides a scalable solution to be implemented into healthcare organizations, delivering information to the patient through the use of a chatbot (seen in *Figure 2.4*), striving to establish a relationship between the patient and the caregiver that is proactive, continuous and collaborative.

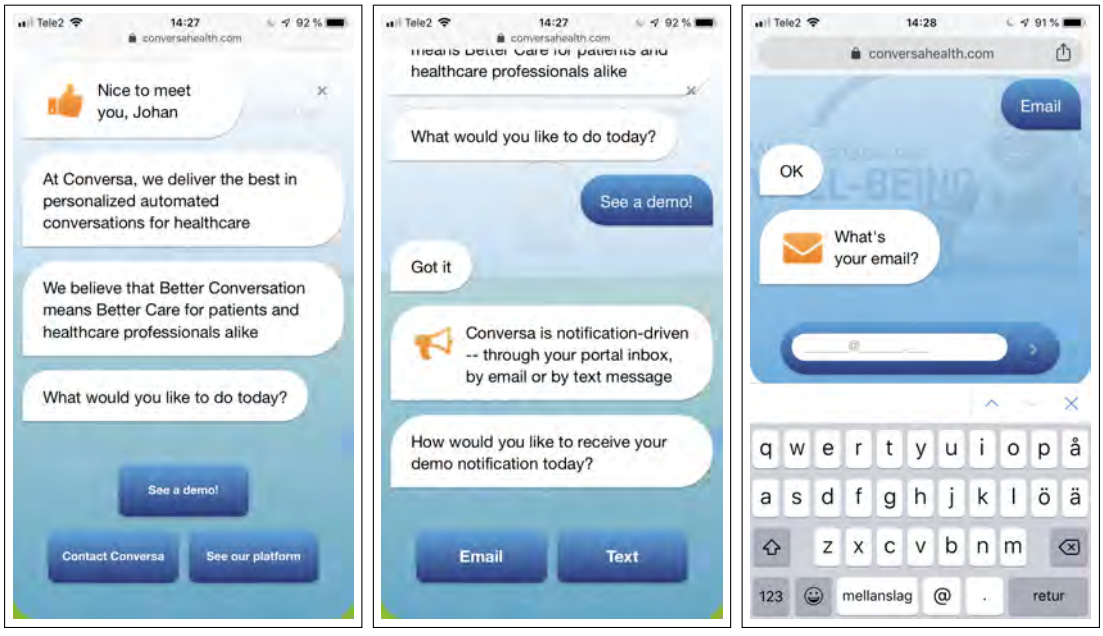


Figure 2.4: Screenshots of demo window in ConversaHealth (2019).

2.3.2.5 Ada

The mobile iOS application *Ada* (2019) works primarily as a health guide based on an integrated chatbot that strives to help people in finding out what is wrong if you personally or a person close to you is not feeling well. It is marketed as being developed by over 100 doctors and scientists and recognizes thousands of symptoms and conditions in various complexities. Ada is able to help people by letting the user explain the situation through text input and selection of choices or parameters which are generated based on how the user has answered previous questions (see *Figure 2.5*). Ultimately it is supposed to get the relevant information and present or visualize it in a digital user friendly experience.

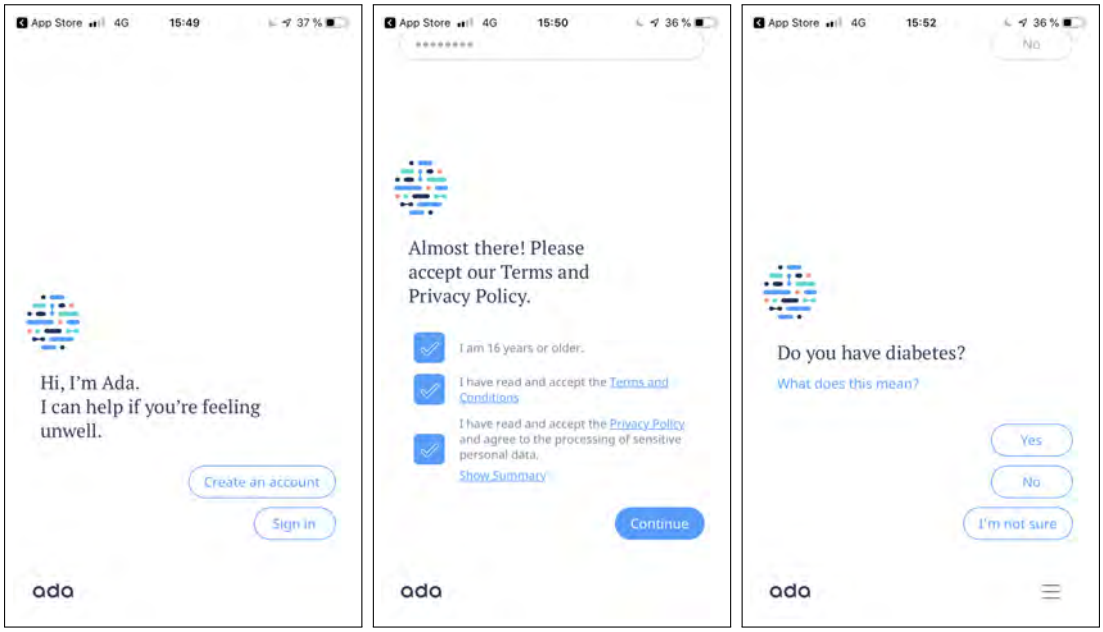


Figure 2.5: Screenshots of chatbot view in Ada (2019).

3
Theory

This chapter presents the theoretical frameworks, relevant concepts and related research. The presented material will be used as a foundation for the work in the design process.

3.1 Interaction Design

The field of interaction design, often abbreviated as IxD, is the practice of designing interactive digital products, environments, systems and services (Cooper et al., 2014). The core concern of its practice is to deliver artifacts that are usable, hence easy to learn, effective to use as well as enjoyable user experiences (Sharp et al., 2011). Digital interactive artifacts may in comparison with mechanical devices be capable of thousands of different states, hence complexity is increased and if not designed for the user in the right way the possibility of it becoming a nightmare is impending (Cooper et al., 2014). In order to start the mental process and reflection about how to design usable artifacts, Sharp et al. (2011) suggests to start by comparing examples of well- and poorly-designed ones.

What is considered to be fundamental about interaction design is to understand how users and technology communicate with each other, while producing engaging interfaces with well thought out behaviours (Usability.gov, 2019a). Hence, according to Usability.gov (2019a), the "leading resource for user experience (UX) best practices and guidelines" for practitioners and students in the american government and its private sectors, there are six qualities that should be fulfilled:

- Define how users can interact with the interface
- Give Users Clues about Behavior before Actions are Taken
- Anticipate and Mitigate Errors
- Consider System Feedback and Response Time
- Strategically Think about Each Element
- Simplify for Learnability

It is of importance for interaction designers to not only consider who the user is going to be, how and where they are using the artifacts, but also to understand what kind of activities the users are engaging in when using and interacting with them (Sharp et al., 2011). Hence, in order to create artifacts that people find both engaging and useful, a methodical approach will support in providing the holistic

perspective necessary (Cooper et al., 2014).

3.1.1 Design Thinking

The work presented in this thesis is grounded in the application of design thinking. Design thinking is according to Serrat (2010) about "using the sensibilities and methodologies that characterize designers to create new ideas, new alternatives, new choices, and new viabilities that satisfy stakeholder desires". The approach of design thinking has proven valuable in creating user-centered and innovative ideas due to its core focus on constantly striving for feedback from users while iteratively shaping a solution that provides maximum benefit for the user in mind (Häger et al., 2014). Traditionally, the role of the designer has been to enhance the functionality and aesthetics of products, but in the recent years they have been tackling problems of more serious characters such as exploring and finding directions to provide low-cost healthcare (Brown and Wyatt, 2010).

The Interaction Design Foundation (2018) describes the iterative process of design thinking in a model that is based on five stages, originally proposed by the Hasso-Plattner Institute of Design at Stanford. As visualized in the figure below (*Figure 3.1*), the process of design thinking is "non-linear, iterative, flexible and focused on collaboration between designers and users" (Interaction Design Foundation, 2018).

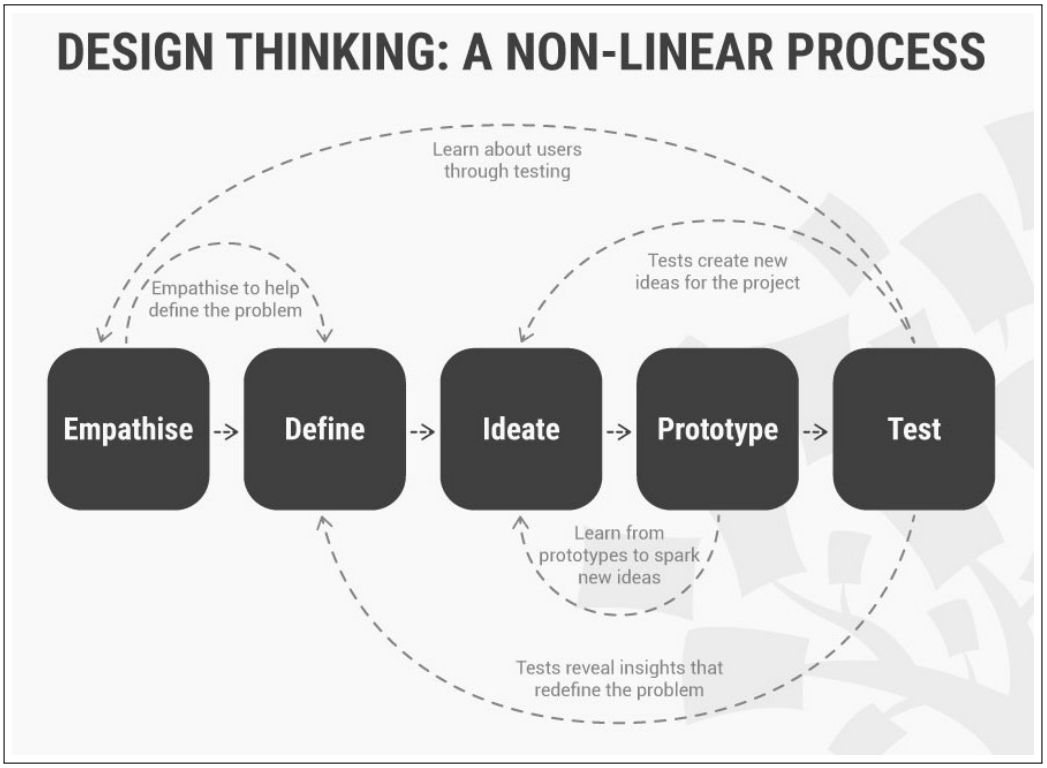


Figure 3.1: The non-linear process of design thinking (The Interaction Design Foundation, 2018).

In chapter four (*4. Methodology*), each stage in the process is given a short description, followed by the specific methodology that is aimed to be used in that specific stage during the process. In short, the different stages of design thinking aims to:

1. **Empathise**: Understand the human needs involved.
2. **Define**: Re-frame and define the problem in a human-centric way.
3. **Ideate**: Create many ideas in ideation sessions.
4. **Prototype**: Adopt a hands-on approach in prototyping.
5. **Test**: Develop a prototype/solution to the problem.

3.1.2 Research Through Design

By examining the processes and tools for design thinking in combination with relevant theory, research through design is seen as a legitimate research activity that enhances design practices (Martin and Hanington, 2012). Gaver (2012) states that during the last years design practitioners have increasingly been more integrated into the community of HCI research, but while design practitioners often work by the process of research through design there has been a debate about whether or not they are considered to be performing traditional research. As stated by Zimmerman et.al (2007) the design process itself should be considered to be the designers path to acquire new knowledge and as a result the artefact being designed is the central object to generate and communicate knowledge.

Applying research through design, as an approach to interaction design, involves the integration of theories and models in combination with technical knowledge during the design process (Martin and Hanington, 2012). Initially designers study secondary design research for comparison and combination with their own previous exploratory research, further reframing the stated problem by performing ideating, critiquing and experimenting to arrive at possible solutions. The emerging artifacts from the design process includes sketches, models, prototypes and above all else documentation that communicates and contextualizes the embodied knowledge of the design (Martin and Hanington, 2012).

Regarding secondary design research from the interaction designer's perspective, it can take advantage of theories, models, technology and field data from a variety of scientific areas in order to make conclusions and design artifacts as possible solutions to a framed problem, proposing for later distribution to practitioners within HCI. This is thoroughly visualized in a model by Zimmerman et al. (2007), seen in *Figure 3.2*.

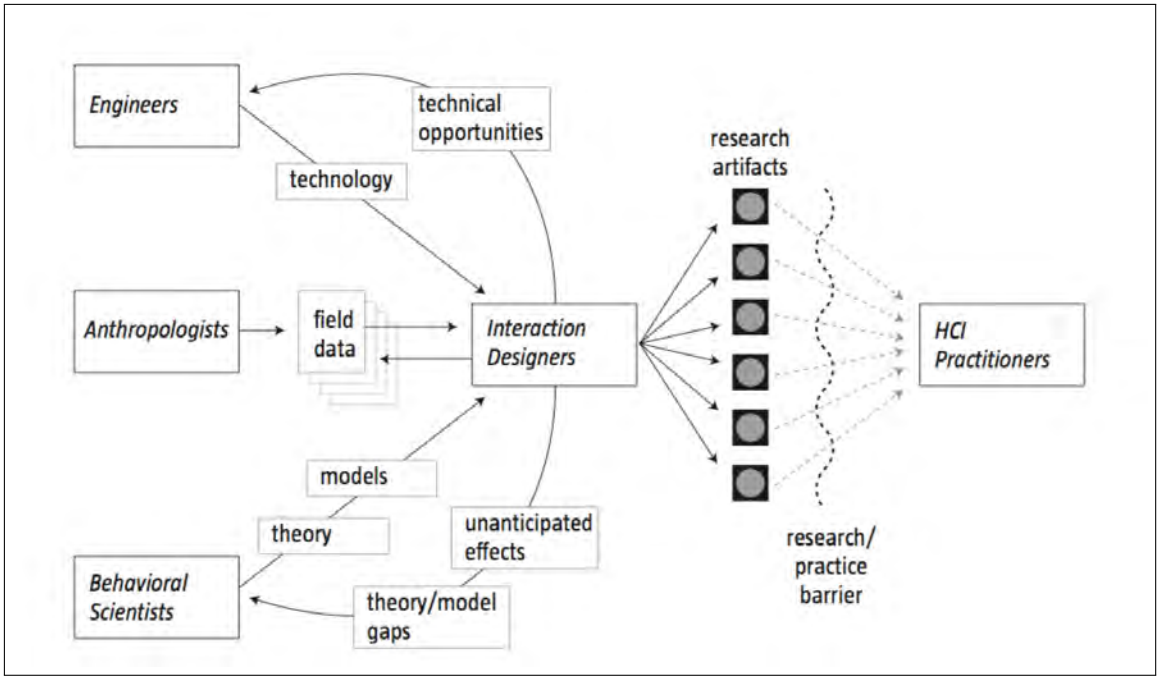


Figure 3.2: The production of artifacts influences both communities of research and practice. The model illustrates the pathways and deliverables between and among HCI researchers and interaction designers (Zimmerman et al., 2007).

3.2 Theoretical Design Frameworks

According to Norman (2005), practitioners within the field of HCI have a single sacred principle described as *"know your user"*. Design practice within HCI can take advantage of a variety of methods and theories in order to get to know the user and some of the most common ones are *Human-Centered Design* (HCD), *User-Centered Design* (UCD), *Activity-Centered Design* (ACD), *Goal-Directed Design* (GDD) and *User Experience Design* (UXD).

Several methods and theories, such as the ones being mentioned above, that have evolved from the field of HCI are sometimes correlating in some aspects and can be combined in multiple ways. HCD could be seen as an umbrella term for several design methods that share some of the fundamental characteristics in understanding the user, but differentiate in various ways of approach and application. Giacomin (2014) describes them as sharing the same goal in reaching clarification of meaning and purpose while being performed as multidisciplinary activities.

It is however of importance for HCI practitioners to distinguish these methods from each other and Norman (2006) supports the idea of using the methods in a complementary manner and apply triangulation for data collection in order to find and use sources containing different strengths and biases. Furthermore, The HCI practitioner should act as a data aggregator by gathering data from a variety of sources and recognize patterns from it.

As stated, the methods and theories mentioned in the beginning of this section are considered to be some of the most common design frameworks within HCI. These are briefly presented further down in individual subsections along with the additional subsections of *Research Informed Design* (RID), *Evidence Based Design* (EBD) and finally the relatively new phenomena of *Patient-Centered Design* (PCD). Furthermore, the continuous use of the noun *artifacts* has the purpose of making a holistic reference to *products*, *systems* and *services*.

3.2.1 Human-Centered Design (HCD)

The core of HCD is as the term itself implies; to perform design work with a centered focus on human aspects. Within the industry of ICT many innovations are driven by the development of technology, neglecting to match artifacts with people's practices, preferences and needs (Steen, 2011). When developing artifacts, Maguire (2001) states there are numerous methods used as a means to meet technical requirements, but stresses upon the equal importance in also meeting requirements from users. However, it is important to also keep in mind that users' might be unaware of their needs, not able to articulate them or possibly not even willing to speak about them (Steen, 2011). In comparison to traditional design practice Giacomin (2014) argues that HCD is more focused on the activities, insights and and questions that is connected to the people the artifact is designed for.

In order to achieve usable artifacts it could also be seen as a method that incorporates the user's perspective in a complementary manner, hence not be considered as a replacement to other methods within software development (Maguire, 2001). Practicing HCD will essentially contribute to artifacts that are intuitively compatible in their attributes with human characteristics (Giacomin, 2014).

3.2.2 User-Centered Design (UCD)

The term UCD originates from computer systems development, where software designers were urged to consider factors such as ergonomics of use and workflow (Kelly and Matthews, 2014). UCD is similar to HCD in its approach to focus on involving the potential users of an artifact during the design process, but as stated by Redström (2006) there is a difference where humans are inhabitants of the world we live in while users are created by the designers. The logic behind this reasoning by Redström (2006) is that a person individually decides to use an artifact for a specific purpose and hence becomes a user of it.

According to Williams (2009) there are three core phases within the UCD process: **(1)** *design research*, **(2)** *design*, and **(3)** *design evaluation*. The process is defined by placing the users in the center of design decisions with possible engagement in the different design activities, but are not explicitly involved in producing the deliverables of the final design (Williams, 2009). Redström (2006) addresses the need of sometimes shifting from the user as the subject of design to the actual artifact due

to the potential risks of minimizing space for improvisation where designs become overdetermined because of too extensive knowledge about the use and users. However, UCD should still be seen as a process for collaboration between the designer and the user (Williams, 2009).

3.2.3 Activity-Centered Design (ACD)

ACD is a design process that focuses on the specific usage and activities related to an artifact. According to Norman (2005) the process of ACD is different to HCD because the practitioner is required to have a deeper understanding of the required technology, tools and reason for the activities related with the artifact. An important distinction between the processes of ACD and UCD is that the former one explicitly asks what kind of activities or tasks that must be enabled by the artifact in mind and hence not what the user itself must be able to perform (Williams, 2009). Furthermore, Norman (2005) states that an important distinction should also be done between the terminology of activities and tasks since an activity is a coordinated, integrated set of tasks.

3.2.4 Goal-Directed Design (GDD)

In the digital product development process Goal-Directed Design (GDD) aims at bridging the gap between user research and design by combining new techniques and known methods in more effective ways (Cooper et al., 2014). As a method and framework it shares several fundamental characteristics with HCD, UCD and ACD. However, in comparison it has a deeper focus on understanding the value, purpose and meaning of certain activities by also asking users the urgency of performing them (Williams, 2009).

According to Cooper et al. (2014), GDD utilizes fundamental patterns and principles from interaction design in combination with *techniques of ethnography*, *stakeholder interviews*, *market research*, *detailed user models* and *scenario-based design*. Williams (2009) states that GDD is more similar to the process of UCD in its deliverables and purpose of being more encompassing and on a higher level, compared to ACD which is more specific and concrete regarding the steps enabling a person to achieve a goal. GDD strives to not only meet the needs of users and their goals, but also to address organizational and technical directives (Cooper et al., 2014).

3.2.5 User Experience Design (UXD)

Digital interactive artifacts do not only facilitate tools for achieving goals, but are also able to involve experiences by fulfilling the need for stimulation, enabling personal growth, evoking memories and communicating self expression in social settings (Karapanos et al., 2009). The process of User Experience Design (UXD) aims at delivering products that brings relevant and meaningful experiences to users (The Interaction Design Foundation, 2018). By studying, designing and evaluating the user's experience, UXD provides an additional dimension in the design process (Roto

et al., 2011).

UXD is discussed by Redström (2006) as an approach in combining the design of the communication process with a sharper focus on the end results, hence the user's experience from interacting with the artifact. The term *user experience* can be seen as a phenomenon, a field of study or as a practice, often being synonymous with terms such as *user interface*, *interaction experience*, *interaction design*, *customer experience* and *usability* (Roto et al., 2011). Hence it can act as an umbrella term for many concepts related to designing for the user's experience.

UXD is considered to be multidisciplinary in its nature, hence contributing to several definitions and perspectives, ranging from for instance a psychology perspective to business perspective or quality centric to value centric, depending on context and purpose (Roto et al., 2011). UXD involves designing the entire process of acquirement and integrations of the product including essential factors such as branding, design, usability and function (The Interaction Design Foundation, 2018).

3.2.6 Research Informed Design (RID)

In the recent years within the healthcare design industry the term *Research Informed Design* (RID) has emerged, often unintentionally being interchanged with the term *Evidence Based Design* (EBD) (Stichler, 2016). As stated by Stichler (2016) RID only utilizes published research as a means to inform the design process, hence it is limited in its application. Furthermore, Peavey and Vander Wyst (2017) defines the concept of RID as "*the process of applying credible research in integration with project-, client-, or population specific empirical inquiry to inform the creation of environmental design and achieve project objectives.*" Practitioners applying RID is hence exclusively searching for research studies that are considered to be the best and most suitable in order to guide the decisions that are related to their features or design process (Stichler, 2016).

3.2.7 Evidence Based Design (EBD)

Previously, as stated by Stichler (2016), the concept of Evidence Based Design (EBD) has broadly been defined as "*the judicious and systematic use of evidence to guide decisions in healthcare design*". This can be put in contrast to a more detailed definition by Peavey and Vander Wyst (2017) as "*the process of making decisions about the creation of an environmental design by critically and appropriately integrating the sum of available, credible evidence, practitioner design expertise, and client or population needs, preferences, and resources, in the context of the project, in order to achieve project objectives.*" Furthermore, for comparison and point of reference, Stichler (2016) points out the distinguishing characteristic of EBD towards RID to be the utilization of multiple forms of evidence as a means to guide the decision making while RID is limited to only utilize research studies that are published.

3.2.8 Patient Centered Design (PCD)

According to Reis et al. (2011) the principle of Patient Centered Design (PCD) is a certain kind of UCD where the design process puts its main focus on fulfilling the patient's expectations as the end user of the designed healthcare solutions. Furthermore, PCD contributes to the empowerment of patients by involving them in the process of decision making and development of an ICT solution, hence ultimately enabling an active role where they are able to provide input on their treatments but also make individual choices (Reis et al., 2011).

In order to improve the environment of healthcare and address the needs of patients and their families through design, the non-profit organization Institute for Patient-Centered Design, Inc. (2019) was established in 2010. The institute's declared mission is as stated on the official website "*to contribute to the quality of healthcare delivery through patient-centered design advocacy, education and research.*", highlighting the issues of designers lack of first-hand experience in hospital environments (Institute for Patient-Centered Design, Inc., 2019).

Mannonen et al. (2017) states that experiences have become the design drivers of research and practice of product and service design. Within healthcare service design the potential of experience-based design has not gone unnoticed, but compared to established frameworks and methods of HCD it lacks both accepted as well as general concepts and definitions (Mannonen et al., 2017). Furthermore, Mannonen et al. (2017) states there are three major gaps in user experience research that are important to be aware of in the context of healthcare services; **(1)** *understanding of context of experience*, **(2)** *characterizing experience over time* and **(3)** *multidimensionality of experience.*

3.3 Relevant Concepts

This subchapter provides a presentation of the relevant concepts for the study.

3.3.1 Patient-Centered Care

Picker Institute Europe coined the term patient-centered care already back in 1988 to address the need of stakeholders within institutionalized healthcare to shift focus from diseases and back to patients and their families (Barry and Edgman-Levitan, 2012). Patient-centered care have various definitions depending on philosophy and context, hence Berwick (2009) demand a new holistic definition, proposing it to be:

> "*The experience (to the extent the informed, individual patient desires it) of transparency , individualization, recognition, respect, dignity and choice in all matters, without exception, related to one's person, circumstances, and relationships in health care.*"
> - Donald M. Berwick (2009)

Picker Institute Europe (2019) has in relation to the subject of matter established *eight principles of patient-centered care* to follow within institutional healthcare:

- Fast access to reliable health advice
- Effective treatment delivered by trusted professionals
- Continuity of care and smooth transitions
- Involvement in decisions and respect for preferences
- Clear, comprehensible information and support for self-care
- Involvement of, and support for, family and careers
- Emotional support, empathy and respect
- Attention to physical and environmental needs

In order to succeed in enhancing hospitalized patients' perception of the QoC a critical condition to consider is the participatory aspect based on empowerment and collaboration (Weingart et al., 2011). It is hence of importance to understand that preferences regarding engagement are not universal, making it important to take hospitalized patients individual needs and preferences into consideration (Jerofke-Owen and Dahlman, 2018).

Regarding QoC it is often defined as providing the right care in the right way at the right time, but with an emphasis on patient-centered care it must be defined by providing the care that the patient needs in the manner the patient desires at the time the patient desires (Davis et al., 2005). However, as stated by Jerofke-Owen and Dahlman (2018), engagement is a dual responsibility and implies that both caregiver and patient must act collaboratively in favor of increasing the QoC. Davis et al. (2005) has proposed seven attributes of care practice and patient services that a patient-centered primary care could benefit from:

1. Superb access to care.
2. Patient engagement in care.
3. Clinical information systems that support high-quality care, practice-based learning, and quality improvement.
4. Care coordination.
5. Integrated, comprehensive care and smooth information transfer across a fixed or virtual team of providers.
6. Ongoing, routine patient feedback to a practice.
7. Publicly available information on practices.

While these attributes for increasing the QoC were presented with the primary care in mind, they can most likely be applied to institutionalized hospitals in perfecting patient-centered care for patients that are bound to a hospital bed. Jerofke-Owen and Dahlman (2018) interviewed seventeen hospitalized patients (eight male and nine female, aged between 19–83 years) regarding their own engagement in their care, eventually contributing to six themes of engagement: **(a)** *sharing the subjective*, **(b)** *involvement of family*, **(c)** *information-gathering*, **(d)** *constraints*, **(e)** "*I*

let them take care of me" and **(f)** *variability.*

Furthermore, it is possible to define different types of patients. In the article *How Design Thinking Is Improving Patient-Caregiver Conversations* the authors, Deichmann and van der Heijde (2017), observed that patients are not always looking for the same conversation. Based on their findings Deichmann and van der Heijde (2017) were able to derive that patients are generally fitting more into one of four specific types:

1. **Google patients:** *Obsessive about information.*
2. **Dominant patients:** *Like to be in charge of their case.*
3. **Quiet patients:** *Says everything is fine, even when it isn't.*
4. **Emotional patients:** *Foremost want reassurance that their caregivers are looking after them.*

Deichmann and van der Heijde (2017) further states that "*less fear translates into greater patient satisfaction*" and in order to calm patients and meet their individual needs it is hence also of importance to understand that patients behaviour varies depending on the context. Ultimately, as stated by Deichmann and van der Heijde (2017), *"personality plays an important role in human health"* and understanding the individual preferences for communication will most likely improve the conversations between the patient and the caregiver.

3.3.1.1 Patient Room Experience

It is of importance to meet the patient's expectations when hospitalized and Patterson et al. (2017) performed a grounded theoretical analysis of patient-centered room elements resulting in a theoretical design framework, seen in *Figure 3.3*. The generated framework by Patterson et al. (2017) is explained more in detail with four implications for practice:

1. *Support comfort by enabling privacy, a sense of security, and personal space and safety.*
2. *Empower patients to control noise levels, visual privacy, room utilities, and provide access to storage units.*
3. *Facilitate connections to family, home, the outside world, information, and entertainment.*
4. *Enable independent access to names and roles of clinical staff, personal belongings, and the bathroom.*

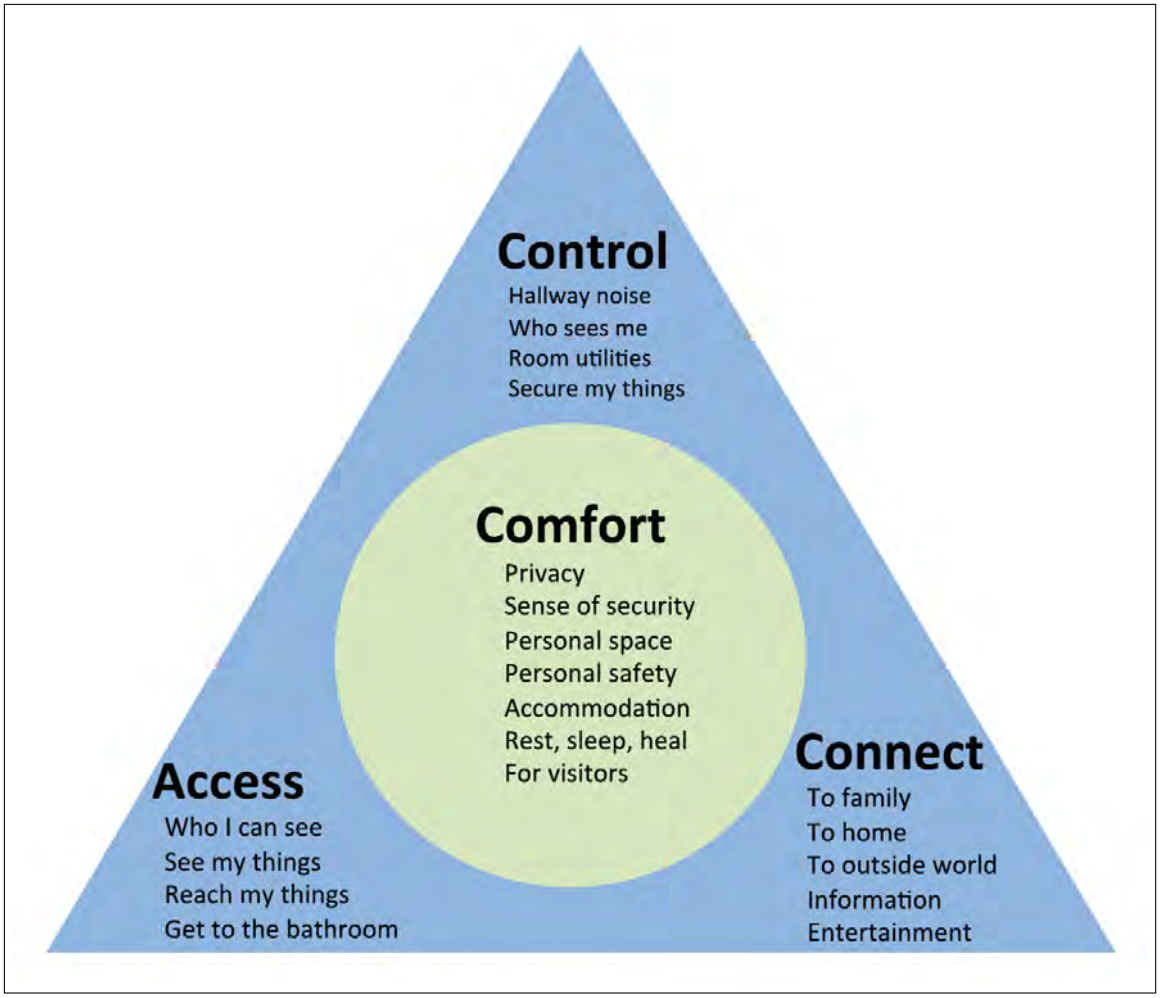


Figure 3.3: Patient Room Experience Model (Patterson et al., 2017)

As a foundation to support the patient's ability to heal, rest and sleep, Patterson et al. (2017) states that designers within healthcare need to understand the patient's journey and acknowledge the core need for *comfort* in order to provide an environment where it has a sense of privacy, security, safety, personal space and comfort for the family. Furthermore, the secondary needs of *connect*, *access* and *control* varies accordingly with the situation of the patient while their importance will increase as the patient moves from dependence to independence, hence the satisfaction of the patient experience relies on meeting every need across the timeline (Patterson et al., 2017).

It is of importance to understand the different perspectives of patients and caregivers, hence Patterson et al. (2017) suggests that in order to meet the complexity of healthcare design there are design methods and tools to be utilized from the field of user experience design (UXD). In regards to this, Patterson et al. (2017) mentions the possibility of codesigning the patient's room with former patients and their families or to iteratively develop use case scenarios and personas.

3.3.1.2 Ask One Question

In the paper *How Asking Patients a Simple Question Enhances Care at the Bedside: Medical Students as Agents of Quality Improvement*, Ward et al. (2013) suggests that, in order to empathize with patients and understand their needs, the concept of *Ask One Question* is a simple but effective method that doesn't require professional training. In practice it is based upon asking the patient by the bedside the simple question of "*What can I do to improve your stay?*", ultimately unlocking the potential of *shifting the emphasis from administering care to a patient, to building a relationship with a person* (Ward et al., 2013). This shift should be considered to be in line with practitioners values and professional duties within the modern healthcare, aiming at respecting patients as individuals and in their study Ward et al. (2013) identified four broad areas of improvement:

- **Communication issues**: *uncertainty about their care management and desire for more time with their health care professional.*
- **Practical issues**: *assistance with tasks made difficult because of ill health.*
- **Organizational requests**: *concerns and ideas relevant for feedback to the wider organization.*
- **Medical needs**: *symptomatic relief or management that required medical or nursing intervention.*

While the method can be seen as a vehicle for identifying opportunities to improve care as well as identifying existing excellence, Ward et al. (2013) further states it serves a commitment to the improvement philosophy that every individual within healthcare has two jobs to perform; **(a)** *to do their daily work* and **(b)** *to improve it.*

3.3.2 Graphical User Interfaces and Healthcare

Nearly all digital interfaces today are considered to be designed as GUIs, and are easily distinguished from other types of interfaces by including graphical elements such as buttons, windows and icons (Christensson 2019). In order to engage users in completing computing tasks efficiently most modern software applications rely on graphical user interfaces that are attractive and intuitive. As companies tries to differentiate their software products from competitors offering similar functionality, delivering a great user experience is critical, hence software with aesthetically displeasing user interfaces are less likely to be able to compete (Moran et al., 2018).

According to Cooper et al. (2014) most user interfaces on commercially available software, websites and digital products frequently fail to meet user goals, resulting in the routine of:

- Making users feel stupid
- Causing users to make big mistakes
- Requiring too much effort to operate efficiently

- Don't providing an engaging or enjoyable experience

As stated by Cooper et al. (2014), this is a result of the conventional development process where a user interface is addressed and prioritized second after the technical work and coding. However, just like a building cannot be effectively designed after the construction begins, an artifact cannot be able to serve users' goals with an inflexible codebase.

Understanding the different elements and guidelines of designing graphical user interfaces increases the chance of succeeding with its implementation. Hence, a few important design guidelines based on the link between HCI and human cognitive abilities are presented, acting as additional framework to this study.

3.3.2.1 Visual Perception

Regarding visual perception there are certain theories and models that explain the cognitive abilities and its related aspects of users' of an artifact. Fitts's law is an empirical model that explains the human ability to move based on human psychomotor behavior (MacKenzie, 1992) and the trade-off between speed and accuracy (Beamish, 2006). Within HCI this is often referred to the act of pointing in an interface, using either hardware such as a mouse or just fingers on a touch surface of sorts. By assigning indices of difficulty in units of bits for certain movements, the performance of a movement task involves the human motor system to transmit a certain amount of "bits of information", furthermore the amount of bits are divided by the time to move resulting in a rate of transmission of bits per second (MacKenzie, 1992).

According to Encyclopedia Britannica (2019) the modern study of human perception is founded on the school of Gestalt psychology which philosophical core is to emphasize that the whole of anything is greater than the sum of its individual parts. Various Gestalt theories are often described as robust laws, principles or rules for pattern perception in visual displays and as stated by Ware (2012) its shared purpose is traditionally to provide a clear description of many basic perceptual phenomena. Furthermore, in practice they are used as tools for providing suggestions of how to present static visual elements as a means to achieve effective visual results. Hence, based on previous scientific Gestalt literature, Chang et al. (2002) identified eleven *Key Laws of Gestalt Theory for Computer Screen Design*:

- **Balance/Symmetry**: A visual object will appear as incomplete if the visual object is not balanced or symmetrical.
- **Continuation**: The eye's instinctive action to follow a direction derived from the visual field.
- **Closure**: Open shapes make the individual perceive that the visual pattern is incomplete.
- **Figure-Ground**: We distinguish the foreground and background in a visual field.

- **Focal point**: Every visual presentation needs a focal point, called the centre of interest or point of emphasis.
- **Isomorphic correspondence**: All images do not have the same meaning to us, because we interpret their meanings based on our experiences.
- **Prägnanz**: Good form is a simple design or a symmetrical layout.
- **Proximity**: Viewers will mentally organise closer elements into a coherent object.
- **Similarity**: Similar objects will be counted as the same group and this technique can be used to draw a viewer's attention.
- **Simplicity**: Simplification works well if a graphical message is already uncluttered, but if the graphics are complex and ambiguous the simplification process may lead to unintended conclusions.
- **Unity/Harmony**: If the related objects do not appear within the same form, the viewer will consider the separate objects to be unrelated to the main visual design, leading to confusion.

Ware (2012) covers three important concepts within information visualization and visual perception called *Gist*, *Priming* and *Recognition*. The concept of Gist stands for the combination of the nonvisual information located in our long-term memory and the knowledge of specific environments comprising visual information such as the structure of an artifact. Priming represents the rapid identification of an artifact due to its recent visual appearance. Recognition implies the state of when the memory recognizes information from a previously encountered artifact while observing the visual appearance of it and matching it to the memory's stored snapshot (Ware, 2012).

As described in **2.3.1 Related Studies**, affordances are defined as perceivable possibilities for action. Furthermore, as stated by Gibson (Ware, 2012), *humans perceive in order to operate on the environment*. Hence the concepts of gist, priming and recognition are able to represent the essentials of affordances. However, a conflict occurs within the theory of information visualization since physical affordances in GUIs does not exist and the majority of them are considered arbitrary due to the fact that they must be learned (Ware, 2012).

3.3.2.2 Principles and Rules

There are several types of frameworks, guidelines, principles and rules to take advantage from when designing user interfaces, but one of the most prominent ones, often compared to *10 Heuristics for User Interface Desig*n by Nielsen (1994) and *First Principles of Interaction Design* by Tognazzini (2014), that takes a holistic approach in a compact format is *The Eight Golden Rules of Interface Design* by Shneiderman (Shneiderman, 2016; Shneiderman et al., 2017):

1. Strive for consistency.
2. Seek universal usability.
3. Offer informative feedback.
4. Design dialogs to yield closure.

5. Prevent errors.
6. Permit easy reversal of actions.
7. Keep users in control.
8. Reduce short-term memory load.

According to Ware (2012) computer-based visualizations of good quality allows users to *drill down and find more data about anything that seems important.* In 1996, as a means for guiding interfaces that support visual information-seeking behaviour, Ben Shneiderman (Shneiderman, 1996) developed the visual information seeking mantra *"Overview first, zoom and filter, then details on demand."*

3.3.2.3 Interface Design for Healthcare

Healthcare comprises a complex organizational structure and is an intense continuous activity of information gathering (Johnson et al., 2005). Designing effective user interfaces is hence a major challenge when developing computer-based healthcare environments (Patel and Kushniruk, 1998). Traditionally many systems within health care have been designed without considering important guidelines of UCD practice (Johnson et al., 2005). As an example Patel and Kushniruk (1998) states that a think aloud protocol is a method suitable for usability testing with the representative end users of a health care system, since it allows them to verbalize their thoughts while interacting with the system's interface.

It is of importance to thoroughly understand cognition within health care and design effective interfaces (Patel and Kushniruk, 1998). Hence, as stated by Johnson et al. (2005) principles of UCD can be incorporated throughout the design lifecycle in order to provide health care systems of quality. Furthermore Johnson et al. (2005) proposes three recommendations in the design process of health care interfaces; **(1)** *collaboration among administration, computer scientists, human factors engineers, cognitive scientists, and clinicians*, **(2)** *information technology groups need to be educated on the principles of user-centered design* and **(3)** *the user culture needs to be educated not to tolerate poorly designed systems* (Johnson et al., 2005).

3.3.2.4 Feature as a Concept

The word *feature* might be understood in different ways depending on context, application and language. Furthermore, an additional layer of complexity is added depending on whether it is used as a *noun* or a *verb*. *Cambridge University Press* (2019) defines the noun as "*a typical quality or an important part of something*" and the verb as "*to include someone or something as an important part*".

Apel and Kästner (2009) have provided an overview of feature-oriented software development (FOSD) in an article in the *Journal of Object Technology* where they try to define the concept of a feature. The introduction of the article states that *"the concept of a feature is at the heart of FOSD"* while a feature itself *"is a unit of functionality of a software system that satisfies a requirement, represents a design decision, and provides a potential configuration option"*.

4
Methodology

This chapter presents the chosen methodology applied during the research and design process. Do note that the presented methods are only described as in how they are applied in practice, hence the actual application and usage of them during the process will follow in the chapter *6. Execution and Process*.

Furthermore, as stated, the report itself presents answers to the research questions, not only as a result of applying theoretical frameworks to analyse the collected data, but in particular to develop and evaluate a prototype in the shape of a GUI. Understanding what features hospitalized patients requests in a GUI for automating the communication with institutionalized healthcare is not only done through derivations of findings but also by visualizing a realistic model.

4.1 Empathize

The initial stage of the design process where the focus lies within empathizing with the problem that is determined to be solved, most often involving the performance of user studies. This is a crucial step in the design process since it makes the researcher set aside its own assumptions about the given context in order to gain essential insights into the users and their needs (The Interaction Design Foundation, 2018).

4.1.1 Interviews

When performing qualitative data collection from a context or a user group it might not be enough to just observe as a bystander. In order to gain valuable information and data, an interview can provide firsthand *personal accounts of experience*, *opinions*, *attitudes*, and *perceptions* in addition to the information acquired of the initial observation (Martin and Hanington, 2012). Performance of interviews can be done on larger focus groups as well as individual users, depending on resources and time (Sharp et al., 2011). Hence, interviews provides possibilities to deliver information that is covering an overall picture and or detailed information about a given context.

Interviews exist in various forms and data collection can hence be performed in different ways. Generally they can either be done for the purpose of generating quantitative data or qualitative data. Structured interviews that follows a script of questions fits for the purpose of generating quantitative data, while unstructured

interviews that has an open conversational format will provide qualitative data. The two presented formats of performing interviews can also be combined as a third format in a semi-structured character where structured questions also leaves room for elaboration (Martin and Hanington, 2012).

4.1.1.1 Subject Matter Expert

A subject matter expert (SME) is according to Cooper et al. (2014) an authority within the domain which an artifact will operate in. It is considered to be of high value to meet with SMEs early on in the design process and especially if the domain is very technical or highly complex (Cooper et al., 2014). However, as stated by Cooper et al. (2014), there are some important aspects to consider when recruiting them and in particular the fact that even though they are considered knowledgeable expert users they are not by any means designers. Having access to multiple SMEs throughout the design process will benefit the final design, and similar to stakeholders they are able to provide perspectives on an artifact and its users that are of high value.

4.1.2 Stakeholder Meeting

Gathering input from various sources that are linked to a project fosters collaboration and increases the possibilities for improving the final outcome. A stakeholder meeting can be used as a method for collecting information about a system's purpose and its overall context of use from technical and domain experts (User Experience Professionals' Association, 2017a). It can also be seen as a strategic event where stakeholders are introduced to each other in order to commit to usability by defining specific usability objectives (User Experience Professionals' Association, 2017a).

4.1.3 Surveys

In order to collect information from large samples of respondents, a fitting option would be the performance of surveys. As a method surveys are great for collecting information that is self-reported by the respondents containing their individual characteristics, thoughts, feelings, perceptions, behaviours or attitudes (Martin and Hanington, 2012). As Martin and Hanington (2012) describes it the term itself describes a broad approach, but in practice there are two dominant techniques for performing a survey where the researcher can either choose to use a questionnaire or lead structured interviews.

4.2 Define

In the stage of *Define* the researcher puts its focus on assembling the information that has been generated and collected in the phase of *Emphasize*, further analyzing the information and combining it in order to identify and define the core problems (The Interaction Design Foundation, 2018).

4.2.1 Affinity Diagrams

After the performance of any type of raw data collection or ideation sessions, where notes have preferably been written onto sticky notes, there is a need to understand the content collected. At first glance there might be a minor or major chaos presenting itself when gathering the notes onto a table or a wall. Affinity diagrams aims at making order out of this chaos by grouping and pairing the notes into common categories or themes, eventually presenting an overview of the data and observations being made (Martin and Hanington, 2012). As stated by Kent (2016) the input data can exist in various forms and are considered to be subjective. As the name of the method implies, the process is based on finding the affinities or kinships hidden within the collected data. Hence by grouping the notes; themes, categories and patterns start to emerge naturally (Martin and Hanington, 2012).

4.2.2 Content Analysis

Applying content analysis as a method enables a researcher to draw conclusions from raw data in a systematic and structured way. As a method it can primary be approached as deductive or inductive and is often characterised by the usage of themes and categories for logical derivation of the gathered information (Hanington and Martin, 2012). It is usually iterated several times for the purpose of finding themes and categories that can be considered to be representative of the gathered data, eventually resulting in a hierarchical overview of the gathered data by potentially assigning the most interesting data pieces with one or more themes and or categories (Graneheim and Lundman, 2004).

The approach of inductive content analysis is generally considered to be the most common and preferred approach, being performed by collecting sentences, quotes or notes from previous observations that are considered representative of the gathered data and study in question (Hanington and Martin, 2012). A deductive approach to content analysis is used when the themes or categories has on beforehand been chosen, most often in relation to the choice of a specific framework that sets the ground rules for how it should be applied (Hanington and Martin, 2012).

4.2.3 Use Cases

As a method *Use Cases* are performed by defining descriptions of how users will perform tasks on a specific artifact, aiming at outlining the artifact's behaviour as it responds to a request from the perspective of a user (Usability.gov, 2019b). Furthermore, according to Usability.gov (2019b), each individual use case is defined as a sequence of basic steps, starting with the user's goal and eventually finishing after the specific goal is fulfilled. Defining use cases adds value in the design process due to the fact that they provide a clarification of how an artifact is supposed to behave, while in the meantime providing brainstorming for what potentially could go wrong.

4.3 Ideate

The third stage in the design process focuses on performing ideation based on the knowledge outcome of the two previous phases. Ideating contributes to the identification of new solutions to the stated problem by applying methods that supports creative thinking outside of the current frames, ultimately generating alternative ways to look at the problem (The Interaction Design Foundation, 2018).

4.3.1 Brainstorming

The method of brainstorming is performed either individually or in a group and has the purpose of generating ideas that will find solutions to problems or increase creative efficiency (Wilson, 2013). In practice it is recommended to strive for producing as many ideas as possible during a certain amount of time while not delimiting the session in any sort of boundaries regarding what kinds of ideas that are actually valid (Kelley and Littman, 2000). This is supported by Wilson (2013) in his declaration of the three fundamental principles for brainstorming where; **(1)** *the aim is for sheer quantity*, **(2)** *defer judgment about the quality of ideas*, **(3)** *encourage new and wild ideas*. However, it is important for the brainstorming session that the problem statement or question in mind is not too vague, since this could inflict on finding the right focus (Kelley and Littman, 2000).

4.3.2 Design Workshop

As stated by Martin and Hanington (2012) the concept of a design workshop is based on activities of participatory design, where "*creative co-design methods are consolidated into organized sessions*" enabling several participants to work with members of a design team. In practice a design workshop might start with a presentation of a topic and agenda in order to spark discussion among the participants. This is eventually followed by practical design work where certain design tools are applied, for instance as a means of producing sketches and or storyboards (Martin and Hanington, 2012).

4.3.3 Mind Mapping

According to Martin and Hanington (2012) mind mapping helps researchers to better understand the "*different ways that people prioritize and organize information*". It is often used as a method for organizing a problem area visually, where the purpose is to increase the understanding of a problem that has several moving parts. Mind mapping supports generating new concepts and ideas when the different parts' relationships' are diffuse. This is possible by adapting a non-linear process of externalizing individual information visually for *consolidation*, *interpretation*, *communication*, *storing*, and *retrieving information* (Martin and Hanington, 2012).

4.3.4 Personas

In user-centered design it is of importance to understand people and their needs, but making an attempt at designing for each individual results in incoherent solutions, hence there is a need for some form of consolidation (Martin and Hanington, 2012). Personas are used as a means of developing a clear concept of a targeted user from a user group (Randolph, 2004) and originates from the need of a technique to synthesize and communicate design research for software development (Martin and Hanington, 2012). The method is initiated through a brainstorming session that aims at generating types of people who will use the system or product in mind. Hence, acting as hypothetical users, personas can represent fictional people from different groups of users (Randolph, 2004).

4.3.5 Sketching

In order to further concretize generated ideas that has been documented in some form, or generate new ones, the use of sketching as a method can be useful. Traditionally freehand sketching has been considered to be a core conceptual tool for design ideation, while this can also be done electronically (Jonson, 2005). The aim of sketching is to support designers in exploring and communicating new ideas by drawing (Purgathofer and Baumann, 2010). It can be useful for planning and considering alternative solutions to a given problem and is suited for producing lo-fidelity prototypes quickly, hence the incomplete visualization of a prototype and its incomplete drawn lines often allows for different interpretation (van der Lugt, 2005).

4.4 Prototype

Based on the proposed solutions in the earlier stages it is important to start producing several versions of a product and or its specific features that has been found to be of importance to solve the problem (The Interaction Design Foundation, 2018). Houde and Hill (1997) states that prototypes are made in order to represent different states of an evolving design and to explore options. The method should be seen as an iterative process where the prototypes serve a variety of purposes such as testing out technical feasibility, clarifying vague requirements or to perform user-testing and evaluation (Sharp et al., 2011). However, prototyping in design thinking is a phase of exploration, hence it can also be used to stimulate imagination (Elverum et al., 2016).

According to Walker et al. (2002) the right choice of prototyping technique will reveal the maximum amount of real usability problems in user tests, while being flexible and inexpensive for the designer. In order to start the prototyping phase and choose the right technique it is important to consider whether the prototypes being produced should be of *Low Fidelity* (Lo-Fi) and or *High Fidelity* (Hi-Fi). In prototyping the term *fidelity* describes the distinction of a prototype from a final product and it is possible to manipulate it to emphasize different aspects of

the design (Walker et al., 2002). The fidelity of a prototype can vary in the areas of *Interactivity*, *Visuals* and *Content and commands* (Nielsen Norman Group, 2019).

Liu and Khooshabeh (2003) states that the fidelity of a prototype is an important factor in order to elicit feedback of quality, while level of automation is another factor that impacts the revealing of major usability issues. It is also possible to combine Lo-Fi and Hi-Fi prototyping as *mixed* prototyping where digital and physical prototypes can contribute to additional insights in the design process (Elverum et al., 2016).

4.4.1 Low Fidelity (Lo-Fi)

Prototypes of low fidelity is often related to physical paper prototyping, but can also be created with certain computer applications (Walker et al., 2002). Prototyping with paper allows the designer to be flexible in the early stages of the prototyping phase, but can be insufficient for application in formal user studies due to issues with the validity (Liu and Khooshabeh, 2003). Another problem is the simulation of automation and sometimes Lo-Fi applications demand a human or computer to fake the behavior in order to demonstrate the interaction (Walker et al., 2002).

4.4.2 High Fidelity (Hi-Fi)

Prototypes that leans towards a higher fidelity are considered to be of a more realistic quality due to its refinement and impression of a finished product. Researchers have claimed low fidelity approaches are insufficient to capture interactivity, hence the use of high fidelity prototypes are necessary (Lim et al., 2006). Prototypes of high fidelity are often made using the same methods and utilities as the final artifact, hence it has a similar appearance and uses the same techniques, but a major drawback is the production which is more expensive and time consuming (Walker et al., 2002). Prototyping artifacts of high fidelity can take advantage of a variety of software and tools to create interfaces that enables automation and interaction of a higher complexity.

4.4.3 Digital Prototyping

Since prototypes of high fidelity strives to be a refined artifact, giving the impression of a more realistic quality, a graphical user interface can take advantage of digital design tools. Digital prototypes can be shaped in different complexities, hence they can be shown as static views, visualize information and involve animations depending on the level of perceived interaction that is aimed for. As a method, Sass and Oxman (2006) states that digital design in general can be described as a "*constructed relationship between information and forms of representation that support design in computational environments*". A variety of software tools for designing graphical user interfaces can be used and some of them have their individual niches for application. Examples of these software tools are *Adobe XD* (2019), *Figma* (2019), *Framer X* (2019) and *Sketch* (2019). Several of them has libraries and plugins to create more immersive user experiences for testing and other purposes.

4.5 Test

It is of importance to evaluate and test the prototypes generated in the previous stage in order to understand whether the problem is being solved or not. The results can then be used to redefine additional problems during the iterative process (The Interaction Design Foundation, 2018).

4.5.1 Cognitive Walkthrough

A cognitive walkthrough is used as a method for evaluating an artifact's reflection of how people process tasks cognitively and are able to anticipate the next upcoming steps when using it (Martin and Hanington, 2012). The focus is put on understanding an artifacts learnability for both new and infrequent users, being carried out by one or more evaluators that works through a series of specific tasks while simultaneously asking themselves a related set of questions for each possible action from the perspective of a real user (User Experience Professionals' Association, 2017b). For each task there are four specific questions that has to be answered in each step of the process. As a method it is versatile and exists in various forms, but most of them are based on using four core questions once constructed by Wharton et al. (1994) in the article *The cognitive walkthrough method: a practitioner's guide*, which is presented in the book *Usability inspection methods* by Nielsen and Mack (1994):

1. Will the user try to achieve the right effect?
2. Will the user notice that the correct action is available?
3. Will the user associate the correct action with the effect that the user is trying to achieve?
4. If the correct action is performed, will the user see that progress is being made toward the solution of the task?

In order to perform a proper cognitive walkthrough there are a set of guidelines for the required resources to take into consideration before proceeding. Wilson (2014) has listed five essential components that are beneficial during the process:

- User profile
- List of tasks
- Action sequence for each task
- Problem reporting form
- Representation of the user interface

4.5.2 Concept Testing

It might be hard to find the best design solution when moving too fast in the design process without considering other alternatives. This potential issue might furthermore be even harder to overcome when time start to goes by and the ideas get attached to a single concept, idea or direction (Bowman, 2017). The method of *Concept Testing* is a smooth and quick way of exploring different alternatives of a

design in order to obtain feedback that is valuable for the final prototype and the iterative design process. By making space to test multiple design concepts there are possibilities in achieving synergy effects, and as stated by Bowman (2017) it is not of importance for a concept to be in the shape of a Hi-Fi prototype, but rather sketches, storyboards or wireframes are considered solid material for testing.

4.5.3 Think Aloud Protocols

According to Fonteyn et al. (1993) the practice of Think Aloud (TA) is used to provide rich verbal data about reasoning during a problem solving task and in combination with protocol analysis it is possible for investigators to identify essential information. It is a method suitable for revealing different aspects of a user interface that are confusing, delighting and frustrating by asking participants to complete a task while verbalizing what they are doing (Martin and Hanington, 2012).

The use of TA-protocols contributes to understanding the processes of reasoning that are used to solve problems in various situations (Fonteyn et al, 1993). TA-protocols can be done on a wide range of artifacts no matter the fidelity, and in practice evaluators can choose between either asking the participants to interact with the interface in mind and be quiet in order to verbalize their thoughts afterwards (retrospective TA) or to "think aloud" while encouraging them to verbalize anything they feel, do or look at as they complete different tasks (concurrent TA) (Martin and Hanington, 2012).

5
Planning

This chapter presents the planning work and its generation of the main three phases in this project: *1. Background Research and Planning*, *2. Design Process* and *3. Finalize*. Each phase involves specific work and scheduled time in a *GANTT* chart, further down presented in their respective subsection.

5.1 Definition of Scope

Based on the initial contact with stakeholder ÅF Digital Solutions, involving negotiations about the establishment of a research question as well as a minor document retrieval, the overarching problem statement was formulated. In a collaborative research project ÅF Digital Solutions and Sahlgrenska Universitetssjukhuset (SU) had agreed upon developing a proof of concept prototype in the shape of an integrated chatbot on a bedside-tablet as a service for hospitalized patients. Hence, there was a stated concern from both stakeholders regarding the implications of integrating chatbots and digital services into institutionalized healthcare. Based on the given concern there was a mutual understanding with the stakeholders towards the need of a graphical user interface that utilizes a chatbot and relevant features to further support a patient-centered care. Ultimately, an initial research question was settled as:

"*What features should be considered when designing a patient-centered GUI for improved communication between hospitalized patients and institutional healthcare?*".

The planning work had its major time distributed onto *gathering and studying relevant methodology and scientific articles of the area*, *defining the scope*, *exploring related products*, *retrieving documents*, and *attending* as well as *setting up meetings with stakeholders*. The outcome of the mentioned activities were then summarized and presented in a planning report that was handed in for review in order to proceed with the project.

5.2 Work Phases

This section presents the planned phases of the project.

5.2.1 Phase 1 - Background Research and Planning

This phase was planned to involve four full weeks of work and comprised the period of: 21-01-2019 to 17-02-2019. In this phase the activities were divided into: *Study Methodology*, *Explore Related Products*, *Define Scope*, *Gather and Study Scientific Articles*, *Attend and Setup Stakeholder Meetings*, and *Document Retrieval* as seen in *Figure 5.1*.

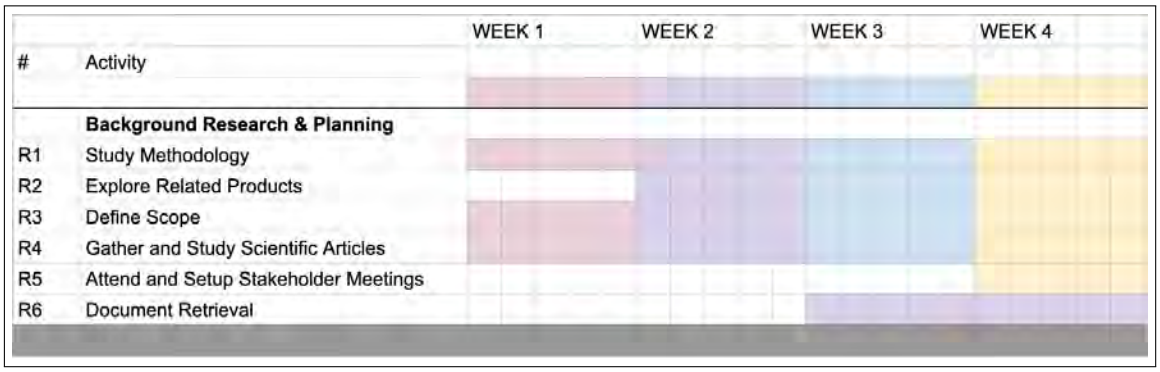


Figure 5.1: Background Research and Planning

5.2.2 Phase 2 - Design Process

This phase involved twelve full weeks of work and comprises the period of: 18-02-2019 to 12-05-2019. This phase was planned to be based on the design thinking process where three iterations were to be performed in order to answer the established research question. Involving the different stages of *Empathize*, *Define*, *Ideate*, *Prototype* and *Test* in the process, several methods were planned to be utilized (see *Figure 5.2*). The specific methods that were learned and utilized can be seen in section *4. Methodology*.

Figure 5.2: Design Process

5.2.3 Phase 3 - Finalize Work

This phase involved four full weeks of work and comprises the period of: 13-05-2019 to 09-06-2019. In this phase the activities were divided into: *Analysis*, *Create Guidelines and or Requirements of Features*, *Report Writing* and *Presentation* as seen in *Figure 5.3*.

Figure 5.3: Finalize Work

6
Execution and Process

This section provides a sequential summary of the work process and its accompanying design iterations. Each iteration is considered to have ended whenever there was a reason to move back to a previous stage in the design process, hence resulting in the initiation of a new iteration. As the previous section provided a description of the planning phase and its planned utilization of design methods during the process, this section is focused on presenting the outcome and occurring events that sparked the actual utilization of different design methods.

6.1 Iteration One

This subsection presents the outcome of the first iteration in the design process.

6.1.1 Empathize

Initially the phase of *empathize* involved a continued focus on defining the scope by studying the relevant methodology, literature and related products accompanied by stakeholder meetings and document retrieval. These activities were crucial to the project since it settled the foundation in providing an overall understanding of how to empathize with hospitalized patients as the targeted end users. The following planned activities of preparing and performing both surveys with patients and interviews with healthcare staff occurred with minor changes that are explained further down in their respective subsection.

6.1.1.1 Literature Review

As described in the section of *5. Planning* it was important to review and analyze the literature further in order to reflect upon its relevance and credibility. The section of *2. Background* covers the digitization of healthcare broadly while discussing its current benefits and problems stated in various scientific sources. In order to answer the established research question the section was decided to include the concepts of interactive dialogue systems, chatbots and healthcare interface design while presenting the related scientific work and products within the area. The section of *3. Theory* covers the essential scientific frameworks, additional concepts of relevance and possible design methodology to utilize.

6.1.1.2 Prepare Surveys

In order to gather information and data about how hospitalized patients experience their situation when laying in bed and subsequently have a chance of making them reflect upon their individual needs, it was mutually agreed with the stakeholders to create a survey. Based on earlier e-mail conversations and stakeholder meetings it was decided that the survey would be performed by using an internet connected tablet that was given to hospitalized patients in department [xx] at SU and having them filling it out in their own pace. Due to ethical reasons the patients would remain as anonymous as possible with no requests of filling in their personal information. Inspired partly by the performed literature reviews the survey was designed to be structured section wise as:

1. Utilize *the eight principles of patient-centered care*, created by Picker Institute Europe (2019), translated into Swedish. In its form patients would rate their experience based on the principles from 1-5, where 1 is "not true" and 5 is "absolutely true".
2. Asking questions about *patients experiences and preferences within their care with a focus put on digital technology usage and communication.* The specific questions requested the same format as in the first section, but with a varied focus depending on the definition of each question.
3. Three final open ended questions about how to improve their visit, inspired by the concept of *Ask One Question* from the article *How Asking Patients a Simple Question Enhances Care at the Bedside: Medical Students as Agents of Quality Improvement* by Ward et al. (2013).

Initially during the preparation of the surveys the stakeholders informed about the realistic possibility of having approximately 15-20 patients filling out the survey. A preliminary date was set for the performance, but a confirmation was to be awaited by the section manager whom would ultimately be responsible to get back with a fixed date and time. The survey can be seen in its full format in *Appendix A*.

6.1.1.3 Prepare Interviews

In order to not only obtain data from hospitalized patients the work would benefit from the additional perspectives of healthcare staff that daily cares for the targeted user group. In coordination with the stakeholders it was promised that 5-10 out of the healthcare staff would be available for interviews and that they were preferably to be held at department [xx] at SU during the shift work. It was mutually agreed that the interviews on the department would also be kept anonymous and hence no personal information would be asked to be provided by the respondents.

The interview format was designed to follow the SPIN methodology where the questions are divided into four areas focusing on the aspects of: *Situation*, *Problem*, *Implication* and *Need-Payoff* (Rackham, 1988). Even though the framework was initially developed by Rackham (1988) as a means for improving selling technique it was considered in agreement with the stakeholders to fit the purpose of understand-

ing these areas in regards to digitization of healthcare and the related perspectives of the healthcare staff. Just like the preparations with the surveys, a date was to be decided by the section manager, even though a preliminary date was discussed during the first stakeholder meeting at the hospital. The interview template can be seen in its full format in *Appendix B*.

6.1.1.4 Stakeholder Meeting

A second meeting with ÅF was setup as a means of informing about technical and strategical aspects of the project's scope and its current status. On a technical note ÅF would attempt at making a basic chatbot prototype for research purposes on the facility of department [xx] at SU and utilize the cloud-based API service *QnA Maker* (2019) by Microsoft. Shortly described; the chatbot itself would be comprised of a knowledge base with the relevant answers and questions in QnA Maker, which is connected to a database provided by ÅF based on MSSQL. Eventually it was to be implemented onto a bed-side tablet with the standard viewport resolution of 768 x 1024 pixels. As described in the introduction (*1. Introduction*) there was a need for a GUI that had a patient-centered focus which integrated not only the chatbot, but also the relevant features that are possibly requested by hospitalized patients. At the current state the chatbot's GUI was very simple and allowed for minimal interaction. The meeting provided basic but valuable insights about the purpose and restrictions of the project.

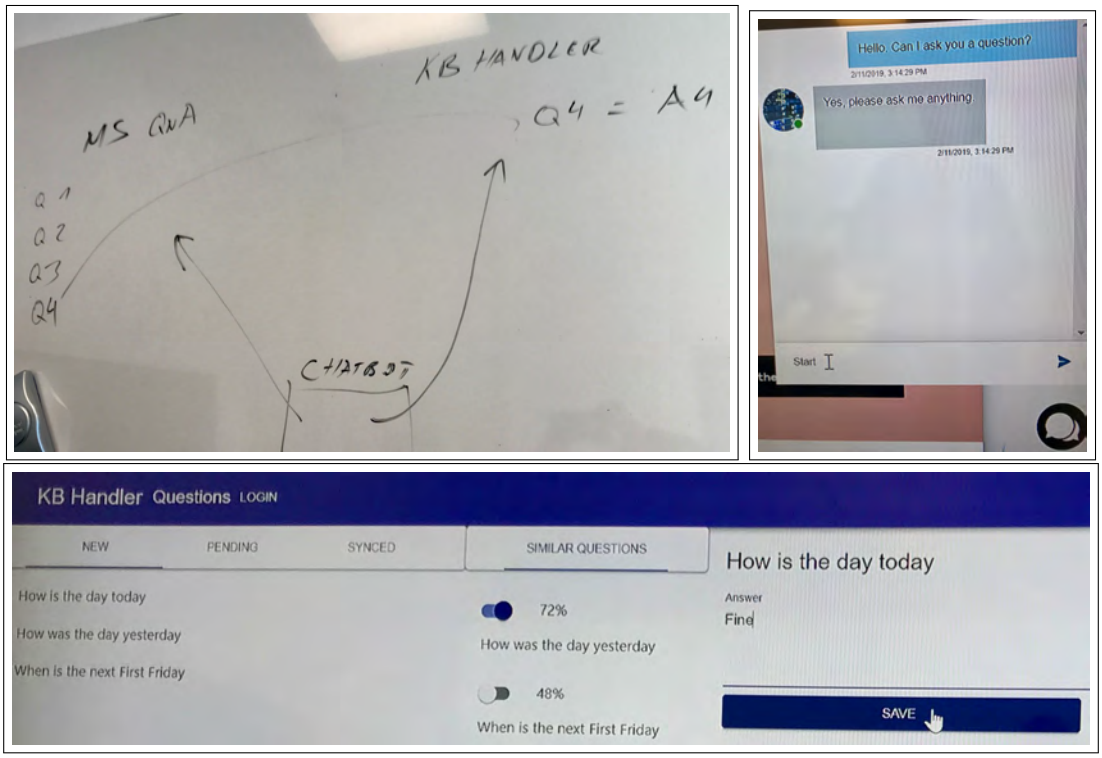


Figure 6.1: *Top Left:* Loose overarching view of chatbot logic. *Top Right:* Chatbot's GUI. *Bottom:* Knowledgebase Handler

6.1.2 Define

In order to proceed with the first iteration of the design process a minor deductive content analysis was performed on the collected literature findings. This was done as a means of getting an overarching view of how to utilize the different findings and to further spark the ideation while receiving clearance of dates from stakeholders and section managers for performing the prepared surveys and interviews.

6.1.2.1 Content Analysis

In order to gather the important findings from the scientific literature, a model was created to represent the scientific guidelines that could potentially be utilized in the process. As seen in *figure 6.1*, the model presents seven "frameworks" from the scientific literature studies and were hence further considered to be able to contribute to future ideation sessions.

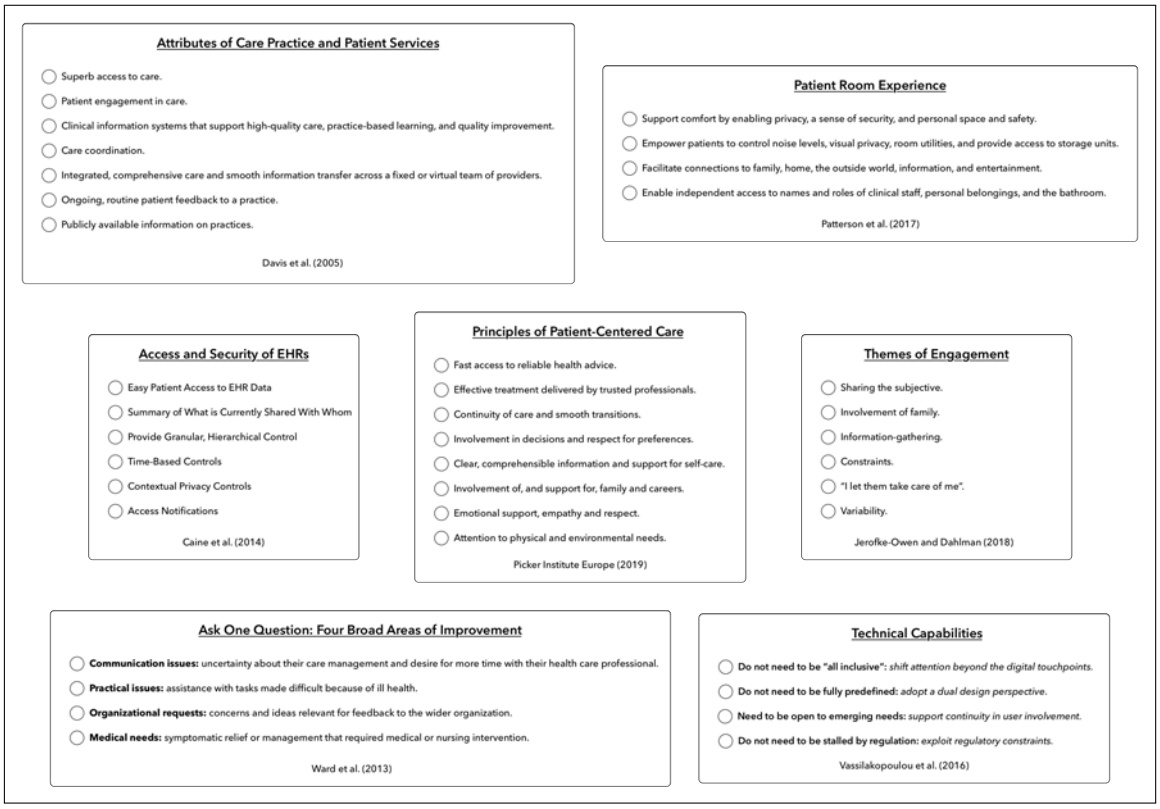


Figure 6.2: Scientific Guidelines

The model helped understand some of the factors that are of relevance for patient-centered care and was considered to eventually be helpful in answering the research question to a beneficial degree. For further clearance in text, the model is comprised of:

- **Attributes of Care Practice and Patient Services** - by Davis et al. (2005)
- **Patient Room Experience** - by Patterson et al. (2017)
- **Access and Security of EHRs** - by Caine et al. (2014)
- **Principles of Patient Centered Care** - by Picker Institute Europe (2018)

- **Themes of Engagement** - by Jerofke-Owen and Dahlman (2018)
- **Ask One Question: Four Broad Areas of Improvement** - by Ward et al. (2013)
- **Technical Capabilities** - by Vassilakopoulou et al. (2016)

Ultimately the "frameworks" would be used consequently when designing the GUI and provide additional insights to the gathered data from the planned surveys and interviews.

6.1.3 Ideate

The ideation in the first iteration focused on exploring the possible features of relevance for a patient-centered GUI. This resulted in a mind map based on the model with scientific guidelines (*Figure 6.2*) and three sketches for suggested implementations of a chatbot onto a bedside-tablet.

6.1.3.1 Mind Mapping

As mentioned, it was possible to utilize the findings from the literature in order to spark ideation. Hence, a mind map was created as a means of putting down ideas of possible features integrated into a bedside-tablet for hospitalized patients. The mind map can be seen in the figure below (*Figure 6.3*) and during the session ideas were provoked from the literature, as illustrated on the whiteboard, and spontaneous suggestions that occurred.

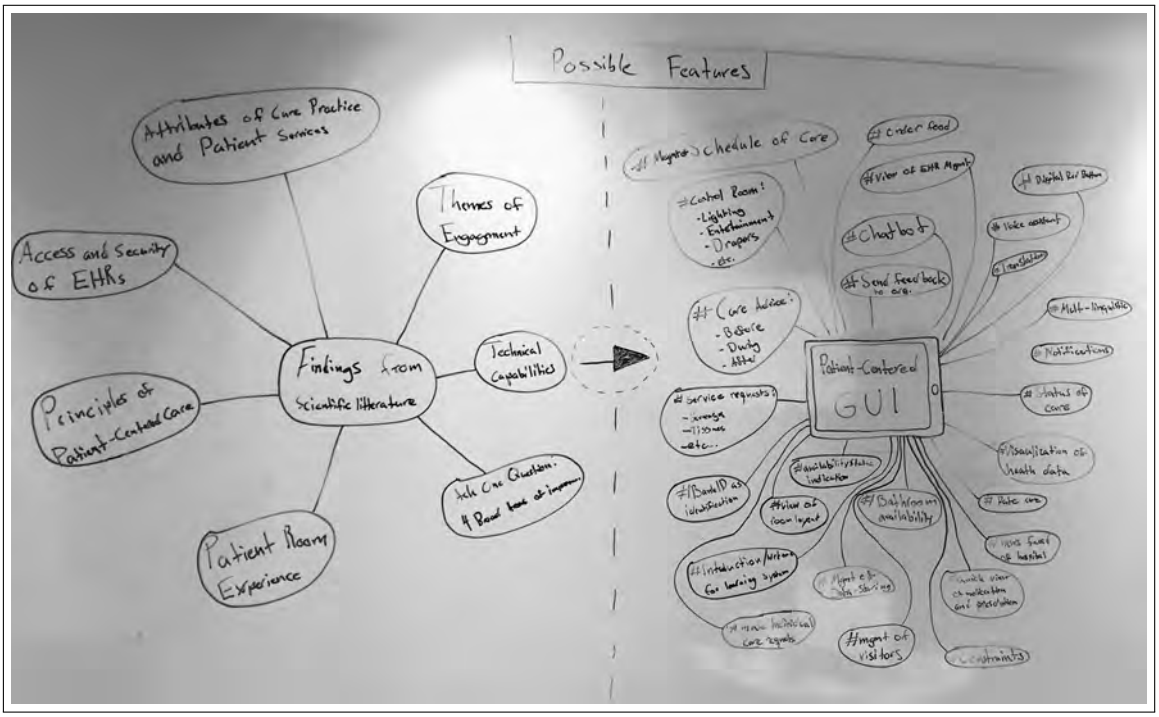


Figure 6.3: Mind map of fossible features for a GUI.

The generated ideas of possible features that were drawn onto the whiteboard were afterwards accumulated and reformulated digitally as a means of creating a foundation for potential use cases as well as a first draft of features to consider. The formulated ideas of possible features can be seen in *Table 6.1* below:

Manage Schedule of Care	**Learn Navigation of GUI**	**View Bathroom Availability**
Control Physical Space	**Learn Properties of GUI**	**View Medication Information**
Get Care Advice	**Make Personal Care Requests**	**View Prescription Information**
Make Service Requests	**View Facility Layout**	**Set Personal Constraints**
Perform Secure Identification	**Set Personal Availability**	**Manage Visitors**
Use Chatbot	**View and Manage EHR**	**Set Preferences for Food**
Manage Data-Sharing	**View Hospital News & Information**	**Rate & Log Care Experience**
Visualize Health Data	**View Care Status**	**Use Digital Red Button**

Table 6.1: Generated Ideas of Possible Features

6.1.3.2 Sketching

The sketching session was performed in a basic manner onto a whiteboard and had the primary purpose of exploring three different visual integrations of a chatbot into a GUI. The three sketches can be seen in *Figure 6.4* down below.

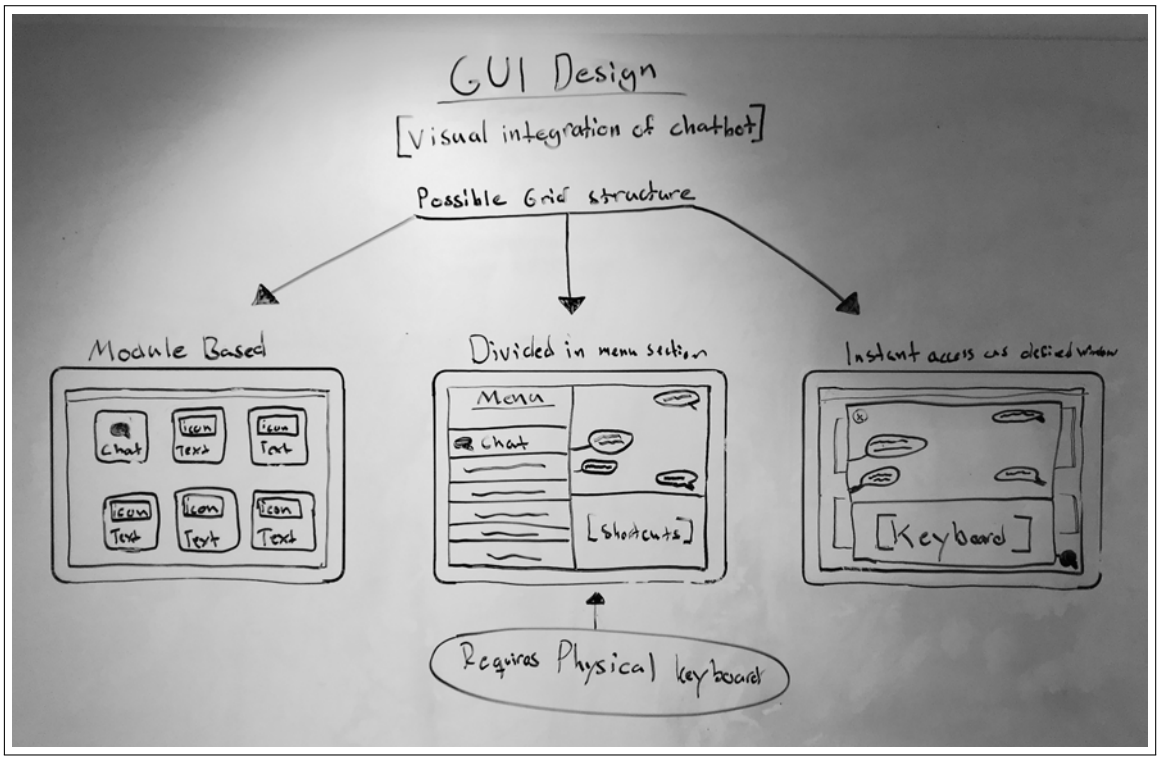


Figure 6.4: Sketches of Alternatives for Chatbot Integration.

As seen in the figure (*Figure 6.4*) the left sketch with the label "*Module Based*" shows how each possible feature is visually divided by a simple grid structure. The middle sketch with the label "*Divided in Menu Section*" is divided as a fixed menu to the left where a suggested physical keyboard is required for interacting with the chatbot or for instance searching for relevant features. The right sketch with the label "*Instant*

Access as Defined Windows" suggest a chatbot that is always accessible in any part of the GUI through a fixed chat bubble down to the right.

6.2 Iteration Two

This subsection presents the outcome of the second iteration in the design process.

6.2.1 Define

Based on the outcome of the first iteration it was possible to generate several possible use cases and define these in a visual manner for later expansion, clearance and revision.

6.2.1.1 Stakeholder Meeting

A first start-up meeting was held with the project group of the Vinnova (2019) supported *Verklighetslabbet* at department [xx] at SU. The meeting had a focus on discussing the technical and design related issues of the implementation of the chatbot while forming a timeline for the different steps in the process. The department acting as a test site was treating patients in advance or after various surgical operations. Due to the fact that the chatbot is not autonomous, hence not learning by itself from the user's input based on algorithmic parameters, the healthcare staff would define how a match is made between a user's question and the possible answer. This sparked a discussion on the backend side whether there would be some sort of *approval* and *signature* functionality embedded in order to provide the patients with the best possible answers.

Regarding the GUI and the information provided by the chatbot towards the patient, it was of importance due to the technical limitations, the answers would include hard coded links and text pieces. If the patient would ask the chatbot about emergent health related issues it would also be important to answer directly that the healthcare staff should be notified immediately. Furthermore, it was decided that a list of frequently asked questions (FAQ) should be produced by the healthcare representative of the project group, ultimately being updated as often as possible. The meeting was concluded with a positive mindset where the project group expressed seeing great potential in being able to increase the efficiency of the healthcare staff.

6.2.1.2 Use Case Generation

In order to further understand the targeted user group and be able to answer the research question, the generated mind map and ideas of possible features from the previous ideation session were able to help generate possible use cases. The aim was not to specify a few detailed use cases, but to generate several overarching use cases for further reference and discussion during a planned workshop. The generated overarching use cases were put in a model as a preparation for the workshop and is seen in *figure 6.4*.

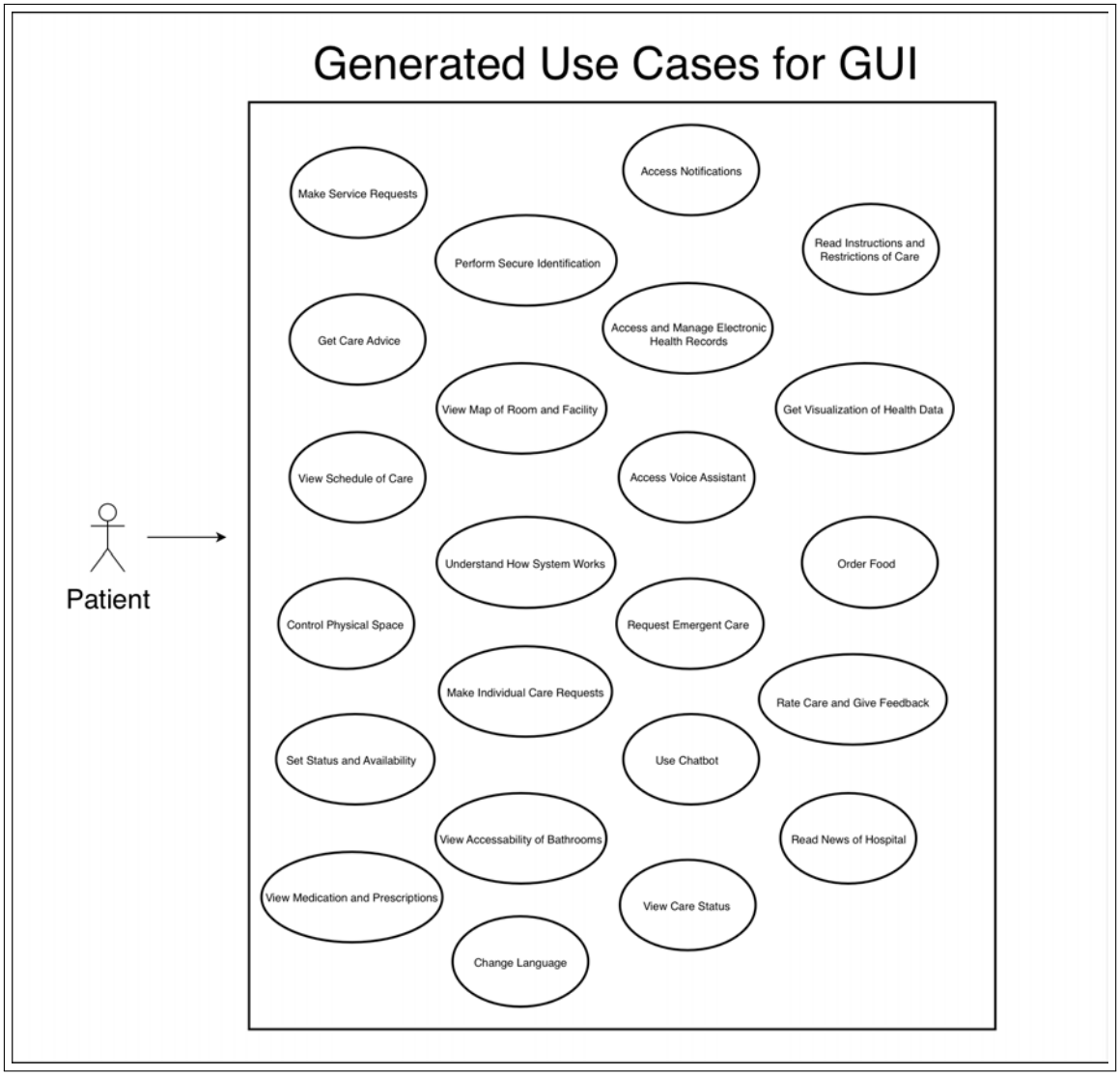


Figure 6.5: First Draft of General Use Cases

6.2.2 Ideate

In order to further ideate and obtain other perspectives in designing for hospitalized patients, a design workshop was set up with three last year master of science students from the program *Interaction Design and Technologies* at Chalmers University of Technology.

6.2.2.1 Design Workshop

The workshop was set up with the agenda of producing new insights and suggestions towards designing for hospitalized patients. The workshop followed a predetermined sequence and started off with a brief presentation about what the research project was about including its scope of patient-centered care and limitations to the format of a tablet and that a chatbot must always be accessible in the navigational structure. The participants were informed that they would participate in *four specific*

design challenges each followed by a discussion, which sequentially followed as:

1. *Five minutes* of noting down as many possible features as possible that they would find beneficial for a patient-centered GUI on a bedside tablet (see *Figure 6.6*). Afterwards they were presented with the previously generated use cases (see *figure 6.4*) as a tool for discussion and inspiration for the three following challenges.
2. *Five minutes* of sketching the possible *grid* and layout for the GUI. This was followed by a short discussion.
3. *Five minutes* of sketching the integration of the *chatbot* into the GUI design. This was followed by a short discussion.
4. *Five minutes* of sketching a *random feature* for the GUI. This was followed by a short discussion.

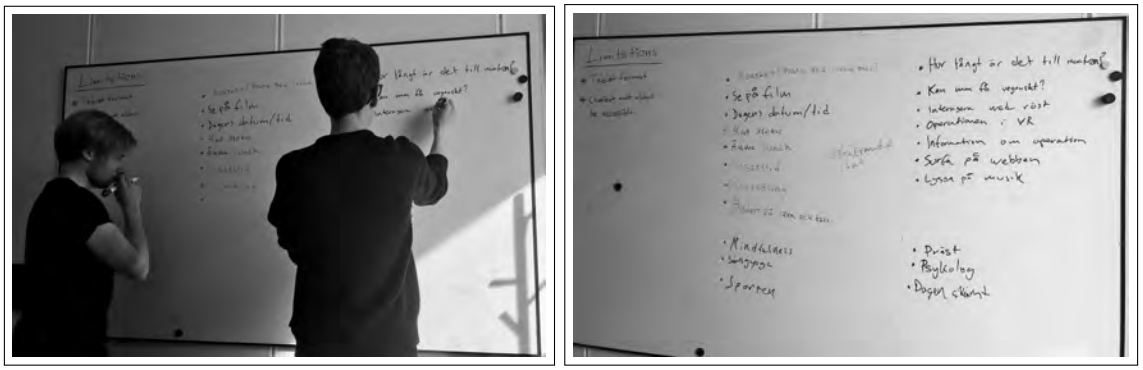


Figure 6.6: Design Workshop - 1st Challenge

Subsequently, after the first challenge the participants had noted down (translated and summarized from Swedish) several ideas of what to do and include in a patient-centered GUI, which can be seen in *Table 6.2*.

Connect with Loved Ones	**On-Screen Entertainment**	**Mindfulness**
View Food Menu	**Change Lunch**	**Interact Through Voice**
Understand Treatment	**Contact Psychiatrist**	**View Date & Time**
Contact Priest	**Motivational Quotes**	**View Visitor Time**
View Operation Procedure	**Surf the Web**	**Listen to Music**

Table 6.2: Ideas of Features for a Patient-Centered GUI

The generated ideas of features provided a foundation for the following three different sketching challenges. Eventually, after performing all four challenges every participant mounted the sketches in a structured manner onto a whiteboard for further discussion. As seen in Figure *6.6*, using post-it notes several additional ideas and thoughts were added.

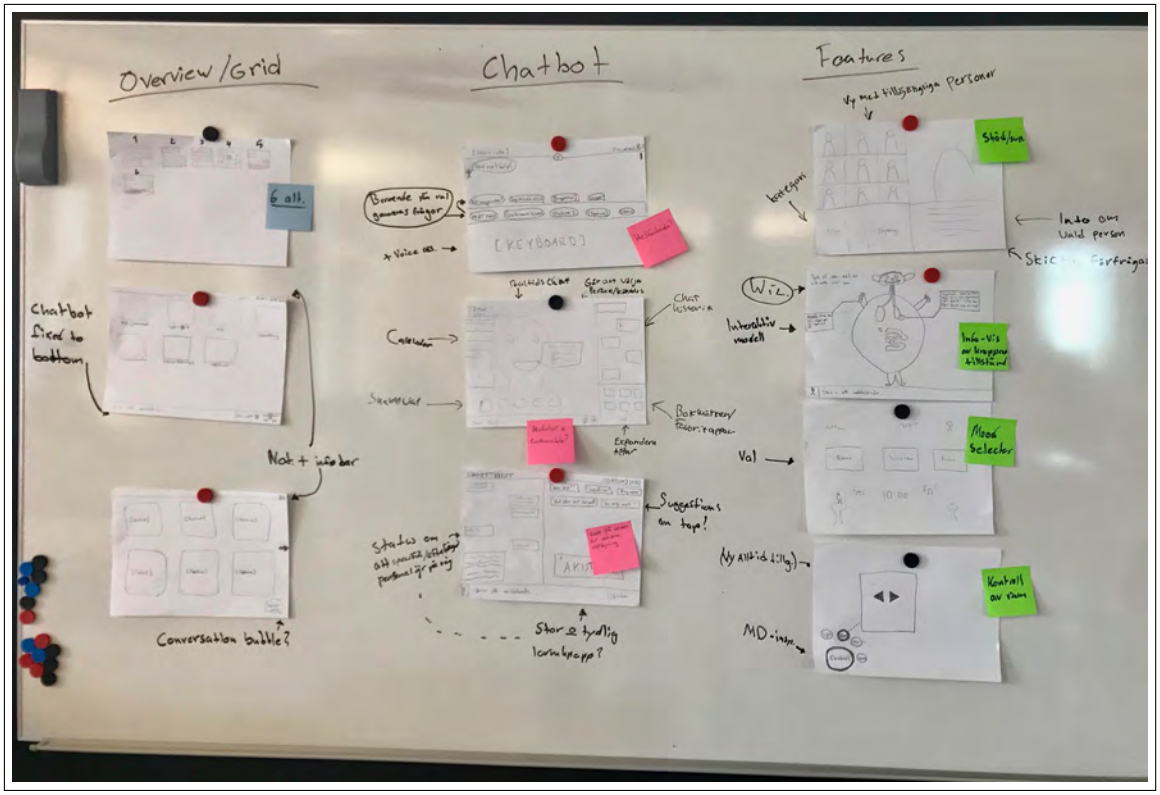


Figure 6.7: Design Workshop - Final Discussion and Ideation

The workshop provided great value and important insights about the interface design which were documented from the discussions and three sketching challenges á five minutes each in their respective area of *Overview/Grid*, *Chatbot* and *Features*.

Regarding the Overview/Grid there were eight different structures to the GUI that was generated and in particular a discussion was held about making the chatbot accessible through the icon of a chat bubble fixed to a certain part of the GUI or just having a defined text input area that is visually the center of the GUI and fixed to the bottom. The sketched wireframes of the chatbot's interface design provided suggestions such as enabling categorization for specific sets of questions, involving different sets of embedded features in a modular grid structure and the possibility of both a physical and digital button for interacting with a voice assistant. The sketched wireframes of randomly generated features presented opportunities of how to access mental health support, an interactive model of the human body that visualizes the information about the hospitalized patient's health state and controlling or selecting features regarding the physical space surrounding the hospitalized patient.

6.3 Iteration Three

This subsection presents the outcome of the third iteration in the design process.

6.3.1 Empathize

Early on in the process, thoroughly described in section *6.1 Iteration One*, a time was settled for both performing surveys with patients as well as interviews with healthcare staff. However, due to several informed delays from the stakeholders and the department [xx], caused partly because of issues with the virus *Caliciviridae* on the department and unexpected events of being understaffed, the planned sessions for interviews and surveys on the department was held back until a few weeks forward. Hence, as understood retrospectively there was a need to manage the time differently during the first iteration. Eventually, after meetings and e-mail conversations with the stakeholders' and their suggested connections, it was understood that what was initially promised regarding the amount of interviews and surveys could not be held. However, even though there was a delay, it was possible to perform both the surveys and interviews on location at department [xx] while it was a minor disappointment regarding the fact that the quantitative data from the patients was a bit comprised.

6.3.1.1 Performance of Surveys

As a means of fully covering any potential drawbacks on location when letting the patients fill in the survey on the tablet, 20 pieces of the survey was printed on paper to be handed out. When meeting with the section manager on location at department [xx] it was clear that it was a wise move to print the surveys on paper on beforehand since passing around the tablet with the digital form would be heavily time consuming. The procedure of handing out the survey was quite simple, but required a great amount of patience. In performance the section manager of the department wrote down a list of the potential patient rooms to visit and based on this the patients were asked if they wanted to participate while being informed about its purpose and the fully anonymous nature of it where no personal information was requested. Some of the patients were at sight not in the physical or mental state to fill these in, hence this was carefully considered when engaging with them. On location this contributed to the decision of letting the patients take their time and not create any sort of discomfort in rushing or pushing them to complete the survey.

Unfortunately the promise of performing the survey with 20 patients was not held and engaging with the hospitalized patients was a struggle in various aspects. In total eight patients performed the survey, partly due to the fact that some of the patients did simply not want to fill in the survey, were too tired or asleep. A great deal of respect was kept towards the patients privacy and followed strictly the process of: **(1)** *visiting the rooms with patients that were of a decent health state based on the section managers decision*, **(2)** *having nurses ask the patients if they would like to participate in the survey*, **(3)** *informing the patient about the survey's purpose and anonymous character*, **(4)** *handing over the survey on paper* and **(5)** *gathering*

it 30 minutes after. Even though the circumstances were not optimal, there were some quantitative and qualitative findings of importance that could be discovered.

6.3.1.2 Performance of Interviews

As stated initially, there was a promise of having access to 5-10 persons from the healthcare staff. The performance of the interviews would have to be done during the shift work and as stated before all of the interviews were mutually agreed upon with stakeholders to be fully anonymous with an exception of letting the staff members tell their working title if agreed upon before starting the interview. However, on location there were only three members of the staff, two assistant nurses and one nurse, that were available for interviews.

Due to the interviews qualitative character, even though somewhat restricted structurally by the SPIN framework, the staff members provided a lot of valuable information regarding how they interact with hospitalized patients and what kind of requests that they have been experienced to be verbally communicated from them. In performance the interviews was held in the lunch room of department [xx] and due to its agreed anonymous character, besides the given work titles, the interview was not recorded on any sort of device and instead notes were taken and quotes were written down for compilation analysis. Before starting the interview the participants were briefed about its purpose, scope and right to full anonymity.

6.3.1.3 Stakeholder Meeting

A second follow-up meeting was held with the project group of Verklighetslabbet at department [xx] at SU. The struggle of accessing hospitalized patients was first on the agenda, due to the problematic experience of performing the surveys. In order to properly being able to design for the target group there would have to be some form of compromise, hence a proposal was made regarding a future co-design workshop involving both healthcare staff and people that has some form of experience of being hospitalized. The proposal did also suggest that the co-design workshop would be held in a hospital environment in order to increase authenticity. Furthermore, a discussion was held about performing some form of risk analysis in order to establish the different risks with the implementation and make sure to avoid pitholes when testing it on the hospitalized patients. Therefore, a proposal was also made regarding the performance of creating a stakeholder mapping in order to understand the connections that have an impact on the hospitalized patient. The project group found the suggestions to be of high value and stated that an attempt would be made at scheduling the workshop at department [xx] at SU within a few weeks time. Furthermore the stakeholders had provided a set of questions and answers for the knowledge base to take advantage from in establishing the essential features in a GUI on a bedside-tablet for hospitalized patients.

6.3.2 Define

After performing the surveys and interviews with patients and healthcare staff members there was a need to analyse and define their qualitative and quantitative outcome.

6.3.2.1 Analysis of Surveys

Regarding distinct quantitative data results it was possible to determine a few factors that could be of importance when implementing a patient-centered GUI into a bedside-tablet. First off, as seen to the right chart in *Figure 6.8*, it was shown that seven out of eight patients had never heard of the concept of a chatbot. Even though the concept was not contextualized in the survey, this could point towards the fact that the usage of chatbots is not widespread or generally understood.

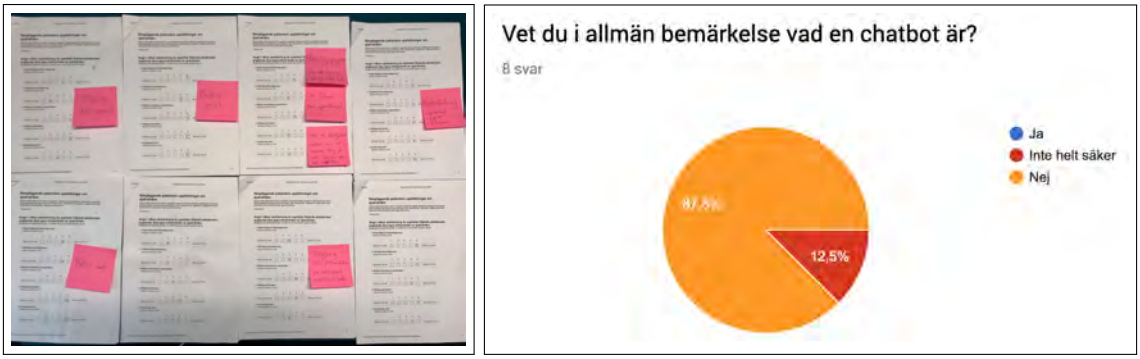


Figure 6.8: *Left:* Gathered Survey from Hospitalized Patients. *Right:* Data Visualization of General Awareness of the Conecpt of Chatbots.

Furthermore, regarding the collected quantitative data that was extracted from the surveys it was shown that the patients did not consider health advice to be fully reliable and that healthcare information is not reaching its potential when it comes to being clear and comprehensible. These conclusions are motivated by the visualized data in *Figure 6.9*.

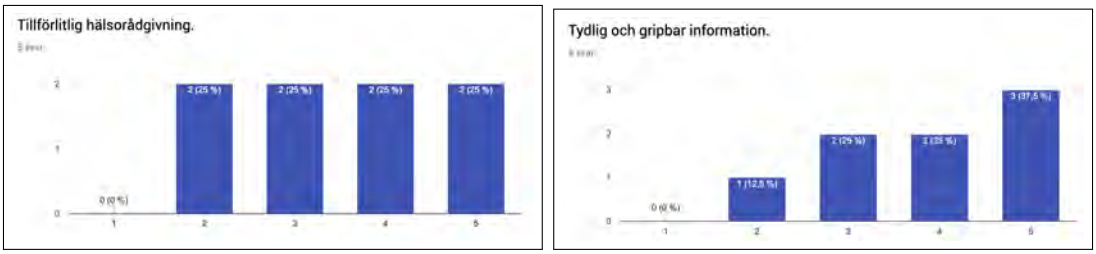


Figure 6.9: *Left Chart*: Reliable Health Advice. *Right Chart*: Clear and Comprehensible Information

Additionally it was possible to conclude that continuation of care was experienced by five participants to not be fulfilled to a certain degree (see left chart of *Figure 6.10*) while the need to search for information without contacting a healthcare staff was somewhat divided (see right chart of *Figure 6.10*).

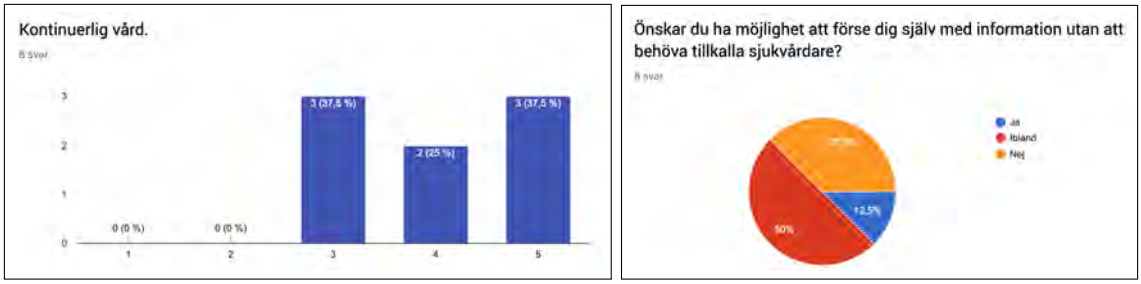


Figure 6.10

6.3.2.2 Analysis of Interviews

After performing the interviews with the healthcare staff at department [xx] on SU it was possible to summarize the findings in a structured manner by the SPIN framework. Below is a summary of the outcome where respondent [1] is an assistant nurse and coordinator, respondent [2] is an assistant nurse and [3] is a nurse.

- **Situation:** The most frequently asked questions from the hospitalized patients involved aspects of nutrition, medication, various support by the bedside, support with toilet visits, change of clothes and appointments with doctors or nurses.

  In regards to patient-centered care the healthcare staff strongly emphasized the lack of it in practice. Respondent 1 put it as providing the care that the limited economical resources decides, where respondent 2 explained that the concept is talked about but the mismatch of formal definition and practice makes it confusing, ultimately when time is given the staff tries to sit down and talk to the patients. Respondent 3 further concluded that the staff makes it best to try and understand what the patient wants.

  When asked about how the staff currently communicates with patients by using digital tools it was understood that many situations involve various digital elements on a basic level. Respondent 1 informed that patients might use microphones to be understood or hearing aid for listening which sometimes makes pen and paper better suited for communication. Furthermore respondent 1 explained that when an interpreter is needed it is done by using a telephone which is switched back and forth between the staff and the patient. Respondent 2 added that they sometimes use a specific app for putting down health metrics while respondent 3 stated that the digital standard is generally considered poor where the patient is limited the somewhat analog red button by the bed when in need of any sort of assistance.

- **Problem:** The respondents provided reflections about the communicative challenges in their work with the patients' and factors such as language, dementia and deafness were brought up. It was also mentioned by the respondents that the shift work sometimes make it complicated to communicate health related aspects of the hospitalized patients towards the colleagues. Respondent

3 in particular referred to the "human factor" where the staff are simply not able to note and document all of the details given in practice.

Respondent 1 further explained that many people might not want to understand what hospitalization actually means and that they are mentally blocked, choosing to not accept certain information and the fact that some routines or the state of health must be repeated numerous times. Respondent 2 added to this concern in that patients does not speak the same language or terminology which makes it hard to sometimes communicate, furthermore as stated by respondent 3; a cognitive disability might make this even more complicated.

Regarding what kind of information that patients states to be missing in their care the respondents stated that patients often want to know details about why, how and when surgeries, x-rays or other treatments are planned. Furthermore respondent 3 has experienced that patients sometimes have requested information of how to reconnect for further treatments, making contact, medical prescriptions and be able to understand what the doctors "actually" said.

- **Impact:** Regarding how patients might not be informative enough during treatment respondent 1 stated that patients might not actually know what kind of questions they should be asking, hence missing out on information that could be vital for treatments or a surgery. Furthermore, respondent 1 stated that when patients receive difficult news about their health state they might not be mentally prepared to start looking for answers. However, according to respondent 3, patients sometimes ask questions which are unfortunately not answered until later during different occasions because of different competence levels of the healthcare staff.

  An issue stated by respondent 3 is the holdback of personal information that patients might not want to share. Another interesting finding was that both respondent 1 and 2 have experienced some patients to be a bit too read upon within their treatment subsequently asking questions that are very hard to answer and discuss. In general the respondents have experienced that the questions from the hospitalized patients are often involving their treatment and due to competence restrictions they are hence not able to answer questions such as "*What did the doctors actually mean during their visit?*"

  The respondents further stated that everything they do in their work involves verbal communication towards the hospitalized patients. Respondent 1 stated that it can be easier tasks such as encouraging the patients to leave the bed or drink a glass of water while respondent 3 experienced that he had to explain and research for the patients how to find specific phone numbers or help find the right department.

  The respondents also explained their experienced communicative challenges of trying to be available at all times, but that they often have to leave conversa-

tions with the patients due to heavy workload and proceed with other patients. Respondent 1 and 2 stated the experience of having patients not willingly co-operating in their treatment. Respondent 1 stated the common experience of having patients asking the purpose of leaving the bed, ultimately forcing the staff to repeatedly explain the purpose of exercise in order to not obtain bedside complications.

- **Need-Payoff:** Regarding the respondents take on how digital tools might change the healthcare from the perspective of hospitalized patients the respondents mentioned possibilities of searching for information by themselves which they can confirm with the healthcare staff and increase their own safety assurance during treatment. Respondent 2 emphasized that digital tools might encourage patients to share important information and get active in their care while making a reference to the fact that the physical "red alert button" is sometimes not used enough by patients, whereas there are also cases with patients using it with a frequency that is considered too high in relation to its main purpose. A concern mentioned by respondent 3 was the problematic age gap where a younger generation are comfortable with using digital tools in comparison with older generations, further stating that it is still of importance to try different technologies in order to assure the best possible care.

  When asked how the communication with patients might change by implementing digital tools, the aspects of greater patient comfort, increased time efficiency, avoiding unnecessary communication, solving complex as well as simpler questions, and transparent and clear information were mentioned. Respondent 1 concluded that ultimately it might enable the possibility to inform patients in various manners depending on the patient's illness and state of health. Furthermore, respondent 2 stated the possibility of being able to spend more time talking to patients due to the fact that important information is usually brought up face to face.

  The respondents found great potential in implementing a patient-centered digital tool, further mentioning that the patients would be able to call for help from the correct level of staff members. hence avoid unnecessary callouts and spend the right amount of time on the right task. Respondent 2 further reflected upon the issue and risk of implementing a patient-centered digital tool that is too complex and that it should not result in having the healthcare staff spend time on explaining its functionality. Furthermore there was a given mix of general concern and optimism from the respondents where it was discussed about potential drawbacks, such as not supporting cognitive disabilities, but also the importance to see the real implications of implementing a patient-centered digital tool in practice.

In a second analytic iteration of the interviews, the process started off by writing down the important quotes and remarks onto post-it notes from each participant while putting these onto a whiteboard into the used SPIN framework. This was

done primarily to get an overview (seen to the left in *figure 6.11*) in order to later group the different findings based on the shared hidden attributes (seen to the right in *Figure 6.11*). Eventually the following categories emerged:

- **External Equipment** - What kind of external equipment might be needed?
- **Accessibility** - What should be considered regarding accessibility?
- **Services** - What specific services should be enabled?
- **Feedback on Care** - How is the patient able to give feedback on its care?
- **Inform Patient** - What information is essential for the patient?
- **Other Issues** - Are there any other contextual issues that might affect the care situation?

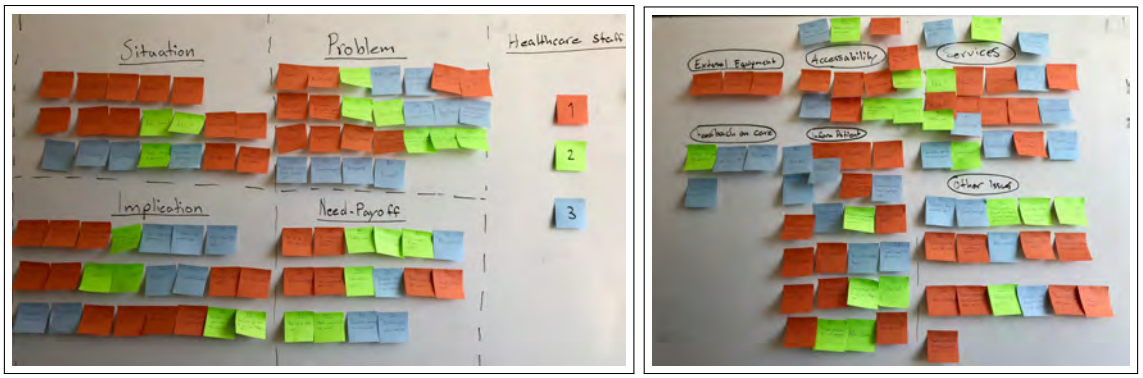


Figure 6.11: Left: Quotes and remarks put on post-it notes attached to whiteboard in SPIN framework. **Right**: Categorisation and theming of findings.

6.3.3 Ideate

In order to stay on track and be efficient with the given time it was important to early on start sketching on a concept. The ideation was further sparked by the outcome of the first design workshop (see subsection *6.2.2.1 Design Workshop*) as well as the important findings from the surveys and interviews.

6.3.3.1 Sketching

As a means of eventually being able to develop an interactive prototype it was of importance to have a variety of sketched wireframes as a foundation. By utilizing related products, previous wireframes and sketches as material for inspiration and reference it was possible to produce a decent amount of sketches of wireframes. In *Figure 6.12* a few wireframes are shown from the first workshop (see *6.2.2.1 Design Workshop*) while a sketched example from a second wireframing iteration is seen in *Figure 6.13*.

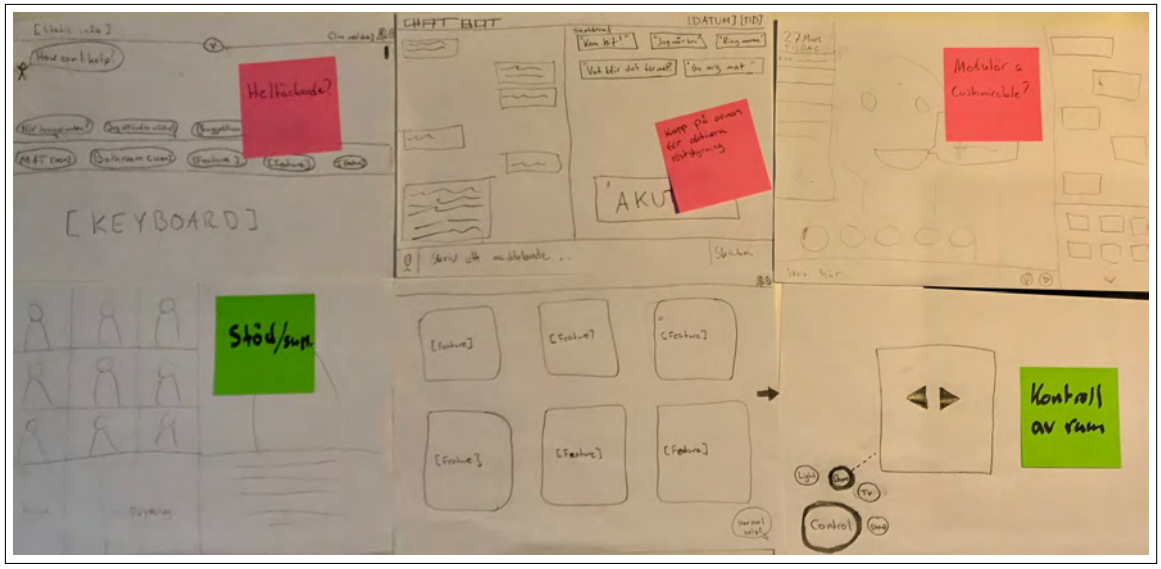


Figure 6.12: Some of the generated wireframes from the time restricted challenges in *6.2.2.1 Design Workshop*.

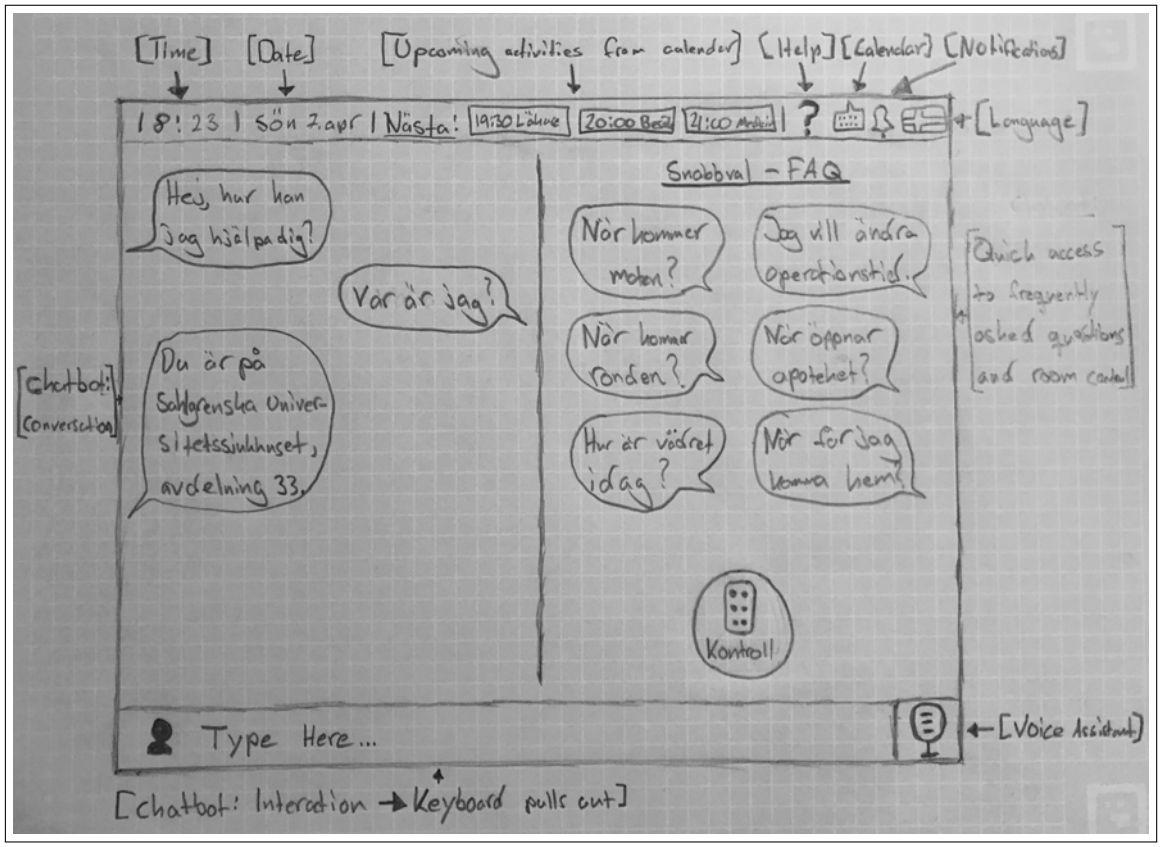


Figure 6.13: Example of a sketched wireframe from a second wireframing iteration.

6.3.4 Prototype

The prototype was decided to be of digital Lo-Fi character as a means of presenting a more realistic representation of the GUI towards the stakeholders. Five alternatives of wireframes were created where one of them were made interactive in order to show the possible functionality and features that could be implemented.

6.3.4.1 Digital Lo-Fi Prototyping

A digital lo-fi prototype was created by studying the paper-sketched wireframes and making five different versions in the software Sketch. Focus was put on keeping a minimal, black and white interface design as a means of not making too much room for discussion about non-essentials such as choice of colors, visual appearance or component design. With the purpose of presenting realistic representations of possible features one version was made interactive by using the web application Invision.

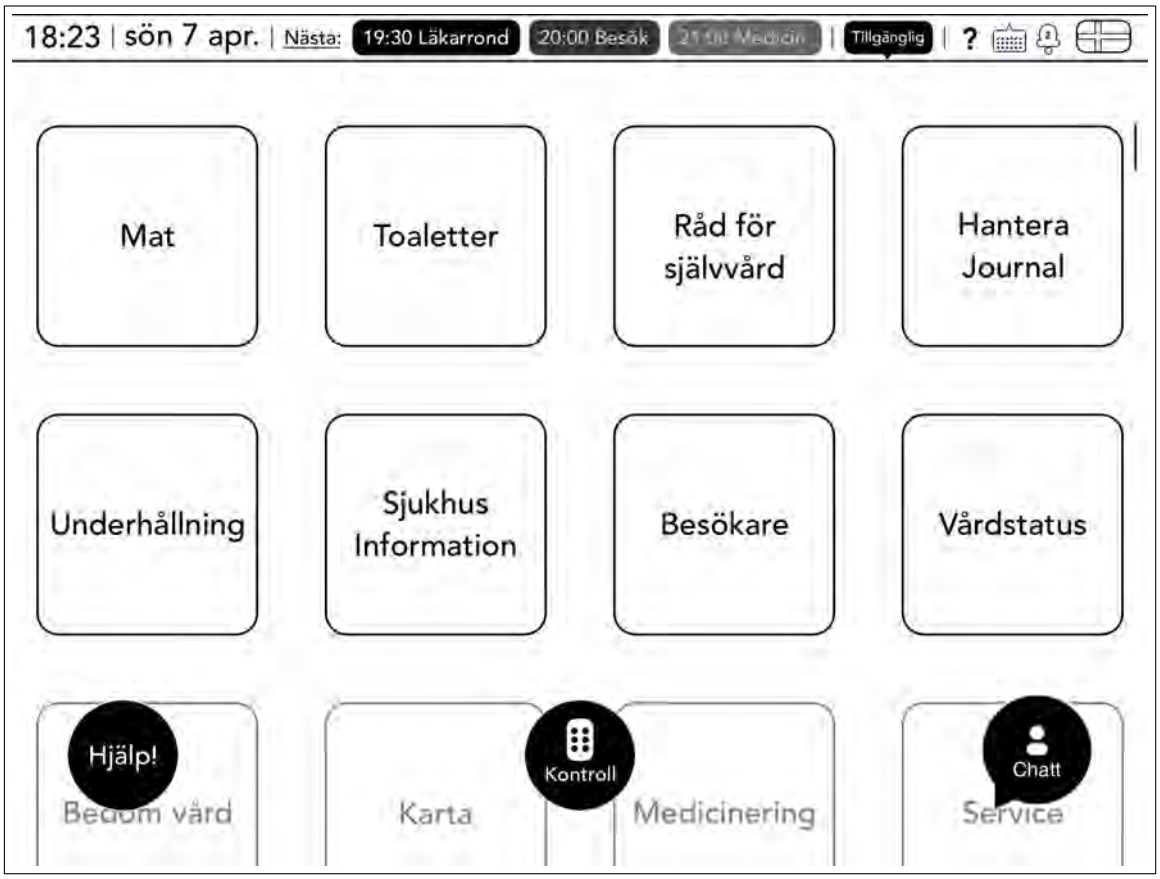


Figure 6.14: Version 1 of the digital Lo-Fi wireframes

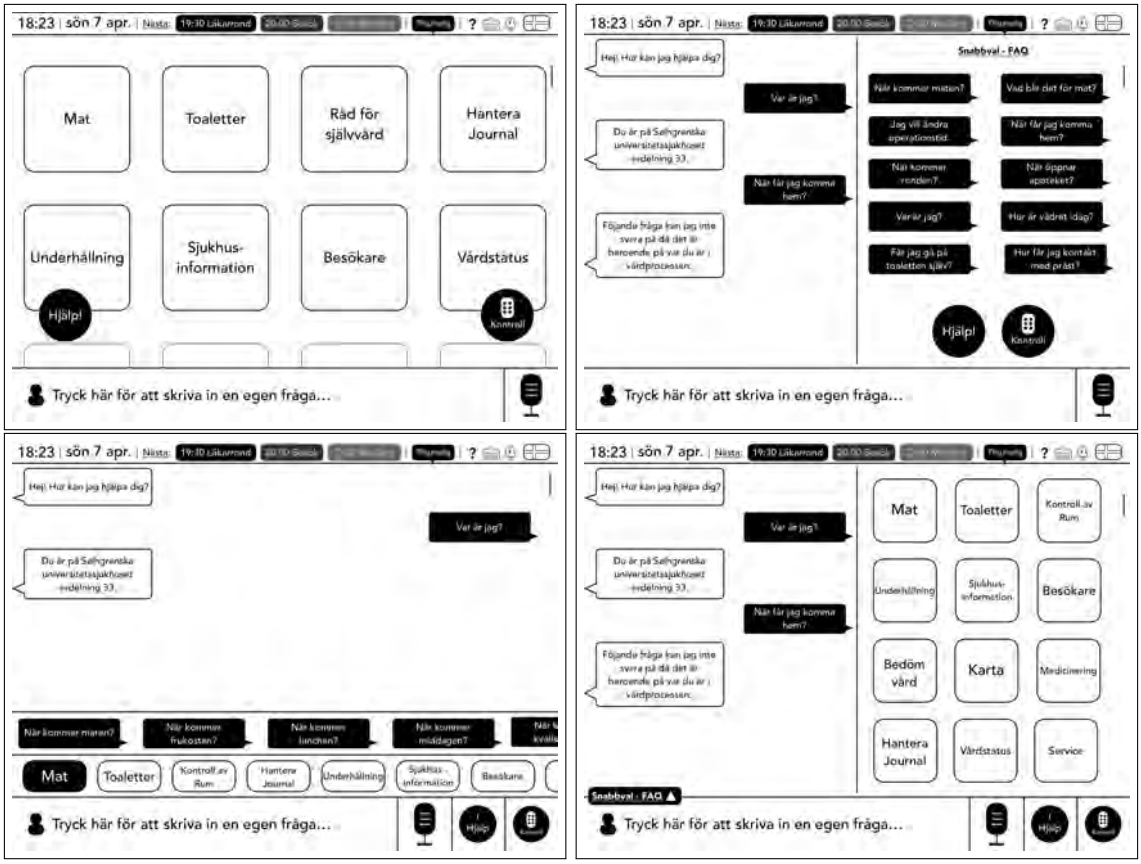


Figure 6.15: Version 2 (top left),3 (top right),4 (bottom left) and 5 (bottom right) of the Digital Lo-Fi Wireframes

6.3.5 Test

In order to validate the first digital design drafts with the stakeholders it was important to not present and give instructions of the underlying ideas and motivations as a means to trigger uninformed thoughts for discussion. This was done by performing a qualitative concept test where the stakeholders were able to make input on different versions of the interface design.

6.3.5.1 Concept Testing

During the concept testing the stakeholders of the project were presented with five different versions of the digital wireframes as well as one interactive version. The concept testing eventually resulted in a list of viewpoints that were based on the stakeholders' input, hence it could be considered to act as material of reference for further advancements of the GUI. The summarizing list of viewpoints is constructed as follows:

- Pop-up windows and overlays might be problematic due to the limited screen real estate as well as possibly creating a cluttered interface experience.
- A chat bubble that has a fixed position might not benefit the user experience due to its considerable occupation of the screen real estate.

- It seems to be of benefit for the interface and screen real estate to split the view of the chatbot and the quick choices of frequently asked questions (FAQ).
- It is beneficial to clearly see previous chat history.
- Enabling FAQ as quick choices is most likely of advantage for several reasons in regards to both the patient and the healthcare staff, as well as the technical aspect of the chatbot.
- It is of importance that the chatbot introduces itself as a digital feature and not imply in any manner that it's a person.
- The chatbot should briefly present how it is able to assist the hospitalized patient.
- A possible feature that might add extra value would be the possibility to choose to send a specific request directly to the healthcare staff, hence not limit the chat to the chatbot's artificial intelligence.
- A feature for making assure that the patient's requests is met by simply letting the chatbot ask the patient if that is the case.
- Minimize any possible confusion of whether the interface's components are features or categories of FAQ.

The established list of viewpoints would eventually act as additional guidelines during the upcoming design iterations of the GUI.

6.4 Iteration Four

This subsection presents the outcome of the fourth iteration in the design process.

6.4.1 Empathize

As mentioned in the section *6.3.1.3 Stakeholder Meeting*, there was a plan to perform a workshop at SU with the stakeholders. However, due to heavy workload and organizational changes several participants had to cancel. This drawback put the backup plan of performing an interview with one of the participants, Mattias Lidbeck, to the table as a subject matter expert.

Meanwhile, in order to proceed with the design work, it was of importance to try and find ways to involve people that have some form of experience of being hospitalized. Due to the fact that there had been a major struggle to interview hospitalized patients there was a possibility that further user research and user testing should be done off location with former hospitalized patients. Hence, contact was established with three different organizations involved with support for certain illnesses.

6.4.1.1 Subject Matter Expert Interview

An interview was held with Mattias Lidbeck, whom works as a project leader at Västra Götalandsregionen (VGR) in projects regarding digitization of healthcare. Lidbeck have worked within institutional healthcare since 2007 and has experience

of working as a care assistant, assistant nurse and nurse specialized within orthopedics and emergency medical treatment. Furthermore, he has applied skillsets from web development in his work. At the moment Mattias is pursuing a master of science degree within health informatics part-time besides his employment, following a bachelor of science degree in nursing and medicine. Furthermore, his experience and knowledge from working in healthcare is of advantage in his current work regarding projects of integrating ICT into various parts of healthcare.

Lidbeck provided insights and reflections of his experience from previous digitization projects within healthcare and emphasized that the overall experience has been negative due to a "top-down" perspective where the various implemented systems unfortunately have lowered the work efficiency for members of the healthcare staff. Lidbeck stated that the implementations have not considered the long-term consequences and that the staff members have often not been able to learn or understand the different digital implementations. Hence, it is up until recently that educations are starting to take shape and be given to the healthcare staff instead of putting them into a position where the only possible method is learning by doing while working.

When asked about the implications of implementing bedside-tablets and how it ultimately will make an impact on the hospitalized patient, Lidbeck emphasized the importance of creating applications from a patient-centered perspective. In his experience it has been hard to involve patients due to various reasons of security and personal integrity, hence it is important to rely on published research and be agile in how hospitalized patients are able to be involved. Furthermore, Lidbeck argued that since patients are not always accessible for research, observation and testing it is, depending on the scope, recommended to perform this on most people since all of us have been a patient at one point or another, concluding that we can all ask ourselves how we want to experience our healthcare systems.

In his experience, Lidbeck explained that at the moment the digital solutions within hospitals are in some manners restricted to the reception where the members of the healthcare staff often has to go and ask for certain information that a patient has requested. A bedside-tablet further enables the possibility of integrating different tools that empowers the patient with increased participation of its care. It is also important to consider the ethical aspects in that the integrated tools should be preinstalled and hence not rely on the patient to choose and pick the necessary functionality as a first step before accessing the different features. The bedside-tablet should hence not imply about any sort of expectations from the patient in this regard.

Lidbeck further gave his thoughts about how chatbots will make an impact on the communication between institutional healthcare and hospitalized patients. A major impact was stated to be the constant limitation of time. In practice there are three work shifts per day where doctor´s are only able to be reached during their own work hours and the emergency healthcare during evenings and weekends cannot possibly

answer any type of question. Hence, there is a hope that a chatbot can support the care work by answering certain types of standardized questions and possibly be able to allow personalization and answer questions that are even narrower. Lidbeck states that there are several factors pointing at the need of a patient-centered supply of information. Lidbeck also states the facts that some services today can only answer questions to a limited scale, such as *1177 Vårdguiden* (1177.se, 2019), patients are too shy to ask questions of personal matter and that statistics from Google shows that people are constantly searching for information about illnesses or how to treat themselves. When it comes to a hospitalized patient in need of information, services such as 1177 Vårdguiden cannot simply help them with a library of general advice.

As stated by Lidbeck, chatbots should not be seen as a replacement and it's of importance to not forget that the human connection is the foundation of healthcare. The chatbot should only be seen as a complementary tool, where it is of importance that it introduces itself as a digital function explaining clearly its purpose and limitations. If the underlying technology would support the backend to gather questions that are asked by the patient towards the chatbot the doctor would be prepared with calming and explaining the questions in mind of the hospitalized patient.

Regarding his experience of what hospitalized patients have expressed to request in their care the most usual questions involve speaking with the doctor, asking for more continuity and specific information about their care status. Lidbeck states the fact that a doctor generally spends around five minutes during the medical rounds with the hospitalized patient, hence the patients are limited to preparing and coming up with questions that are important to them in that short time frame. Furthermore, assistant nurses and nurses can only answer a limited amount of questions and if the chatbot would be able to collect specific important questions this could ease the patient's mind, presuming that the doctor considers these questions during its medical round.

6.4.1.2 Preparation of Survey

As stated above three different organizations were contacted by e-mail and phone calls as a means of getting additional user input. However, even though all three replied positively about their wish to cooperate and participate, only one organization were continuously responding during the process. The one organization that was consistent in replying on the propositions for user involvement was *Ung Cancer*. Even though the user group of the project was considered to be hospitalized patients, the members of Ung Cancer had various experiences of being hospitalized during treatment. In order to gather proper data it was decided to utilize the foundation of the survey that was used in the section *6.1.1.2 Prepare Surveys*, see *Appendix A*. A section of an iterated version of the GUI based on the feedback from the concept testing was added, along with relevant questions regarding its value and features. The GUI was presented as seen in *Figure 6.16*.

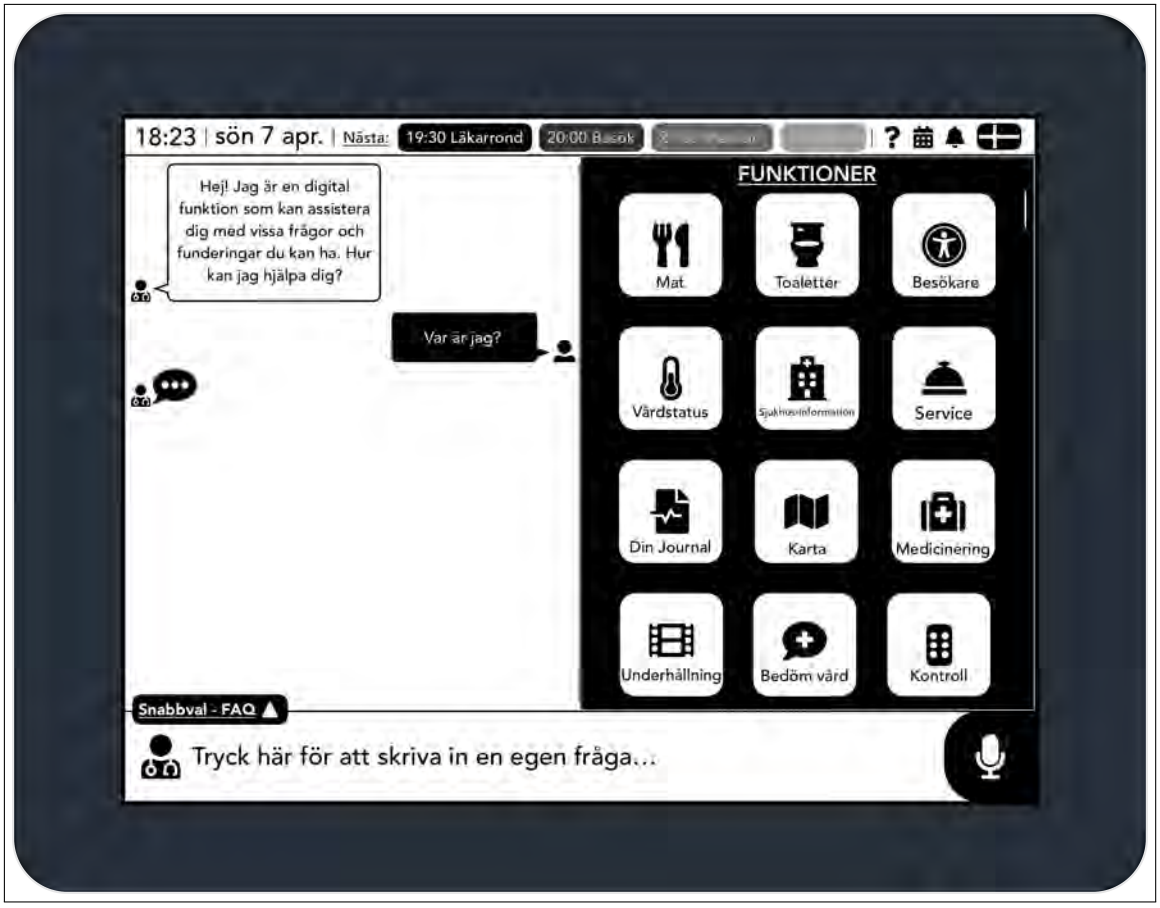


Figure 6.16: Iterated version of the digital Lo-Fi wireframe presented in the survey.

Presented next to the wireframe were the three following questions (translated from Swedish):

1. What value do you see in having access to a "bedside tablet"?
2. Do you reckon that something should be added or neglected in the wireframe?
3. Are you thinking about anything else that should be considered in terms of features or design?

The added section to the original survey format, containing the wireframe and correlating questions, can be seen in *Appendix C*.

6.4.2 Define

In order to maintain the process of answering the research question there was a need to gather and summarize the findings into a first list of features. In total the list was constructed by 28 findings that would later need to be revised and compressed. Furthermore, personas and use cases were created.

6.4.2.1 1st Full Draft of List of Features

- **Food Management:** View meals of the day and make personal requests or changes.
- **Journal Management:** Enable individual restrictions and management of electronic health records.
- **View Treatment Process:** Visualize important information and crucial steps about the treatment process.
- **Access to Restrooms:** Be presented with map of toilets and user position.
- **Management of Visitors:** Information about and management of the upcoming visits of family and friends.
- **View Hospital Information:** Read news and essential information about the hospital.
- **Make Service Requests:** Make simple service requests for comfort.
- **View Map of Facility:** Interactive map of the hospital and user position.
- **Give Feedback on Care:** Rate and feedback the different parts of the treatment process.
- **Control Physical Space:** Control the room's various artifacts that are able to be connected and maneuvered digitally.
- **Access Entertainment:** Watch, listen and play on integrated entertainment services.
- **Change Language:** Switch between the preferred language of choice.
- **View Routines of Hospital:** Read instructions and routines of the hospital.
- **Get Vital Reminders for Treatment:** Be reminded of self-caring routines that are vital for treatment.
- **Get Notifications about Treatment:** Get notified about upcoming events in the calendar or requests from the healthcare staff.
- **Request Bedside Help:** Ask for help by the bedside.
- **Access Calendar:** View calendar that integrates essential scheduled events during the stay.
- **Access Voice Assistant:** Perform actions by voice as an alternative to keyboard input.
- **Request Mental Support:** Ask for mental support during treatment by psychologists or priests.
- **Retrieve Contact Information:** Search for and view register of contact information about the hospital.
- **View Guide of GUI:** View guide for essentials about interacting with the GUI.
- **View Advice for Self-Care:** Read advice about self-caring during treatment.
- **Perform Secure Identification:** Integrate legitimate privacy services for secure identification.
- **Set Personal Availability:** Set individual preferences of availability of matters outside of treatment.
- **View of Procedures of Upcoming Operations:** Be informed about procedures and crucial steps of planned operations.
- **Request Changes of Clothing:** Ask for fresh clothing.

- **Perform Mindfulness Activities:** Integrate digital mindfulness services for peace of mind.

6.4.2.2 Personas

In order to define specific use cases it was of importance to initially make personas as a foundation to build upon. Due to the fact that it was hard to create numerous extensive personas based on the previous user research it was decided to take another approach by combining the different types of patients constructed by Deichmann and van der Heijde (2017) with the insights from the interviews with healthcare staff members. Eventually four different personas were created with basic information that could help in defining specific use cases. The images of faces that are represented in the personas have been gathered from Unsplash.com (2019) which is a service that provides free stock footage to be used in both commercial and non-commercial purposes.

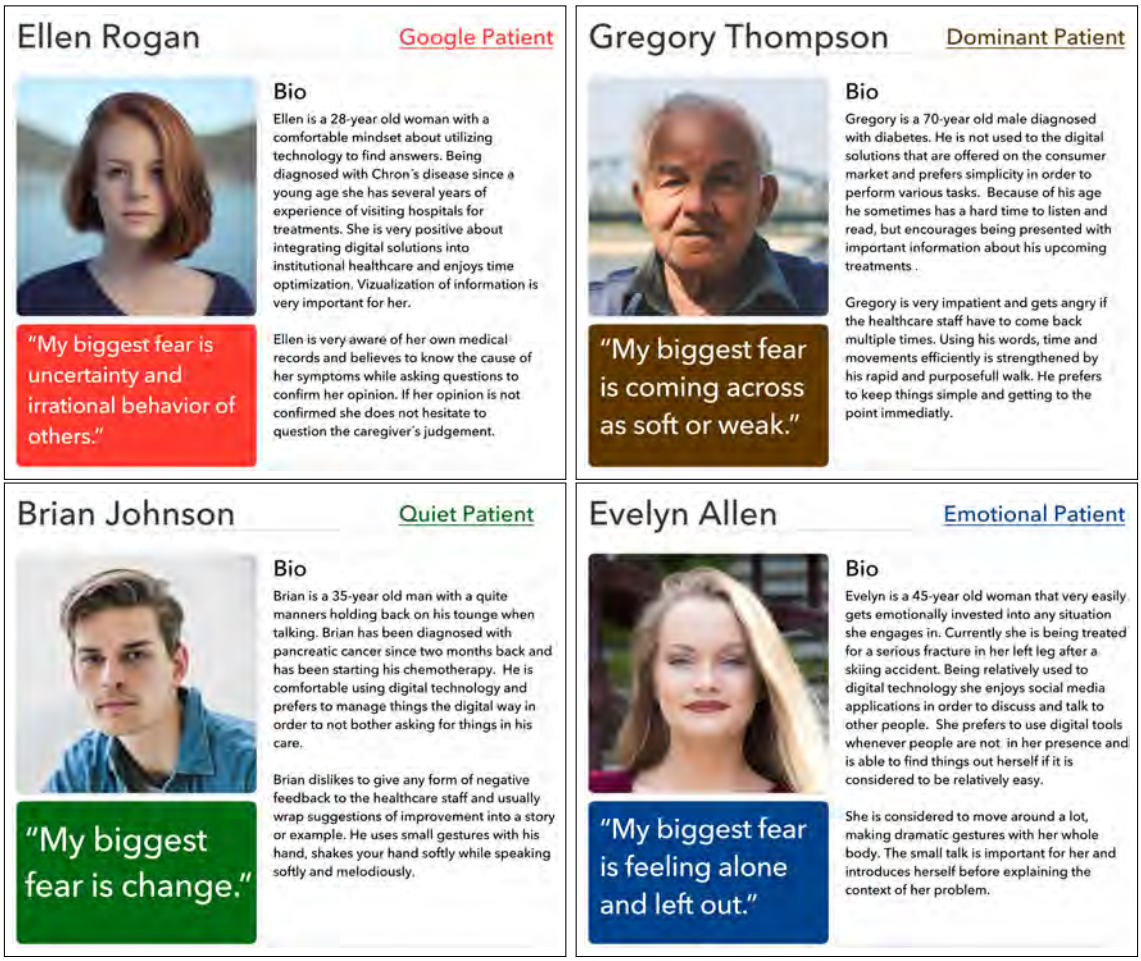


Figure 6.17: Generated Personas

6.4.2.3 Use Cases of Personas

In order to create the next interactive version of the prototype it was important to establish use cases as a foundation for structuring the GUI. The different use cases

are based on the personas and is presented in the tables below (*Table 6.3*, *Table 6.4*, *Table 6.5* and *Table 6.6*) where the *basic flow* represents a navigational approach and the *alternative flow* represents the use of the integrated chatbot.

Use Case 1	Check journal
Actor	Ellen Rogan - Google Patient
Basic Flow	Ellen wants to check her journal and electronic health records, hence she uses the bedside-tablet next to her in order to explore the data and its accessibility from different stakeholders. She navigates in the interface to see what stakeholders that has information about her Chron's disease.
Alternativ Flow	Ellen wants to check her journal and electronic health records, hence she uses the bedside-tablet next to her and asks the chatbot what stakeholders that have access to her file containing information about her Chron's disease.

Table 6.3: Use Case 1

Use Case 2	Inspect the treatment process
Actor	Gregory Thompson - Dominant Patient
Basic Flow	Gregory wants to see the timeline of his visit with details about his upcoming events in his treatment. He uses the bedside-tablet and navigates to a section showing the process of the treatment.
Alternative Flow	Gregory wants to understand the timeline of his visit with details about his upcoming events in his treatment. He uses the bedside-tablet and simply asks the chatbot "what happens now?".

Table 6.4: Use Case 2

Use Case 3	View available restrooms
Actor	Brian Johnson - Quiet Patient
Basic Flow	Brian needs to go to the bathroom and using the bedside tablet he navigates in the interface to see the available restrooms in the facility.
Alternative Flow	Brian needs to go to the bathroom and using the bedside tablet he asks the chatbot where the nearest free restroom is.

Table 6.5: Use Case 3

Use Case 4	Request psychologist
Actor	Evelyn Allen - Emotional Patient
Basic Flow	Evelyn is in help of mental support and using the bedside-tablet she navigates in the interface to a section for requesting help.
Alternativ Flow	Evelyn is in help of mental support and using the bedside-tablet she asks the chatbot to help her find a psychologist.

Table 6.6: Use Case 4

6.4.3 Ideate

This stage in the iteration involved a stakeholder meeting and sessions of sketching the use cases for further digital implementation in the prototype.

6.4.3.1 Stakeholder Meeting

A stakeholder meeting was setup at ÅF where developers of the chatbot wanted to discuss details of the GUI and its different features. The insights, ideas, sketches and prototypes that had been developed throughout the process was presented for feedback and discussion. The work that had been done so far was greatly appreciated and would support the developers in the forthcoming implementation. Furthermore, there was a mutual understanding that categorizing the *FAQ* questions in the chatbot based on the generated list of requested features would be of great use for both back-end and front-end development, while also enabling a logical cognitive structure for the hospitalized patient.

However, an issue was discussed regarding privacy and whether the patient should in some way define on beforehand if it was going to ask the chatbot a question of private or general manner. This issue would have to be discussed further in order to define and design a feature that would take care of the stated problem. As a last point of the meeting the problem of reaching out for the target group in hospitalized patients was discussed. Due to the major struggles of engaging the user group and testing the prototype on the facility there was a mutual agreement that anyone should be considered a potential patient. Hence, testing certain aspects of a prototype on a regular person should not significantly decrease the validity of the requested features or the prototype itself.

6.4.3.2 Sketching

Based on the use cases four wireframes were sketched. These can be seen in *Figure 6.18*.

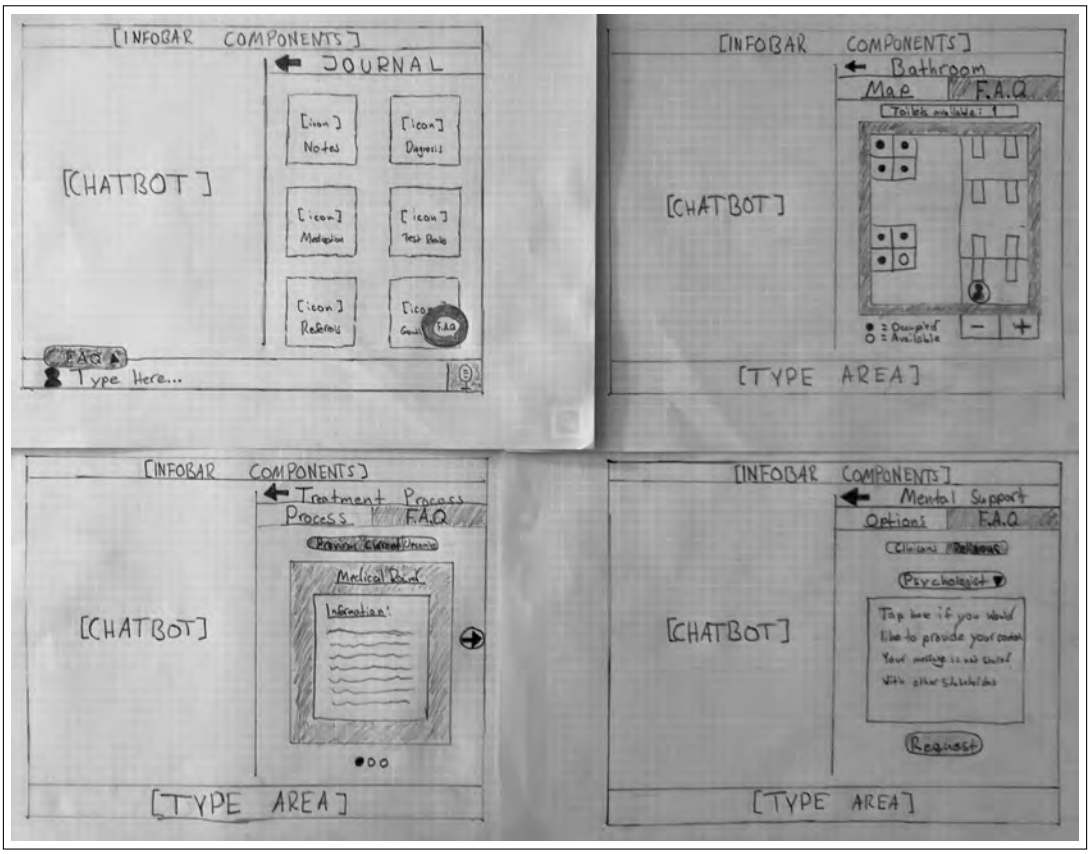


Figure 6.18: Sketches of Use Cases

6.4.4 Prototype

With the sketched wireframes as a foundation, an interactive digital Lo-Fi prototype was generated in the software Sketch. Screenshots of the interactive prototype can be seen below in *figure 6.19*.

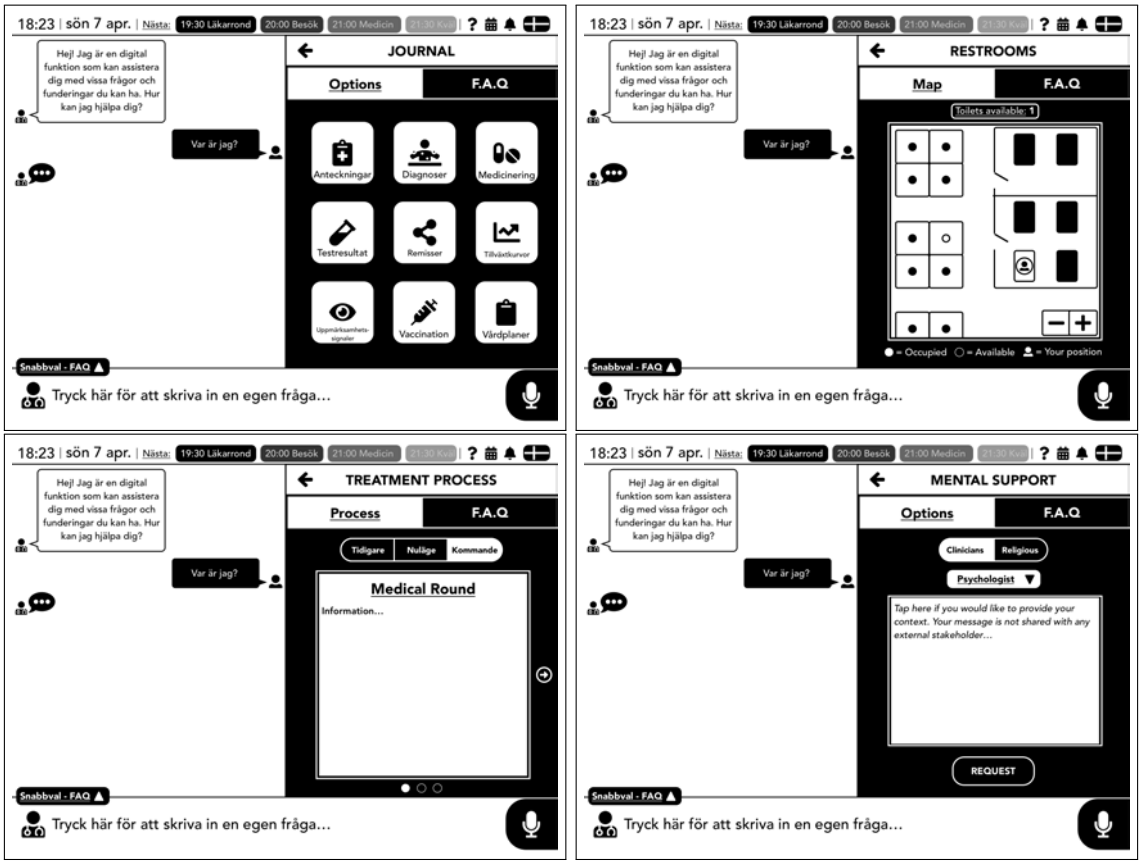


Figure 6.19: Screenshots of Lo-Fi Prototype

6.4.5 Test

In order to evaluate the prototype a think-aloud test was performed on two nurses after work hours. Before starting the think-aloud test the nurses were informed of the purpose of the test and instructed of how to verbalize every single detail that occurred during the process. The test was structured by the four use cases, hence the participants performed the four different use cases on the prototype.

6.4.5.1 Think-Aloud

The process of the think-aloud test was done by letting the participants start from the "*index*" view, seen in *Figure 6.16*, and verbally express their process of completing the different tasks. The tasks were as stated before structured accordingly to the use cases as follows:

1. Check journal
2. Inspect the treatment process
3. View available restrooms
4. Request psychologist

The outcome of the test resulted in several insights about the GUI's different features as well as reflections about the real implications in the daily practice at a hospital. To start with, the simple factor of showing the time for the patient was understood as very important while religion was an aspect that would add a layer of complexity in a full implementation. Overall the GUI was considered as easy to understand due to its generic look and feel. The insights being considered as essential for the further development of the GUI are summarized below in bullet points, either formulated as questions or statements:

Index view:

- The grid structure of the GUI was considered logical and understandable.
- The area on the top of the GUI involving the upcoming events from the calendar was considered valuable.
- The symbol of a doctor answering as a chatbot might be confusing.

Journal view:

- Does the use of the term **F.A.Q** imply universal accessibility?
- What kind of journals are actually integrated into "Din Journal"?

Treatment Process view:

- The time should be defined and shown for each event during the process.
- Previous events will help patients with mental disabilities, such as Alzheimers.

Restrooms view:

- The patients own location was not fully understood.
- Highly valuable for patients that are not physically well.

Mental Support view:

- Is it possible to talk to a nurse as mental support?
- Are the religious alternatives taking all minorities into consideration?

6.5 Iteration Five

This subsection presents the outcome of the fifth iteration in the design process.

6.5.1 Empathize

In this stage a survey was shared with members of Ung Cancer while a third stakeholder meeting was held with the project group of Verklighetslabbet at department [xx] at SU.

6.5.1.1 Performance of Survey

A survey was sent to a representative from Ung Cancer as stated in the section *6.4.1.2 Preparation of Survey*, with the promise of sharing the survey in a private facebook group called *Ung Cancer - Förfrågningar och Erbjudanden*. The representative was optimistic of its value and informed that out of 400 members there would hopefully be plenty of valuable feedback. The outcome is presented in the section *6.5.2.2 Analysis of Survey*.

6.5.1.2 Stakeholder Meeting

A third follow-up meeting was held with the project group of Verklighetslabbet at department [xx] at SU. The agenda of the day was to show the evolving design of the GUI as well as discuss the listed features that are considered relevant for a patient-centered bedside tablet. The GUI was demonstrated in an iterated interactive version on a projector screen and resulted in the following input:

- It should be possible to log in on the application anonymously without personal identification.
- Identification should possibly only be allowed when it is needed, for instance in the case of asking questions of personal character.
- The categorization of features containing interactive FAQs is positive from an accessibility point of view.
- Due to current restrictions and regulations within Swedish healthcare, a patient can only universally access the journals from 1177.se.
- Some of the listed features are dependent upon solutions based on IoT (Internet of Things).
- Regarding food it could be valuable to show the patient different metrics of each meal.
- Making feedback on the served food by the bedside should be enabled for the patient.

The demonstrated GUI was much appreciated by the project group while they also stated that several of the features are possibly several years into the future. The members of the project group debated the current standards within healthcare and discussed the obstacles of economical restrictions and implementation into daily practice. In regards to this the project group found the interface easy to understand

and put a positive note on the modularity since all features might be hard to implement due to limited resources. On a final note the project group found it very interesting to look at it as a visualization of what patient-centered healthcare could look like in the future.

6.5.2 Define

In this stage a feature diagram was created as a means of gathering and redefining the features. Furthermore, an analysis of the survey shared with Ung Cancer is presented.

6.5.2.1 Feature Diagram

In this phase of the process there was a need to review the selected features and group them accordingly as a means of eventually creating a comprehensible list. Hence, a digital affinity diagram was performed and the result can be seen in *Figure 6.20*.

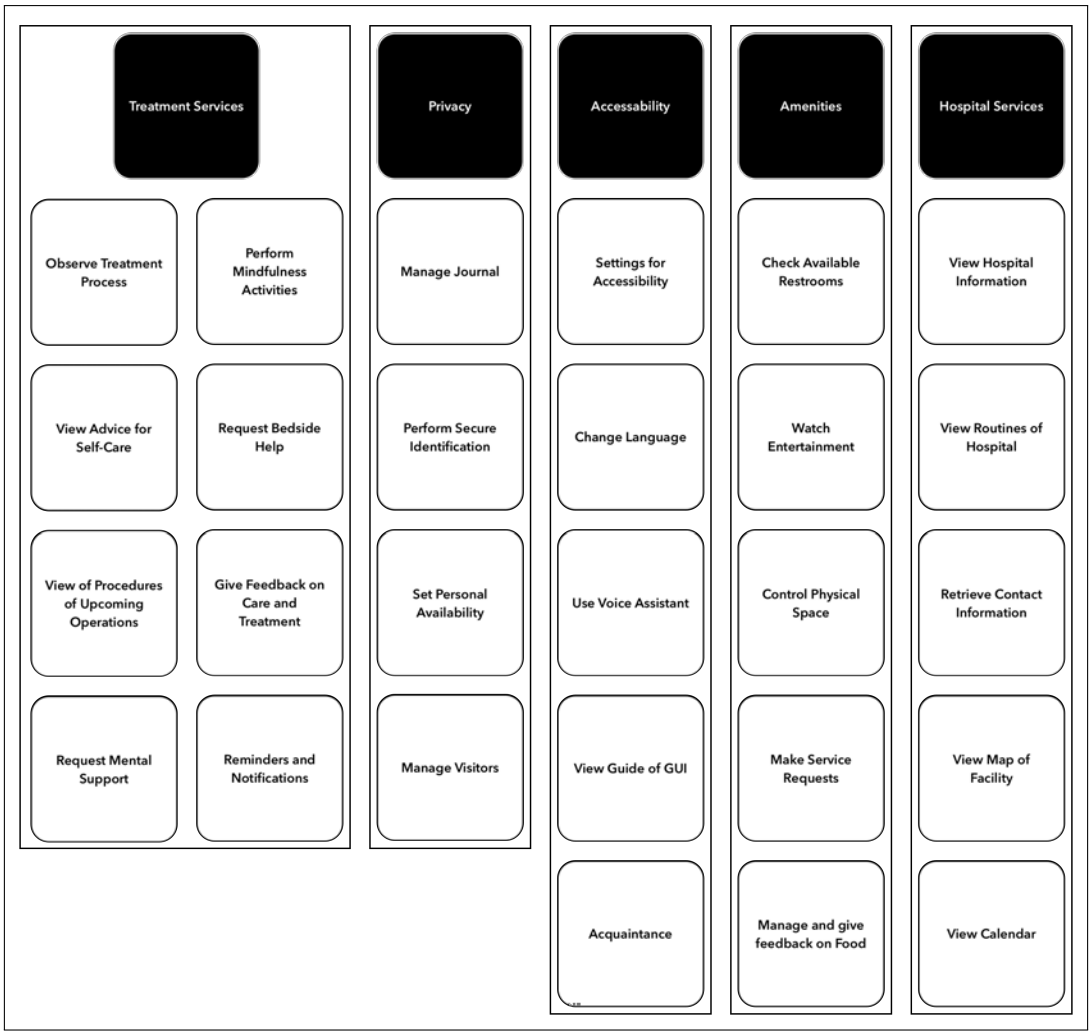


Figure 6.20: Feature diagram

6.5.2.2 Analysis of Survey

The outcome of the sent survey to Ung Cancer was a disappointment in regards to the final sum of participating members. In order to assure the participation by the organization's members in the survey the representative was frequently reminded. However, out of 400 members only three participated in the survey. Hence, the quantitative statistics were neglected. However, the qualitative input of those three members was found valuable and confirmed previous research regarding patient-centered care.

The survey showed that the three participants requested information about their disease, side effects of their treatment, care plan, possible rehabilitation procedures, contact information, tools for self-care, test results and explanations of terminology. In regards to how the stay as a hospitalized patient could be improved the survey showed that activities, change of environment and empowerment of self-service was of high value.

The participants found great value of having access to a bedside-tablet and in particular the possibility of searching for information in an individual pace and not feeling that they would have to disturb the staff members. It was stated by a participant that it is great to have functionality that involves patients in their care where the they are able to participate actively in its own healing. When asked if there is something that should be added or neglected on the presented Lo-Fi wireframe the major requests involved integrating applications for meditation and mindfulness as well as recommendations for training and nutrition.

Furthermore, it was considered a benefit to keep the GUI as simple as possible with minimal navigational excise and clear overview. One participant stated that since hospital environments are very sterile it would be somewhat cheerful to have a colorful GUI with animations. Lastly the participants stated that if there was a possibility to change some of the settings for increased accessibility, in terms of aspects such as colors, text size, volume and component size, that would be very appreciated.

6.5.3 Ideate

In this stage a simple color scheme was created in order to add a graphical aesthetic to the prototype.

6.5.3.1 Color Scheme

In order to keep the GUI and its graphical profile to a simple but yet relatively colorful aesthetic it was decided to restrict the use of colors to a palette with just five colors. Therefore, a color scheme was created which can be seen in *Figure 6.21*.

Figure 6.21: Color board with hexadecimal codes.

6.5.4 Prototype

After adding the color profile to the prototype along with minor improvements with the overall design a refined Hi-Fi character started to appear. The index page of the prototype is seen below in *Figure 6.22*.

Figure 6.22: Index page on Hi-Fi prototype.

6.5.5 Test

A cognitive walkthrough was performed on two students from the Master of Science program *Interaction Design and Technologies* at Chalmers University of Technology, hence they are considered as experts within the field when performing the test.

6.5.5.1 Cognitive Walkthrough

The cognitive walkthrough was structured by performing six different tasks on an interactive Hi-Fi prototype and asking the student to answer the four specific questions that are involved. Considered as experts within the field, they were asked to put themselves in the position of a hospitalized patient, hence one of them impersonated the tasks by lying down when performing the six different tasks. The six different tasks that were performed during the test were the following:

- Log in
- Check diagnosis in journal
- Inspect the treatment process
- View available restrooms
- Request psychologist
- Change food

The four questions being answered:

1. Will the user try to achieve the right effect?
2. Will the user notice that the correct action is available?
3. Will the user associate the correct action with the effect that the user is trying to achieve?
4. If the correct action is performed, will the user see that progress is being made toward the solution of the task?

After each task that had been performed the participants were asked to summarize and give feedback on the different aspects of the GUI in regards of the process of performing the task. In general the GUI was perceived as easy to grasp from a cognitive perspective considering its common use of components for interaction, but also providing a minimal navigational excise due to the integration of a chatbot. The outcome of each task is summarized below:

- **Log in:** The dropdown-button is somewhat perceived as an input field and might be better suited in a step before typing in the password so that the user can choose this first.
- **Check diagnosis in journal:** A straight forward process since the title and icon of the components supports each other. Diagnosis was easy to find after entering the journal.
- **Inspect the treatment process:** Although considered logical and easy to understand, it was not at first understood what the difference was between upcoming and current in the view of the treatment process. It was understood

at first to be some sort of a calendar, hence some modifications should be made for making the purpose clear for the user.

- **View available restrooms:** The process of viewing available restrooms was considered logical, but two major suggestions of change was given by the participants. First, using red and green as color identifications is not seen as a fitting visualization for color blind users. Second, one participant suggested that it should be easy and logical for the patient to request help with walking to the toilet in the exact same view.
- **Request psychologist:** One searches cognitively first for the component with a title for psychologist, but the placement in "mental support" is considered logical even though it is a slight navigational excise. The patient should also possibly be presented with options that they are requesting help with and not make the user type in that it is depressed since this could have reversed effect.
- **Change food:** Logical, but too much underlined text as information. This could very easily be implied as hyperlinks to other sections in its current appearance. An easy fix was suggested to use bold formatting instead of using underlines. It was also suggested to maybe restructure the information into a list unless increasing the visual appearance of the current grid by adding separating lines.

On a final note the GUI was considered a straight forward process since the title and icon of the different components supports each other in a clear manner. The components are furthermore considered to be of viable pliancy with its graphical aesthetic.

7
Results

This chapter aims at presenting the results of the design process where the established research question of "*What features should be considered when designing a chatbot-based graphical user interface for hospitalized patients?*" has been explored by designing and testing a GUI through the standards of different design methods. The chapter hence presents the final design of the prototype as well as a thorough list of features to consider when designing a GUI for hospitalized patients.

7.1 Features

As previously mentioned the design process took advantage of the previous scientific research within the field and added continually findings from the performed interviews, surveys and user tests. This section provides a dedicated list of features which are to be considered when designing a patient-centered GUI for hospitalized patients. The overarching features that have been identified are presented accordingly: *Accessibility*, *Amenities*, *Hospital Services*, *Modularity*, *Privacy* and *Treatment Services*.

7.1.1 Accessibility

The aspect of accessibility was frequently brought up during the design process and was in particular stated during the interviews with the healthcare staff, see section *6.3.2.2 Analysis of Interviews*. As a hospitalized patient you are in some way affected either physically or mentally during your visit in a hospital. Hence, striving for high accessibility must be a priority. Further down in this section the features of *Aquaintance*, *Guide*, *Settings*, *Chatbot* and *Voice Assistant* are presented.

7.1.1.1 Acquaintance

In order to design a GUI that strives to be of high accessibility it should involve common and recognizable GUI components. By utilizing research from visual perception (see *3.3.2.1 Visual Perception*) and the eight golden rules of interface design (see *3.3.2.2 Principles and Rules*) as guidance it is possible to design a GUI that promotes universal usability and cognitive pattern perception. Hence, acquaintance as a feature aims at placing the overall GUI design and aesthetic as well as its components within the current standards of what regular people are using daily.

7.1.1.2 Guide

As a means of supporting individuals that are not experienced with various digital appliances it is of importance to provide help in this regard. This issue can be prevented by providing a guide that explains how to operate the GUI as a user. Furthermore, it is of importance to provide a deeper understanding of the different components and sections of a GUI whenever a usability problem might occur. The need for a guide was presented early in the design process during an ideation session (see *6.1.3.1 Mindmapping*) where *Learn Navigation of GUI* and *Learn Properties of GUI* was put down as ideas of possible features (see *Table 6.1*).

7.1.1.3 Settings

In order to further support accessibility a patient-centered GUI should enable personal settings which consider any possible disability of hospitalized patients. A basic accessiblity issue that is of importance to be solved for hospitalized patients is the language barrier. Inspired by the related product in section *2.3.2.1 Care to Translate*, and stated numerous times during the design process (see for instance *6.3.2.2 Analysis of Interviews*), the feaure of *changing language* should be considered in a patient-centered GUI. Furthermore, it has also been suggested to make it possible to change text size, colors and component sizes (see *6.5.2.2 Analysis of Survey*) depending on disabilities and preferences. This a common feature of most operating systems, and in particular for smartphones.

7.1.1.4 Chatbot

The reasoning for considering the feature of a chatbot is based on the strive of empowering the hospitalized patient, further acting as a complement to calling for members of the healthcare staff. As stated in the section *2.2.1 Experienced Problems*, Jerofke-Owen and Dahlman (2018) declares that patients want to take an active engagement in information seeking for continuous discussion with the healthcare team. Furthermore, critical barriers between caregiver and patient must be broken down (Barry and Edgman-Levitan, 2012).

The feature of a chatbot was requested by the stakeholders of this thesis and is explained in the section *1.1 Problem Description*, where they looked for assistance in designing a chatbot-based GUI and a user experience that allows patients to gather information through self-service. The related products presented in the sections *2.3.2.3 Your.MD*, *2.3.2.4 Conversa Health* and *2.3.2.5 Ada* further provided inspiration for this specfic feature.

A virtual assistant comprises the use of either a chatbot or other interactive dialogue system that depending on its complexity can help the hospitalized patient with requests through digital communication. In the interview with Mattias Lidbeck (see *6.4.1.1 Subject Matter Expert Interview*) it was further stated that due to different staff members being available at different times and hence their respective competence they are not always able to answer every type of question that a hospitalized

patient might have.

7.1.1.5 Frequently Asked Questions

Enabling sections of FAQs, for instance enabled for interacting with a chatbot, is a factor that was considered to increase accessibility in several aspects (see section *6.5.1.2 Stakeholder Meeting*). During the design process the suggested feature of FAQ (first presented in the section *6.2.1.1 Stakeholder Meeting*) within a GUI was iterated numerous times with the purpose of providing a logical structure and guidance since hospitalized patients do not always know what questions to ask. In regards of empowering patients and involving them in their care the feature of FAQ is of relevance.

7.1.1.6 Voice Assistant

If a patient has a disability that restricts them from navigating within the GUI or typing on a monitor they should be provided with a voice assistant that involves *Text-to-speech* and *Speech-to-Text* while possibly being integrated to a chatbot (see *7.1.1.4 Chatbot*). The feature itself was ideated early in the design process and is introduced in the section *6.2.2.1 Design Workshop* while later defined in the section *6.4.2 Define*.

7.1.2 Amenities

This section provides features related to *amenities* and are hence considered to be features that are not directly connected to the treatments or caring procedures. A longer hospital stay might involve a significant amount of time spent in between different procedures, therefore providing features that can make the stay a bit more comfortable and enjoyable is important. The features presented further down are accordingly: *Room Controls*, *Entertainment*, *Food*, *Restrooms* and *Service Requests*.

7.1.2.1 Room Controls

In order to put the patient in control during hospitalization, the surrounding environment should be possible to be maneuvered by the bedside. As modeled by Patterson et al. (2017) in the article *Meeting Patient Expectations During Hospitalization: A Grounded Theoretical Analysis of Patient-Centered Room Elements* patients want to control hallway noise, their visibility, utilities and security of personal belongings. Hence, integrating tools for support of IoT (stated in section *6.5.1.2 Stakeholder Meeting*) and enabling control of objects close to the hospitalized patients bedside such as curtains, lighting, noise cancellation, sound and television. The idea of controlling the physical space was inspired by Patterson et al. (2017) and was put down early in the design process within ideas of possible features, see *Table 6.1*.

7.1.2.2 Entertainment

During hospitalization it is of importance to stimulate the need of entertainment for those patients that feel the need for it. Hence, by integrating requested services of

sound, vision and games to be accessed on a bedside tablet, the hospital experience might also allow patients to put their mind of concerns regarding their treatment. Partly inspired by the *Patient Room Experience Model* by Patterson et al. (2017), but foremost from the findings during the design process (see for instance section *6.3.2.2 Analysis of Interviews* or *section 6.2.2.1 Design Workshop*), this is considered to be of high value in a patient-centered GUI.

7.1.2.3 Nutrition

The possibility to choose food, make feedback on it but also get information about nutrition was found in several phases of the design process. As found in the interviews with the healthcare staff (see *6.3.2.2 Analysis of Interviews*), hospitalized patients frequently ask for certain information about their food and as discussed with the project group of Verklighetslabbet (see *6.5.1.2 Stakeholder Meeting*) at SU it could be valuable to show the patient different metrics of each meal as well as perform feedback on the served food by the bedside.

7.1.2.4 Restrooms

Regarding access to restrooms this feature was ideated during a mindmapping session (see section *6.1.3.1 Mindmapping*), mentioned in *Patient Room Experience Model* (Patterson et al., 2017), presented in *6.4.2.3 Use Cases of Personas* and later on tested in one use case on the Lo-Fi prototype as a think-aloud test (see section *6.4.5.1 Think-Aloud*). In the think-aloud test the two nurses that participated found it highly valuable for patients that are not physically well since this would provide a minimized physical effort to get to and from the restroom.

7.1.2.5 Service Requests

The feature of *service requests* has the aim of digitize what has been commonly referred to as the usage of the "red button" by the bedside which is currently still used for many things of different purposes (see section *6.3.2.2 Analysis of Interviews*). This feature involves any requests that patients might have when hospitalized in regards of comfort. Examples of common service requests from the patients has been discovered in the design process as: beverages, books to read or board games.

7.1.3 Hospital Services

The features involved with hospital services are related to serving the patient with general information and services about the specific hospital where the patient is hospitalized and treated. The features that are considered as hospital services are *Hospital Information*, *Map of Facility* and *Calendar*. These are described further down.

7.1.3.1 Hospital Information

The feature of presenting information about the hospital is a basic but useful feature which provides the patient with relevant as well as essential information regarding

routines, contacts and news from the hospital. This feature was a result of early ideation sessions (see *6.1.3 Ideate*) as well as suggested by the project group (see *6.2.1.1 Stakeholder Meeting*) to let the patient have a sense of its surroundings.

7.1.3.2 Map of Facility

A map of the facility is also used as a feature that allows the patient to understand its surroundings, similar to the feature in section *7.1.3.1 Hospital Information*, but with the focus on providing the patient its location on a map. This is suggested to either be shown in a static presentation or an interactive version depending on requested complexity. This was ideated during a mindmapping session (see *6.1.3.1 Mindmapping*) as *view facility layout*.

7.1.3.3 Calendar

The calendar feature is a simple calendar that is related to the different events that occurs within the hospital as well as the possibility of integration with the treatment plan. The purpose with the feature is to be informative and provide an overview of the stay. The importance of time for hospitalized was stressed by the healthcare staff at SU (see *6.3.2.2 Analysis of Interviews*) as well as the two nurses during the think-aloud test (see *6.4.5.1 Think-Aloud*).

7.1.4 Modularity

The feature of *modularity* was considered from the early phase of the design process and was very appreciated by the stakeholders when presenting an iteration of the Hi-Fi prototype during a meeting (see *6.5.1.2 Stakeholder Meeting*). It is beneficial to consider modularity in a GUI that is integrated to a bedside tablet since hospitals are restricted with different resources (as mentioned in *6.3.2.2 Analysis of Interviews*). By considering a modular component based GUI, hospitals are able to integrate the prioritized features that are frequently requested by the hospitalized patients.

7.1.5 Privacy

This section involves features of privacy. As discussed in the section *6.4.3.1 Stakeholder Meeting* it is of importance for patients to be thoroughly informed of the prevailing privacy standards, as a means of further putting the patient into the position of control of the decision making. In order to support hospitalized patients with concerns of private matters this section suggests features that are connected to data privacy as well as the physical space. The privacy features presented in individual subsections are *Journal Management*, *Secure Identification* and *Personal Availability*.

7.1.5.1 Journal Management

The feature of *Management of Journal* is focused on providing hospitalized patients with the content of their EHRs. As suggested by Caine et al. (2014) a patient-

centered GUI should take patients preferences of data accessibility into consideration, hence it is a viable feature of privacy. This feature was visualized and tested during several iterations of the design process due to its scientific credibility and relevance for data privacy.

7.1.5.2 Secure Identification

An integration of a patient-centered GUI onto a bedside tablet that involves sensitive search information or private requests must in some way be approved by the hospitalized patient. As defined in the section *6.4.2.1 1st Full Draft of List of Features*, it should be possible to integrate legitimate privacy services for secure identification when interacting with other features that are involved with private data. The feature was at first inspired by BankID (2019) in section *2.3.2.2 Kry*, later ideated in the first iteration (see section *6.1.3 Ideate*), while continually discussed during all stakeholder meetings and stated in the section *6.4.1.1 Subject Matter Expert Interview* with Lidbeck.

7.1.5.3 Personal Availability

Personal availability is suggested as a privacy feature that is not related to data privacy. It´s relevance is in part inspired by *Patient Room Experience* by Patterson et al. (2017), and is possibly related to the feature presented in section *7.1.2.1 Room Controls* depending on purpose and available resources. In a patient-centered GUI the hospitalized patient should be able to perform two different privacy settings in regards of personal availability. The two privacy settings that should be considered for management in a GUI are: **(1)** Availability for unrelated matters and **(2)** Availability for visitors.

7.1.6 Treatment Services

This section involves the features that are of most importance for supporting treatment related aspects and aims at fulfilling several wished states presented in the section *3.3.1 Patient-Centered Care*. The features presented are as follows: *Process*, *Mindfulness*, *Self-Care*, *Bedside Help*, *Upcoming Operations*, *Feedback*, *Mental Support* and *Reminders and Notifications*.

7.1.6.1 Treatment Process and Care Plan

Two features of importance that are closely related and has been brought up during the design process are the *treatment process* and the *care plan*. The treatment process was first defined based on previous ideation sessions in the section *6.4.2.1 1st Full Draft of List of Features* as "*Visualize important information and crucial steps about the treatment process*" while the care plan was requested in the section *6.5.2.2 Analysis of Survey*.

Enabling the hospitalized patient to understand what has happened, is happening and what is planned for the future regarding the treatment process and the care

plan is considered to increase the understanding of every step in the healing process. Furthermore, the think-aloud test (see 6.4.5.1 Think-Aloud) suggested that for accessibility reasons these features will come in handy in particular for mentally disabled patients.

7.1.6.2 Mindfulness

The feature of *mindfulness* was brought up early in the design process during a design workshop (see section *6.2.2.1 Design Workshop*). Enabling hospitalized patients to perform various mindfulness activities will possibly help them in mental aspects of their treatment. In the section *6.4.2.1 1st Full Draft of List of Features*, the feature was ultimately defined as to "*integrate digital mindfulness services for peace of mind*". Supporting this in a GUI was also requested by the participants of the survey published in Ung Cancer (see *6.5.2.2 Analysis of Survey*).

7.1.6.3 Self-Care

A hospitalized patient should be informed of how to take care of itself in between or after different procedures. By integrating a feature that pushes and informs the patient of how to take care of itself will possibly improve the treatments outcome. The feature itself was primarily inspired by one of the eight principles of patient-centered care (Picker Intstitute Europe, 2019): *Clear, comprehensible information and support for self-care.* Furthermore this was previously defined in section *6.4.2.1 1st Full Draft of List of Features* as *read advice about self-caring during treatment.* This is further supported in section *6.5.2.2 Analysis of Survey* where empowerment of self-service was stated to be of high value.

7.1.6.4 Bedside Help

As stated by the healthcare staff in *6.3.2.2 Analysis of Interviews* the issue of requesting help by the bedside using a red analog button was its diverse use and application. A hospitalized patient should be able to define in a GUI what sort of bedside help it is searching for and as stated in *6.4.2.1 1st Full Draft of List of Features* it supports the simple action of asking for help by the bedside. The feature involves support for the patient with tasks such as requesting change of clothes, help with walking to the toilet or other requests by the bedside.

7.1.6.5 Upcoming Surgeries

It was shown already in the third iteration (see section *6.3.2.2 Analysis of Interview*) that patients frequently ask for various information about their planned surgeries. In a patient-centered GUI the patient should be able to understand every question that might occur to them without requesting the healthcare staff to answer numerous times. The feature is formulated as *being informed about procedures and crucial steps of planned surgeries or operations* a minor update to its definition in the section *6.4.2.1 1st Full Draft of List of Features.*

7.1.6.6 Feedback

A hospitalied patient must be able to give feedback on its treatment and care. The feature of feedback was sparked by one of the eight principles of patient-centered care as: "*Ongoing, routine patient feedback to a practice*". Furthermore, section *3.3.1.2 Ask One Question* brings up the aspect of organizational requests by Ward et al. (2013) as: *concerns and ideas relevant for feedback to the wider organization.* Presented in the section *6.3.2.2 Analysis of Interviews*, a second analysis of the interviews with the healthcare staff stated the concern "*How is the patient able to give feedback on its care?*".

7.1.6.7 Mental Support

During the design process it was found that enabling mental support for a hospitalized patient is beneficial of several reasons and is something that a hospital offers in various manners. When a patient is in mental struggle due to upcoming surgeries or receives difficult treatment information it is common by hospitals to in some manner support this through religion or psychiatric measures. In the section *6.2.2.1 Design Workshop* it was ideated that a hospitalized patient should be able to contact a priest and or a psychiatrist. This was further defined in *6.4.2.1 1st Full Draft of List of Features* as: *Ask for mental support during treatment by psychologists or priests.* In section *6.4.5.1 Think-Aloud* two questions were asked as: "*is it possible to talk to a nurse as mental support?*" and "*are the religious alternatives taking all minorities into consideration?*".

7.1.6.8 Reminders and Notifications

The feature of reminders and notification has the purpose of reminding the hospitalized patient of its treatment and self-care procedures while notifications has the purpose of informing the patient about other information that is of importance during the stay. Conversa Health (2019) presented in section *2.3.2.4 Conversa Health* inspired this initially in the process. In the section *6.4.2.1 1st Full Draft of List of Features*, reminders were defined as: "*Be reminded of self-caring routines that are vital for treatment.*" while notifications were defined as: "*Get notified about upcoming events in the calendar or requests from the healthcare staff.*".

7.2 Prototype

During the process of this thesis a prototype has been designed and iterated numerous times as a means of testing the established features that have been listed in the chapter *7.1 Features*. The prototype itself is in the format of a GUI that is interactive and visualized to be implemented on a bedside tablet. The purpose of the prototype is furthermore to understand how it can serve and support hospitalized patients during their stay. The shown features are provided with screens of the GUI in order to exemplify different user scenarios. Some of the sections of the GUI that represents its features are presented and described further down as *Log In*, *Index*, *Journal*, *Food*, *Mental Support*, *Treatment Process* and *Restrooms*.

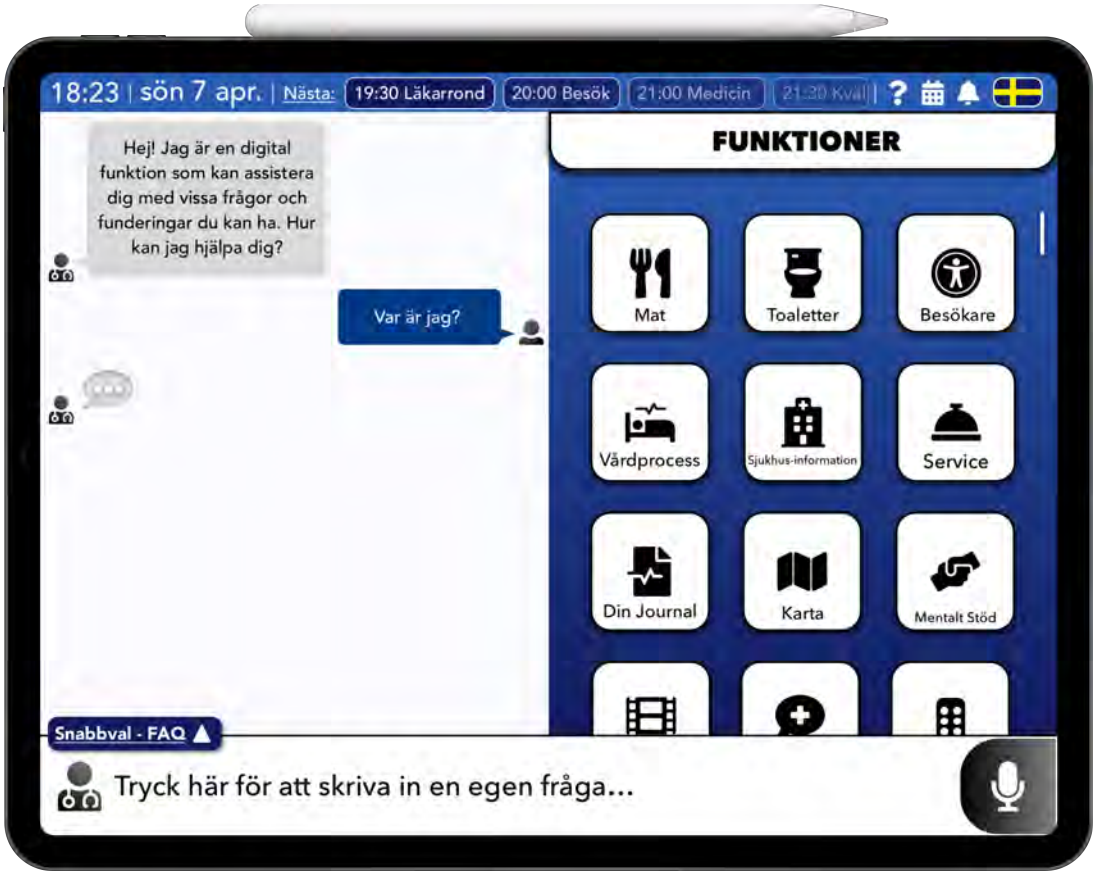


Figure 7.1: Index page of Hi-Fi Prototype

The basic idea of the GUI is to utilize the screen real estate for putting the chatbot and its features close together visually while dividing it into two distinct parts. The end result is a GUI that is centered around a chatbot that is always accessible (placed to the left part of the screen real estate) but with the alternative of enabling the user to navigate through the GUIs different features (placed to the right part of the screen real estate). Each feature is represented as a component as seen in *figure 7.1* above in the index page (further described in the section *7.2.2 Index*) where the user can either interact by performing actions herself or take advantage of the subpage FAQ which is represented for each feature.

As seen in *Figure 7.2* the top information bar comprises features for *time*, *date*, *upcoming events*, *help*, *calendar*, *notifications* and *language selector*. This bar is always accessible for the patient when logged in.

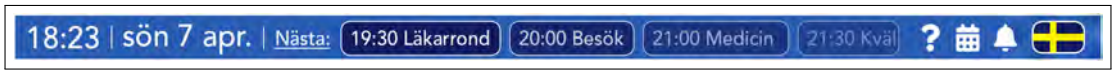


Figure 7.2: Top Information Bar.

The input area of the chatbot is interactive in three different places. As seen in *Figure 7.3* to the left the user can either tap on the input field with the describing representative text, the microphone for voice input or on the blue colored quick choice button for general FAQ (see *Figure 7.3:* ***Middle***).

In *Figure 7.3:* ***Right*** a feature component is shown which sends the user to the specific section of the feature itself. In order to support *acquaintance* the components for the different features have taken advantage of using free licensed standardized icons from *Font Awesome* (2019) as a means of supporting the text and assuring the user of the navigation.

Figure 7.3: Left: Input area for chatbot. **Middle:** Quick choice - FAQ **Right:** Feature component.

7.2.1 Log In

In *Figure 7.4* the feature of secure identification is visualized. As seen on the left screen the hospitalized patient is able to enter its personal identification number while selecting the preferred identification service. After entering the correct details and selecting identification service the patient presses the green button to log in, and as seen on the right screen, gets sent to a visualization of a pending security check (in this case BankID). Inspired by Kry (2019) (see section *2.3.2.2 Kry*) the patient would in this case have to confirm the log in session using BankID on its private smartphone. The user would in thiIf the language is not correct the user can simply change it by tapping on the top right representative flag icon.

Figure 7.4: Logging in on the interactive Hi-Fi prototype.

7.2.2 Index

The index page is the main view of the GUI. This where the patient is presented with the chatbot interactions to the left part of the screen real estate (see *figure 7.5*). On the right part of *Figure 7.5* a visualization of a keyboard for input to the chatbot is seen. On the right part of the screen real estate the user is presented with features (the reason of naming the section's headline *FUNKTIONER* is for avoiding confusion for the user) that are visualized as interactive components for navigation. The icon and title let's the patient know what section in the GUI that it's being sent to. The interactive components represents, as stated before, certain features to improve the stay for hospitalized patients. Furthermore, this is based on modularity in mind since hospitals should be able to prioritize and integrate the features that the economical and organizational resources decides. Hence, depending on purpose, the modular approach is supposed to make the GUI extensible as a means of integrating the requested or preferred features.

Figure 7.5: Index view of Hi-Fi Prototype.

7.2.3 Journal

The journal integrates features for managing and viewing the personal EHRs. In this case the Journal is inspired by the content from *1177.se* (2019). As with all sections and components of the GUI the hospitalized patient is presented with the possibility to ask the chatbot FAQ questions related to the present section if they for any reason would not be able to find what they are looking for type using the keyboard. By tapping on *chat bubble* in the FAQ section the chatbot is supposed to answer the patient by default to the left where the chat history is seen.

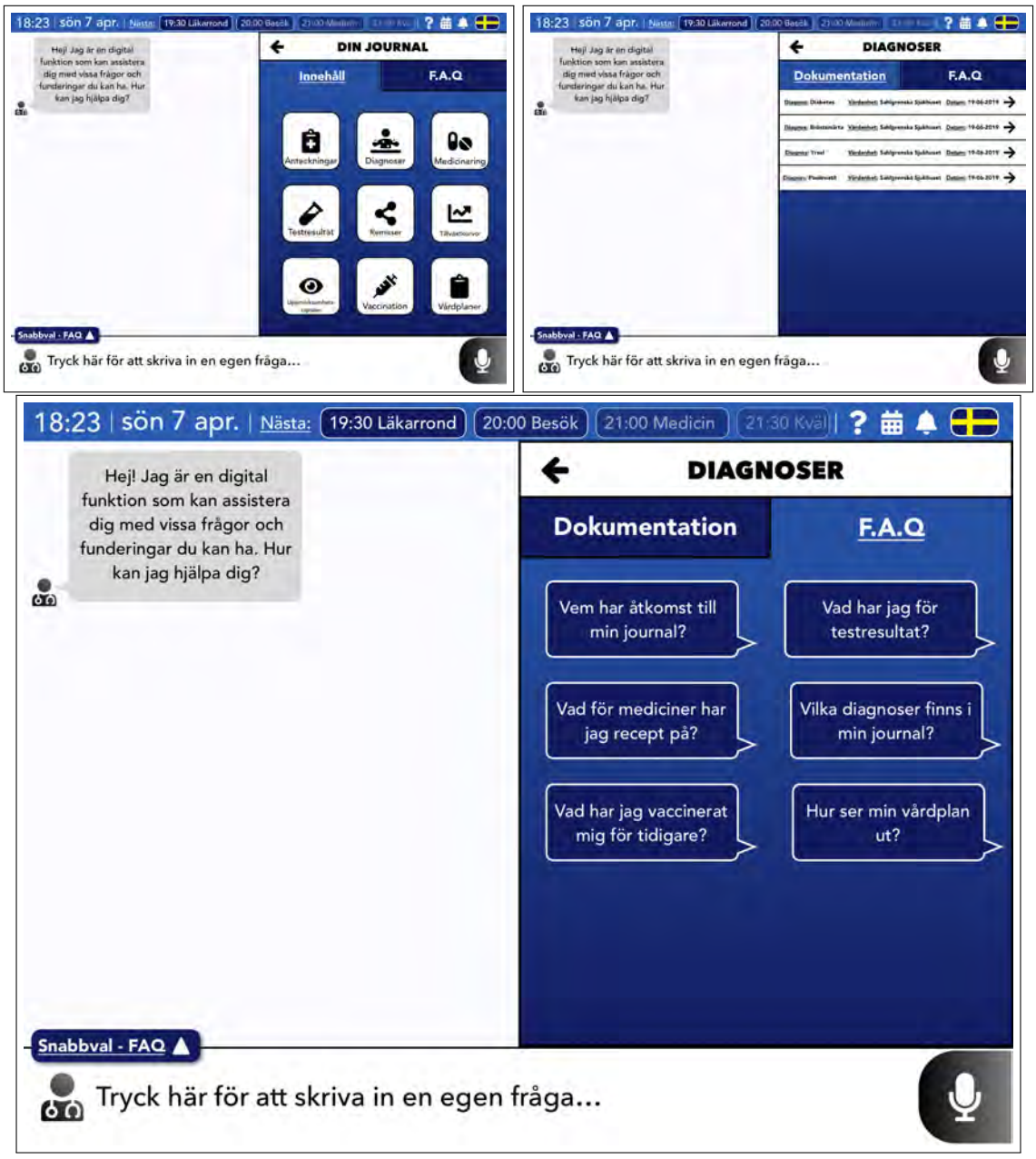


Figure 7.6: Top Left: Index page of Journal. **Top Right:** Documentation section of Diagnosis. **Bottom:** FAQ section of Diagnosis section.

7.2.4 Food

The section of Food is related to the listed feature of nutrition (see *7.1.2.3 Nutrition*). The hospitalized patient is presented with information regarding the menu of the day and is able to change the meal. If anything is uncertain the patient can turn towards the section of FAQ and get a respond from the chatbot.

Figure 7.7: Food view of Hi-Fi Prototype.

7.2.5 Mental Support

The hospitalized patient can choose to request mental support of preferred type. In this case it is simply divided into the categories of *clinicians* and *religious*. The patient can then based on the preferred mental support select a specific type within the category. The patient can also type in a specific message if wanted and the send it by tapping on the green button. The response is made in the chatbot to the left and if uncertain of how to reach out for help the section of FAQ can be used as support.

Figure 7.8: Mental support view of Hi-Fi Prototype.

7.2.6 Treatment Process

The treatment process is designed to involve what events that has happened, is happenning and will happen regarding the treatment during the visit. In the section of *Status* the patient is presented with the segmented control for navigating between *Tidigare* = *Previous*, *Nuläge* = *Current* and *Kommande* = *Upcoming*. By using the arrow button to the right of the information card the patient is able to see further details about the treatment process.

Figure 7.9: Treatment Process view of Hi-Fi Prototype.

7.2.7 Restrooms

In the view of restrooms the patient is presented with an interactive map of the patients location as well as the restrooms with indications of availability. The symbol with a *T* (for *toalett* in Swedish) is used as extra indication of the restrooms locations and in order to enhance accessibility the availability indicators are designed with a *mark for occupied* and *OK for free*. This is further strengthened by the supporting examples below the map.

Figure 7.10: Restrooms view of Hi-Fi Prototype.

8
Discussion

This chapter discusses the outcome of the work that has been performed in order to answer the research question of this thesis. Furthermore, it entails the utilization of *Background and Theory*, the experience of *Methodology, Execution and Process*, the *Results* and finally the *Validity*.

8.1 Background and Theory

The section *2. Background* provided the essential information for the domain of the thesis. Due to the given problem statement by the stakeholder ÅF and the established research question a foundation of Interactive Dialogue Systems and Chatbots (see *2.1 Interactive Dialogue Systems and Chatbots*) was provided before entering the sections of *2.2 Research Area* and *2.3 Related Work*. The combined focus of scientific research regarding the needs of hospitalized patients and communication within hospitals provided a foundation for eventually being able to list requested features. However, what could have been beneficial for the design process was if the related work involved more related products that are being used at hospitals in the daily care, since the section *2.3.2 Related Products* is primarily presenting commercial chatbot products for reference. Unfortunately, this was considered a bit hard to find and access while it would also require an immense amount of time spent on reaching out to different hospitals.

The work in this thesis has been based on the process of design thinking (see *3.1.1 Design Thinking*) where numerous iterations have helped to design the final prototype. Furthermore the research of this thesis has been done accordingly with research through design (see *3.1.2 Design Thinking*), hence the generated knowledge is in part represented by the prototype itself. Regarding the utilization of different design frameworks (see *3.2 Theoretical Design Frameworks*) the work process has been considered to have benefited from triangulation by combining primarily HCD, ACD, EBD and PCD.

As stated in section *3.2 Theoretical Design Frameworks* the presented design frameworks share some of the fundamental characteristics in understanding the user while they have a niche towards specific areas or users. RID, UXD, GDD and UCD is considered to have been slightly less involved due to the fact that RID relies only on published research, UXD focuses primarily on the design of an experience, GDD has a niche on achieving goals for both user and organization while UCD is very

focused on continually involving users throughout the design process.

Furthermore, the relevant concepts in section *3.3.1 Patient-Centered Care* and section *3.3.2 Graphical User Interfaces and Healthcare* provided knowledge of the field and essential scientific knowledge for GUIs in order to explore the research question. In particular the concept of patient-centered care put a philosophical agenda for the thesis where it became a roadmap in order answer the research question.

What became a major source of inspiration for defining and listing the features was the framework in *Patient Room Experience* by Patterson et al. (2017) which shared this thesis goal of understanding the patient's journey in treatment and acknowledging its core need for comfort during their stay. As a final statement, these sections of scientific resources are considered as crucial to the outcome of this project since they provided information and scientific research to rely on during the whole design process.

8.2 Methodology, Execution and Process

As stated in the section *8.1 Background and Theory*, the project's design process relied to a great extent on the gathered scientific resources of what patients have expressed to be missing as well as requested in order to fulfill their needs of treatment and services. In section *6.1.2 Define* a model with the scientific guidelines was created and helped sparking the ideation of creating features to consider in a patient-centered GUI for hospitalized patients. Furthermore the attended stakeholder meetings with ÅF and Verklighetslabbet at SU allowed pragmatic input of the implications for implementing a bedside tablet.

What was considered a major letdown during this project was the struggles of accessing hospitalized patients. Due to the fact that the participation in the survey stayed at eight hospitalized patients, some critique could be turned to minor involvement of the target group. However, the few surveys that were gathered did provide some basic research to analyze and build upon. Verklighetslabbet at SU tried continually to involve the section managers of department [xx] but failed numerous times due to work overload, new staff, other organizational problems, and various unexpected problems such as the spread of the virus Caliciviridae. The input from the interviews with the healthcare staff provided great feedback in order to proceed while the number of interviewees was shifted from five to ten into three of similar reasons.

Hence, since promises by Verklighetslabbet at SU for explainable reasons could not be held, it was of importance to start ideating early based on the gathered scientific resources and in parallel try to work agile in performing both the surveys and the interviews. What was occasionally considered a major letdown was the lack of support in order to complete these crucial steps and gather vital information about how patients at SU experienced their care. The problems are presented in detail in their respective sections, see *6.3.1.1 Performance of Surveys* and *6.3.1.2 Performance of Interviews*. Without guidance and as a single person try to approach hospitalized

patients, gather and analyze the information, defining the features and designing a prototype for testing on the target group, preferably on location, was the least to say a major challenge.

Proceeding with defining the general use cases in a patient-centered GUI for hospitalized patients was in some manner not fully covered as seen in the section *6.2.1.2 Use Case Generation*. Although intended to be created for the design workshop (*6.2.2.1 Design Workshop*), the process could in the retrospective have benefited from lesser and more thoroughly defined use cases. However, the design workshop provided, besides wireframes and features to be utilized as resources, discussions of relevance for the continued design process. This made a perfect example of how beneficial input can be from various sources and in particular the perspectives of external participants.

In section *6.3.2.2 Analysis of Interviews* the insights that were made in a second analytic iteration provided value in asking the right questions for defining the final list of features. Due to the fact that the stakeholders of the project primarily was focused on the chatbot's design and functionality some confusion occasionally occurred in the process of answering the established research question. While some input was hence primarily given towards the design of the chatbot, such as input from the concept testing (see *6.3.5.1 Concept Testing*), the stakeholders showed a great interest and curiosity in the design and development of the prototype while continually asking questions during meetings for discussion about the proposed features.

A stated problem during the process was the difficulties of finding patients and involve them to a greater extent when designing the prototype. This was an issue stated by the subject matter expert Mattias Lidbeck (see *6.4.1.1 Subject Matter Expert Interview*) where he argued for the importance of relying on published research and be agile in how hospitalized patients are able to be involved, due to the fact that they are not always accessible for research, observation and testing. Further he concluded that most people have been a patient at one point or another and we can all ask ourselves how we want to experience our healthcare systems.

Due to the problems of involving patients another approach had to be taken and three patient organizations were contacted in order to gather data from previously hospitalized patients instead. While one of the organizations eventually shared a survey three times, after several reminders, in a facebook group with 400 members, only three people answered it (see 6.4.1.2 Preparation of Survey). The feedback from the three people was however very detailed and provided some additional knowledge. Hence, as a means of narrowing some of the generated features down four personas (see *6.4.2.2 Personas*) and use cases (see *6.4.2.3 Use Cases of Personas*)were generated. This could be considered to be done somewhat late in the process, but it pushed the design process forward and as fictional representations the use cases they provided a foundation in designing the prototype.

Finally, performing the think-aloud test with two nurses (see *6.4.5.1 Think-Aloud*) provided the design process with work life input in how to improve the current prototype. Furthermore, the cognitive walkthrough (see *6.5.5.1 Cognitive Walkthrough*) with two interaction designers provided insights of how further iterations could shape the final Hi-Fi prototype. The design process showed that the initial planning report had been a bit too ambitious where multiple methods required an extensive time for analysis as well as the actual prototyping. In the retrospective it would have been better of for the process to rely on fewer methods in order to provide time for more extensive user research and testing on numerous departments at a hospital in order to gather extensive input from hospitalized patients.

On a final note the process of performing the different phases and iterations, as a single individual, was sometimes very hard. One initial goal that eventually had to be scratched was to codesign the prototype with hospitalized patients and other stakeholders. However, as stated before, this was much trickier than imagined. Acting alone and often without support became very challenging and time demanding. In the process, the promised support from stakeholders was often not fulfilled, sometimes due to explainable reasons, hence the wished outcome of a higher fidelity of the prototype as well as testing it on a facility was not possible. However, the restricted time of the project is considered to be a factor that also affected this, and even though some parts of the design process were heavily time consuming the final deliverable was fulfilled.

8.3 Results

The design process resulted in a set of features to consider when designing a patient-centered GUI for hospitalized patients as well as an interactive Hi-Fi prototype visualizing a selection of the produced features. Regarding the generated list of features in section *7.1 Features* they have been based on the abstract formulation by Chen et al. (2005) as "*a product characteristic from user or customer views, which essentially consists of a cohesive set of individual requirements*". The definite list of features is suggested to extend in correlation to the advancement of digitization in general and within healthcare. The overarching goal has been to provide categorizations of features to consider while all its subfeatures, presented in section *7.1 Features*, should partially be considered as current propositions to integrate in a patient-centered GUI on a bedside tablet.

An issue with the prototype that might be of questionable character is the fact that seven out of eight hospitalized patients stated in the survey (see *6.3.2.1 Analysis of Surveys*) that they did not know of the concept of a chatbot. As presented in the section *7.2 Prototype*, the design of the GUI is in part based on defining a specific area for a chatbot that is always accessible. Hence, this specific design choice might seem contradictory, but is in part motivated by the problem statement provided by the stakeholders of the project at SU. It was also considered logical for the user to always be able to choose between chatbot interaction or navigating in the GUI depending on the individual preferences of the hospitalized patient.

The final prototype did unfortunately not visualize any sophisticated interactions with the chatbot due to the limited time of the project. Even though somewhat out of scope for this project, there are also considerable aspects to think of regarding the implementation of a chatbot from a usability perspective. When done right the chatbots mimicking of human conversation, being able to answer questions to a certain automated degree as well as providing fast responses, it is most likely of use for a hospitalized patient. However, due to its autonomous downsides it might not be able to answer all questions in a proper manner since it requires somewhat correct input. There are possibly also scenarios for a hospitalized patient where navigating the GUI to access certain features is better suited than asking the chatbot to perform specific requests.

As stated by Jerofke-Owen and Dahlman (2018) and experienced during the phases of the design process, patients feel confusion and frustration when individual preferences for engagement are not assessed. Furthermore, the access to viewing test results, looking up medication, managing appointment times and asking non urgent medical questions are a few examples of services not always offered and presented towards hospitalized patients. Hence, the final prototype aims at preventing the mentioned negative aspects of a hospital experience for hospitalized patients, as well as suggesting integration of the features that are not always offered.

8.4 Validity

The results of this thesis may have some threats to its validity in various aspects. The user research and user testing has not been performed exclusively on the target group throughout the process due to the stated problems of access and personal integrity. However, as described in the chapter *6. Execution and Process* and the section *8.2 Methodology, Execution and Process*, in the early stages of a design process, a viable replacement for hospitalized patients should be considered to be most people, since many of us have some form of experience from the institutional healthcare and want to provide input. Furthermore the first survey and interviews were limited in its performance to department [xx] which might question the generalizability of this study regarding the aspects of accessibility, even though the extensive involvement of published research.

In its favor, both the generated list of features and the designed prototype have relied to a great extent on published scientific research as well as the discovered findings presented in the chapter *6. Execution and Process*. While the time was not sufficient to plan and perform a user test on the prototype at department [xx] at SU, input was continually provided by different stakeholders, healthcare workers and experts. Hence, a considered downside is not testing it on site during daily practice in order to get a greater extent of data collection from hospitalized patients. What is furthermore a possible argument for question of validity is the lack of real experience within the field of medicine.

The validity of the design work might be affected by subjective design decisions due to the fact that a single individual performed the research, testing and prototyping. As with all design work multiple perspectives increases the final outcome and when considering the design process it would probably have benefited from three to four more members with preferably different skillsets. On a final note, the validity of the work would have been increased if having the possibility to test the prototype on hospitalized patients in various environments and departments.

8.5 Future Work

A few suggestions for further enhancements of the proposed list of features as well as the prototype should be considered. First of all, extensive input from healthcare experts should be involved in order to evaluate the actual implications of implementation. Further, the prototype should be tested more extensively in order to gather data from the target group in real settings of various character. Based on the proposed list of features it is also suggested to consider the different use case scenarios that are related to each feature. Providing several possible use case scenarios with more detail will probably enable an understanding of the technical aspects that are needed in order to fulfill implementation of the features. As a means of developing the prototype further, it should be considered to perform co-design workshops with hospitalized patients, members of the healthcare staff and other stakeholders that are of relevance for implementing it into the daily practice.

What should be considered for future work is to test and understand the various implications of a chatbot. As previously explained, the prototype did not showcase much of the chatbot's functionality. Hence, for future work, the interactions with a chatbot from the perspective of hospitalized patients would be of importance in order to fulfill the definition of a patient-centered GUI to a certain degree. On a final note, an interesting aspect to evaluate would be the three factors that rests on the ability to configure awareness, originally constructed by Alsos et al. (2012). Evaluating the physical form factor, the GUI and the physicians communication in practice would provide other perspectives that should be considered as important in defining the various implications on the hospitalized experience of the patient.

9
Conclusion

The work in this thesis have been focused on exploring an established research question while designing a prototype by the means of research through design. In numerous studies hospitalized patients have expressed their experiences of feeling left out and not able to understand different phases of their treatments. In order to improve the current healthcare systems it is vital to not objectify the patients in their treatments, but rather make them an active participant in their own healing. Allowing patients to securely view the content of their EHRs, search for information about their treatment and request relevant services for increased comfort by the bedside most likely improves the experience of being hospitalized.

In order to minimize confusion and dissatisfaction among hospitalized patients work must be done to provide them with tools by the bedside as a means of supporting them whenever healthcare staff is not available. Based to a great extent on published research, user research and performed user tests on an interactive Hi-Fi prototype, a set of features to consider when designing a patient-centered GUI have been formulated. The research question of "*What features should be considered when designing a chatbot-based GUI for hospitalized patients?*" is hence answered by the process and the final results as the prototype and listed features below:

- ■ Accessibility
  - ☐ Acquaintance
  - ☐ Guide
  - ☐ Settings
  - ☐ Chatbot
  - ☐ FAQ
  - ☐ Voice Assistant
- ■ Amenities
  - ☐ Room Controls
  - ☐ Entertainment
  - ☐ Nutrition
  - ☐ Restrooms
  - ☐ Service Requests
- ■ Hospital Services
  - ☐ Hospital Information
  - ☐ Map of Facility
  - ☐ Calendar
- ■ Modularity

- ■ Privacy
  - ☐ Journal Management
  - ☐ Secure Identification
  - ☐ Personal Availability
- ■ Treatment Services
  - ☐ Treatment Process and Care Plan
  - ☐ Mindfulness
  - ☐ Self-Care
  - ☐ Bedside Help
  - ☐ Upcoming Surgeries
  - ☐ Feedback
  - ☐ Mental Support
  - ☐ Reminders and Notifications

The generated list of features is intended to help designers within healthcare to support a patient-centered experience. Furthermore bring knowledge of what is considered as vital for hospitalized patients in order to feel as participators in their own healing and not as bystanders. Finally, the designed interactive Hi-Fi prototype aims at visualizing an actual implementation of the proposed features into an actual GUI in a bedside tablet.

Bibliography

Articles

[1] Alsos, O., Das, A. and Svanæs, D. (2012). Mobile health IT: The effect of user interface and form factor on doctor–patient communication. *International Journal of Medical Informatics*, [online] 81(1), pp.12-28. Available at: https://doi.org/10.1016/j.ijmedinf.2011.09.004 [Accessed 23 Jan. 2019].

[2] Apel, S. and Kästner, C. (2009). An Overview of Feature-Oriented Software Development. *The Journal of Object Technology*, [online] 8(5), pp.49. Available at: http://dx.doi.org/10.5381/jot.2009.8.5.c5 [Accessed 12 Mar. 2019].

[3] Barry, M. and Edgman-Levitan, S. (2012). Shared Decision Making — The Pinnacle of Patient-Centered Care. *New England Journal of Medicine*, [online] 366(9), pp.780-781. Available at: http://www.nejm.org/doi/full/10.1056/NEJMp1109283 [Accessed 29 Jan. 2019].

[4] Beamish, D., Bhatti, S., MacKenzie, I. and Wu, J. (2006). Fifty years later: a neurodynamic explanation of Fitts' law. *Journal of The Royal Society Interface*, [online] 3(10), pp.649-654. Available at: https://dx.doi.org/10.1098%2Frsif.2006.0123 [Accessed 4 Mar. 2019].

[5] Brown, T. and Wyatt, J. (2010). Design Thinking for Social Innovation. *Development Outreach*, [online] 12(1), pp.29-43. Available at: https://doi.org/10.1080/14606925.2017.1372005 [Accessed 7 Feb. 2019].

[6] Caine, K., Kohn, S., Lawrence, C., Hanania, R., Meslin, E. and Tierney, W. (2014). Designing a Patient-Centered User Interface for Access Decisions about EHR Data: Implications from Patient Interviews. *Journal of General Internal Medicine*, [online] 30(S1), pp.7-16. Available at: https://doi.org/10.1007/s11606-014-3049-9 [Accessed 5 Jan. 2019].

[7] Chen, K., Zhang, W., Zhao, H. and Mei H. (2005). An Approach to Constructing Feature Models Based on Requirements Clustering. *Proceedings of the International Conference on Requirements Engineering (RE)*, pp 31–40.

Available at: https://doi.org/10.1109/RE.2005.9 [Accessed 11 Mar. 2019].

[8] Chang, D., Dooley, L., and Tuovinen, J. E. (2002). Gestalt theory in visual screen design: a new look at an old subject. *Proceedings of the Seventh world conference on computers in education conference on Computers in education: Australian topics-Volume 8* (pp. 5-12). Australian Computer Society, Inc..

[9] Davis, R., Jacklin, R., Sevdalis, N. and Vincent, C. (2007). Patient involvement in patient safety: what factors influence patient participation and engagement?. *Health Expectations*, [online] 10(3), pp.259-267. Available at: https://doi.org/10.1111/j.1369-7625.2007.00450.x [Accessed 5 Jan. 2019].

[10] Davis, K., Schoenbaum, S. and Audet, A. (2005). A 2020 vision of patient-centered primary care. *Journal of General Internal Medicine*, [online] 20(10), pp.953-957. Available at: https://dx.doi.org/10.1111%2Fj.1525-1497.2005.0178.x [Accessed 5 Jan. 2019].

Deichmann, D. and van der Heijde, R. (2017). How Design Thinking Is Improving Patient-Caregiver Conversations. [online] Harvard Business Review. Available at: https://hbr.org/2017/11/how-design-thinking-is-improving-patient-caregiver-conversations [Accessed 14 Apr. 2019].

[11] Elverum, C., Welo, T. and Tronvoll, S. (2016). Prototyping in New Product Development: Strategy Considerations. *Procedia CIRP*, [online] 50, pp.117-122. Available at: https://doi.org/10.1016/j.procir.2016.05.010 [Accessed 12 Feb. 2019].

[12] Fonteyn, M., Kuipers, B. and Grobe, S. (1993). A Description of Think Aloud Method and Protocol Analysis. *Qualitative Health Research*, [online] 3(4), pp.430-441. Available at: https://doi.org/10.1177%2F104973239300300403 [Accessed 5 Mar. 2019].

[13] Følstad, A. and Brandtzæg, P. (2017). Chatbots and the new world of HCI. *Interactions*, [online] 24(4), pp.38-42. Available at: https://doi.org/10.1145/3085558 [Accessed 19 Feb. 2019].

[14] Gastaldi, L. and Corso, M. (2012). Smart Healthcare Digitalization: Using ICT to Effectively Balance Exploration and Exploitation within Hospitals. *International Journal of Engineering Business Management*, [online] 4(9), pp.1-13. Available at: https://doi.org/10.5772%2F51643 [Accessed 28 Jan. 2019].

[15] Gaver, W. (2012). What should we expect from research through design?. *Proceedings of the SIGCHI conference on human factors in computing systems*, [online], pp.937-946. Available at: https://dl.acm.org/citation.cfm?id=2208538

[Accessed 28 Jan. 2019].

[16] Giacomin, J. (2014). What Is Human Centred Design?. *The Design Journal*, [online] 17(4), pp.606-623. Available at: http://dx.doi.org/10.2752/175630614X14056185480186 [Accessed 8 Feb. 2019].

[17] Graneheim, U. and Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, [online] 24(2), pp.105-112. Available at: http://10.1016/j.nedt.2003.10.001 [Accessed 8 Feb. 2019].

[18] Griffiths, F., Armoiry, X., Atherton, H., Bryce, C., Buckle, A., Cave, J., Court, R., Hamilton, K., Dliwayo, T., Dritsaki, M., Elder, P., Forjaz, V., Fraser, J., Goodwin, R., Huxley, C., Ignatowicz, A., Karasouli, E., Kim, S., Kimani, P., Madan, J., Matharu, H., May, M., Musumadi, L., Paul, M., Raut, G., Sankaranarayanan, S., Slowther, A., Sujan, M., Sutcliffe, P., Svahnstrom, I., Habran, E., Saulpic, O. and Zarlowski, P. (2018). Digitalisation in healthcare: An analysis of projects proposed by practitioners. *British Journal of Healthcare Management*, [online] 24(3), pp.150-155. Available at: https://doi.org/10.12968/bjhc.2018.24.3.150 [Accessed 28 Jan. 2019].

[19] Hancock, B., Bordes, A., Mazare, P. E., and Weston, J. (2019). Learning from Dialogue after Deployment: Feed Yourself, Chatbot!. *arXiv preprint arXiv:1901.05415*, [online] pp.1-19. Available at: https://arxiv.org/abs/1901.05415 [Accessed 11 Feb. 2019].

[20] Häger, F., Kowark, T., Krüger, J., Vetterli, C., Übernickel, F. and Uflacker, M. (2014). DT@Scrum: Integrating Design Thinking with Software Development Processes. *Understanding Innovation*, [online] pp.263-289. Available at: https://doi.org/10.1007/978-3-319-06823-7_14 [Accessed 13 Feb. 2019].

[21] Jenssen, B., Mitra, N., Shah, A., Wan, F. and Grande, D. (2015). Using Digital Technology to Engage and Communicate with Patients: A Survey of Patient Attitudes. *Journal of General Internal Medicine*, [online] 31(1), pp.85-92. Available at: https://doi.org/10.1007/s11606-015-3517-x [Accessed 24 Jan. 2019].

[22] Jerofke-Owen, T. and Dahlman, J. (2018). Patients' perspectives on engaging in their healthcare while hospitalised. *Journal of Clinical Nursing*, [online] 28(1-2), pp.340-350. Available at: https://doi.org/10.1111/jocn.14639 [Accessed 28 Jan. 2019].

[23] Johnson, C., Johnson, T. and Zhang, J. (2005). A user-centered framework for redesigning health care interfaces. *Journal of Biomedical Informatics*, [online] 38(1), pp.75-87. Available at: https://doi.org/10.1016/j.jbi.2004.11.005

[Accessed 5 Mar. 2019].

[24] Jonson, B. (2005). Design ideation: the conceptual sketch in the digital age. *Design Studies*, [online] 26(6), pp.613-624. Available at: https://doi.org/10.1016/j.destud.2005.03.001 [Accessed 11 Feb. 2019].

[25] Kang, K., Cohen, S., Hess, J., Novak, W. and Peterson, A. (1990). Feature-Oriented Domain Analysis (FODA) Feasibility Study. *Technical Report CMU/SEI-90-TR-21*, Software Engineering Institute, Carnegie Mellon University.

[26] Karapanos, E., Zimmerman, J., Forlizzi, J., and Martens, J. B. (2009). User experience over time: an initial framework. *Proceedings of the SIGCHI conference on human factors in computing systems*, [online] pp. 729-738. Available at: https://doi.org/10.1145/1518701.1518814 [Accessed 11 Feb. 2019].

[27] Kent, R. (2016). *Quality Management in Plastics Processing - Strategies, Targets, Techniques and Tools - 7.10 Affinity Diagrams*. Elsevier. Available at: https://app.knovel.com/hotlink/pdf/id:kt0119MZA4/quality-management-in/when-do-you-use-affinity [Accessed 15 Feb. 2019].

[28] Konttila, J., Siira, H., Kyngäs, H., Lahtinen, M., Elo, S., Kääriäinen, M., Kaakinen, P., Oikarinen, A., Yamakawa, M., Fukui, S., Utsumi, M., Higami, Y., Higuchi, A. and Mikkonen, K. (2018). Healthcare professionals' competence in digitalisation: A systematic review. *Journal of Clinical Nursing*, [online] pp.1-17. Available at: http://10.1111/jocn.14710 [Accessed 28 Jan. 2019].

[29] Kelly, J. and Matthews, B. (2014). Displacing use: Exploring alternative relationships in a human-centred design process. *Design Studies*, [online] 35(4), pp.353-373. Available at: https://doi.org/10.1016/j.destud.2014.02.001 [Accessed 9 Feb. 2019].

[30] Lee, O. and Meuter, M. (2010). The adoption of technology orientation in healthcare delivery. *International Journal of Pharmaceutical and Healthcare Marketing*, [online] 4(4), pp.355-374. Available at: https://doi.org/10.1108/17506121011095209 [Accessed 23 Jan. 2019].

[31] Lim, Y., Pangam, A., Periyasami, S. and Aneja, S. (2006). Comparative analysis of high- and low-fidelity prototypes for more valid usability evaluations of mobile devices. *Proceedings of the 4th Nordic conference on Human-computer interaction changing roles - NordiCHI '06*, [online] pp.1-10. Available at: https://doi.org/10.1145/1182475.1182506 [Accessed 16 Feb. 2019].

[32] Liu, L. and Khooshabeh, P. (2003). Paper or interactive?. *Extended abstracts of the 2003 Conference on Human Factors in Computing Systems, CHI 2003*, Ft. Lauderdale, Florida, USA, April 5-10, 2003, [online] pp.1-2. Available at:

https://doi.org/10.1145/765891.766132 [Accessed 15 Feb. 2019].

[33] MacKenzie, I. (1992). Fitts' Law as a Research and Design Tool in Human-Computer Interaction. *Human–Computer Interaction*, [online] 7(1), pp.91-139. Available at: https://doi.org/10.1207/s15327051hci0701_3 [Accessed 4 Mar. 2019].

[34] Maguire, M. (2001). Methods to support human-centred design. *International Journal of Human-Computer Studies*, [online] 55(4), pp.587-634. Available at: https://doi.org/10.1006/ijhc.2001.0503 [Accessed 12 Feb. 2019].

[35] Maher, M., Kaziunas, E., Ackerman, M., Derry, H., Forringer, R., Miller, K., O'Reilly, D., An, L., Tewari, M., Hanauer, D. and Choi, S. (2016). User-Centered Design Groups to Engage Patients and Caregivers with a Personalized Health Information Technology Tool. *Biology of Blood and Marrow Transplantation*, [online] 22(2), pp.349-358. Available at: http://dx.doi.org/10.1016/j.bbmt.2015.08.032 [Accessed 29 Jan. 2019].

[36] Mannonen, P., Kaipio, J., and Nieminen, M. P. (2017). Patient-centred design of healthcare services: Meaningful events as basis for patient experiences of families. *ITCH* [online] pp. 206-210. Available at: https://doi.org/10.3233/978-1-61499-742-9-206 [Accessed 8 Mar. 2019].

[37] Meskó, B., Drobni, Z., Bényei, É., Gergely, B. and Győrffy, Z. (2017). Digital health is a cultural transformation of traditional healthcare. *mHealth*, [online] 3(38), pp.1-8. Available at: http://dx.doi.org/10.21037/mhealth.2017.08.07 [Accessed 21 Jan. 2019].

[38] Moran, K., Bernal-Cardenas, C., Curcio, M., Bonett, R. and Poshyvanyk, D. (2018). Machine Learning-Based Prototyping of Graphical User Interfaces for Mobile Apps. *IEEE Transactions on Software Engineering*, [online] pp.1-1. Available at: http://dx.doi.org/10.1145/3238147.3238203 [Accessed 22 Feb. 2019].

[39] Nielsen, J. (1994). Enhancing the explanatory power of usability heuristics. *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*, [online] pp. 152-158. Available at: https://doi.org/10.1145/191666.191729 [Accessed 28 Feb. 2019].

[40] Norman, D. (2005). Human-centered design considered harmful. *Interactions*, [online] 12(4), p.14. Available at: http://10.1145/1070960.1070976 [Accessed 11 Feb. 2019].

[41] Norman, D. (2006). Logic versus usage: the case for activity-centered design. *Interactions*, [online] 13(6), p.45. Available at:

https://doi.org/10.1145/1167948.1167978 [Accessed 7 Feb. 2019].

[42] Patel, V.L. and Kushniruk, A. (1998). Interface design for health care environments: the role of cognitive science. *Proceedings. AMIA Symposium*, [online] pp.29-37. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2232103/ [Accessed 4 Mar. 2019].

[43] Patterson, E., Sanders, E., Sommerich, C., Lavender, S., Li, J. and Evans, K. (2017). Meeting Patient Expectations During Hospitalization: A Grounded Theoretical Analysis of Patient-Centered Room Elements. *HERD: Health Environments Research Design Journal*, [online] 10(5), pp.95-110. Available at: https://doi.org/10.1177/1937586717696700 [Accessed 6 Mar. 2019].

[44] Peavey, E. and Vander Wyst, K. (2017). Evidence-Based Design and Research-Informed Design: What's the Difference? Conceptual Definitions and Comparative Analysis. *HERD: Health Environments Research Design Journal*, [online] 10(5), pp.143-156. Available at: https://doi.org/10.1177/1937586717697683 [Accessed 10 Mar. 2019].

[45] Pereira, M. J., Coheur, L., Fialho, P., and Ribeiro, R. (2016). Chatbots' Greetings to Human-Computer Communication. *arXiv preprint arXiv:1609.06479*, [online] pp.1-22. Available at: https://arxiv.org/abs/1609.06479 [Accessed 11 Feb. 2019].

[46] Pinsonneault, A., Addas, S., Qian, C., Dakshinamoorthy, V. and Tamblyn, R. (2017). Integrated Health Information Technology and the Quality of Patient Care: A Natural Experiment. *Journal of Management Information Systems*, [online] 34(2), pp.457-486. Available at: https://doi.org/10.1080/07421222.2017.1334477 [Accessed 22 Jan. 2019].

[47] Purgathofer, P. and Baumann, K. (2010). Sketching User Experiences: Getting the Design Right and the Right Design. *Information Design Journal*, [online] 18(1), pp.88-91. Available at: https://doi.org/10.1016/j.destud.2005.03.001 [Accessed 11 Feb. 2019].

[48] Radziwill, N. and Benton, M. (2017). Evaluating quality of chatbots and intelligent conversational agents. *arXiv preprint arXiv:1704.04579*, [online] pp.1-21. Available at: https://arxiv.org/abs/1704.04579 [Accessed 11 Feb. 2019].

[49] Randolph, G. (2004). Use-Cases and Personas: A Case Study in Light-Weight User Interaction Design for Small Development Projects. *Informing Science: The International Journal of an Emerging Transdiscipline*, [online] 7, pp. 105–116. Available at: https://doi.org/10.28945/505 [Accessed 12 Feb. 2019].

[50] Redström, J. (2006). Towards user design? On the shift from object to user as the subject of design. Design Studies, [online] 27(2), pp.123-139. Available at: https://doi.org/10.1016/j.destud.2005.06.001 [Accessed 5 Feb. 2019].

[51] Reis, C. I., Freire, C. S., Fernández, J., and Monguet, J. M. (2011). Patient centered design: challenges and lessons learned from working with health professionals and schizophrenic patients in e-therapy contexts. *International Conference on ENTERprise Information Systems*, [online] pp. 1-10. Available at: http://dx.doi.org/10.4018/978-1-4666-3667-5.ch008 [Accessed 9 Mar. 2019].

[52] Roto, V., Law, E., Vermeeren, A. and Hoonhout, J. (2011). User Experience White Paper - Bringing clarity to the concept of user experience. In: *Dagstuhl Seminar on User Experience*. [online] pp.1-12. Available at: http://www.allaboutux.org/files/UX-WhitePaper.pdf [Accessed 12 Feb. 2019].

[53] Roué, J., Kuhn, P., Lopez Maestro, M., Maastrup, R., Mitanchez, D., Westrup, B. and Sizun, J. (2017). Eight principles for patient-centred and family-centred care for newborns in the neonatal intensive care unit. *Archives of Disease in Childhood - Fetal and Neonatal Edition*, [online] 102(4), pp.F1-F5. Available at: https://doi.org/10.1136/archdischild-2016-312180 [Accessed 5 Jan. 2019].

[54] Sass, L. and Oxman, R. (2006). Materializing design: the implications of rapid prototyping in digital design. *Design Studies*, [online] 27(3), pp.325-355. Available at: https://doi.org/10.1016/j.destud.2005.11.009 [Accessed 14 Feb. 2019].

[55] Serrat, O. (2010). Design thinking. Washington, DC: *Asian Development Bank*, [online], pp 1-8. Available at: https://www.adb.org/sites/default/files/publication/27579/design-thinking.pdf [accessed 11 Feb. 2019].

[56] Shneiderman, B. (1996). The eyes have it: a task by data type taxonomy for information visualizations. *Proceedings 1996 IEEE Symposium on Visual Languages*. [online] Available at: https://doi.org/10.1109/VL.1996.545307 [Accessed 28 Feb. 2019].

[57] Srinivasan, A. and Madheswari, A. (2018). The Role of Smart Personal Assistant for improving personal Healthcare. *International Journal of Advanced Engineering, Management and Science*, [online] 4(11), pp.769-772. Available at: https://dx.doi.org/10.22161/ijaems.4.11.5 [Accessed 15 Feb. 2019].

[58] Steen, M. (2011). Tensions in human-centred design. *CoDesign*, [online] 7(1), pp.45-60. Available at: https://doi.org/10.1080/15710882.2011.563314 [Accessed 6 Feb. 2019].

[59] Stichler, J. (2016). Research, Research-Informed Design, Evidence-Based Design. *HERD: Health Environments Research Design Journal*, [online] 10(1), pp.7-12. Available at: https://doi.org/10.1177%2F1937586716665031 [Accessed 9 Mar. 2019].

[60] Stuij, S., Labrie, N., van Dulmen, S., Kersten, M., Christoph, N., Hulsman, R. and Smets, E. (2018). Developing a digital communication training tool on information-provision in oncology: uncovering learning needs and training preferences. *BMC Medical Education*, [online] 18(1), pp.1-12. Available at: https://doi.org/10.1186/s12909-018-1308-x [Accessed 25 Jan. 2019].

[61] Taggart, F., Uddin, A., Verran, A., Walker, L. and Sturt, J. (2018). The role of digital communication in patient–clinician communication for NHS providers of specialist clinical services for young people [the Long-term conditions Young people Networked Communication (LYNC) study]: a mixed-methods study. *Health Services and Delivery Research*, [online] 6(9), pp.1-270. Available at: https://doi.org/10.3310/hsdr06090 [Accessed 4 Jan. 2019].

[62] Tresp, V., Marc Overhage, J., Bundschus, M., Rabizadeh, S., Fasching, P. and Yu, S. (2016). Going Digital: A Survey on Digitalization and Large-Scale Data Analytics in Healthcare. *Proceedings of the IEEE*, [online] 104(11), pp.2180-2206. Available at: https://arxiv.org/abs/1606.08075? [Accessed 28 Jan. 2019].

[63] Tuzii, J. (2018). Healthcare information technology in Italy, critiques and suggestions for European digitalization. *Pharmaceuticals Policy and Law*, [online] 19(3-4), pp.161-176. Available at: http://dx.doi.org/10.3233/PPL-180460 [Accessed 22 Jan. 2019].

[64] van der Lugt, R. (2005). How sketching can affect the idea generation process in design group meetings. *Design Studies*, [online] 26(2), pp.101-122. Available at: https://doi.org/10.1016/j.destud.2004.08.003 [Accessed 11 Feb. 2019].

[65] Vassilakopoulou, P., Grisot, M. and Aanestad, M. (2016). Enabling Electronic Interactions between Patients and Healthcare Providers: a service design perspective. *Scandinavian Journal of Information Systems*, [online] 28(1), pp. 71-90. Available at: http://aisel.aisnet.org/sjis/vol28/iss1/3 [Accessed 21 Jan. 2019].

[66] Walker, M., Takayama, L. and Landay, J. (2002). High-Fidelity or Low-Fidelity, Paper or Computer? Choosing Attributes when Testing Web Prototypes. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, [online] 46(5), pp.661-665. Available at: https://doi.org/10.1177%2F154193120204600513 [Accessed 14 Feb. 2019].

[67] Ward, H. O., Kibble, S., Mehta, G., Franklin, M., Kovoor, J., Jones, A., Panesar, S. and Carson-Stevens, A. (2013). How asking patients a simple question enhances care at the bedside: medical students as agents of quality improvement. *The Permanente Journal*, [online] 17(4), pp.27-31. Available at: https://dx.doi.org/10.7812%2FTPP%2F13-028 [Accessed 10 Mar. 2019].

[68] Weingart, S., Zhu, J., Chiappetta, L., Stuver, S., Schneider, E., Epstein, A., David-Kasdan, J., Annas, C., Fowler, F. and Weissman, J. (2011). Hospitalized patients' participation and its impact on quality of care and patient safety. *International Journal for Quality in Health Care*, [online] 23(3), pp.269-277. Available at: https://dx.doi.org/10.1093%2Fintqhc%2Fmzr002 [Accessed 5 Jan. 2019].

[69] Wharton, C., Rieman, J., Lewis, C.D., and Polson, P.G. (1994). The cognitive walkthrough method: a practitioner's guide.

[70] Witteman, H., Dansokho, S., Colquhoun, H., Coulter, A., Dugas, M., Fagerlin, A., Giguere, A., Glouberman, S., Haslett, L., Hoffman, A., Ivers, N., Légaré, F., Légaré, J., Levin, C., Lopez, K., Montori, V., Provencher, T., Renaud, J., Sparling, K., Stacey, D., Vaisson, G., Volk, R. and Witteman, W. (2015). User-centered design and the development of patient decision aids: protocol for a systematic review. *Systematic Reviews*, [online] 4(1), pp.1-8. Available at: http://10.1186/2046-4053-4-11 [Accessed 29 Jan. 2019].

[71] Zimmerman, J., Forlizzi, J. and Evenson, S. (2007). Research through design as a method for interaction design research in HCI. *CHI '07 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. pp. 493-502. [Accessed 29 Jan. 2019].

Blogs

[72] Lee Scher, D. (2015). Five Ways Digital Communication Tools Can Improve Health Care. [Blog] *The Digital Health Corner*. Available at: https://davidleescher.wordpress.com/2015/05/11/five-ways-digital-communication-tools-can-improve-health-care/ [Accessed 25 Jan. 2019].

Books

[73] Cooper, A., Reimann, R., Cronin, D. and Noessel, C. (2014). *About Face: The essentials of interaction design*. 4th ed. Indianapolis, Indiana: John Wiley Sons, Inc.

[74] Houde, S. and Hill, C. (1997). *What do prototypes prototype? Handbook of human-computer interaction*, 2nd ed. pp. 367-381.

[75] Martin, B. and Hanington, B. (2012). *Universal Methods of Design*. Beverly, MA: Rockport Publishers, pp 1-207.

[76] Nielsen, J. and Mack, R. (1994). *Usability inspection methods*. New York: Wiley.

[77] Kelley, T. and Littman, J. (2001). *The art of innovation*. New York: Doubleday, pp.1-307.

[78] Menvielle, L., Audrain, A. and Menvielle, W. (2017). *The digitalization of healthcare*. 1st ed. London, United Kingdom: Palgrave Macmillan, pp.1-454.

[79] Rackham, N. (1988). *SPIN Selling SITUATION PROBLEM IMPLICATION NEED-PAYOFF*. New York: McGraw-Hill.

[80] Sharp, H., Rogers, Y. and Preece, J. (2011). *Interaction design: beyond human-computer interaction*. 3rd ed. Chichester, West Sussex, England: John Wiley Sons Ltd, pp.1-521.

[81] Shneiderman, B., Plaisant, C., Cohen, M., Jacobs, S. and Elmqvist, N. (2017). *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, Global Edition. 6th ed. Pearson Education Limited.

[82] Ware, C. (2012). *Information visualization*. 3rd ed. Amsterdam: Morgan Kaufmann, pp.1-443.

[83] Wilson, C. (2013). *Brainstorming and Beyond*. Burlington: Elsevier Science, pp.1-84.

[84] Wilson, C. (2014). User interface inspection methods. Waltham, MA: Morgan Kaufmann.

Manuals

[85] SKL. (2018). Råd för bättre kommunikation - mellan patient och vårdpersonal. [online] Available at: https://webbutik.skl.se/sv/artiklar/rad-for-battre-kommunikation-mellan-patient-och-vardpersonal.html [Accessed 27 Nov. 2018].

Reports

[86] Deloitte. (2018). *A journey towards smart health - The impact of digitalization on patient experience*. [online] Available at: https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/life-sciences-health-care/lu_journey-smart-health-digitalisation.pdf [Accessed 28 Nov. 2018].

[87] McKinsey Company (2016). *Värdet av digital teknik i den svenska vården*. [online] McKinsey Company, pp.1-25. Available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Healthcare%20Systems%20and%20S healthcare-in-Sweden.ashx [Accessed 4 Feb. 2019].

[88] IVO. (2018). *Kommunikationsbrister äventyrar vården*. [online] Available at: https://www.ivo.se/publicerat-material/nyheter/2014/kommunikationsbrister-aventyrar-varden/ [Accessed 27 Nov. 2018].

Software

[89] Ada. (2019). Ada Health GmbH. Mobile smartphone application. Version 2.39.0. Available from App store. Accessed 27 march 2018.

[90] Adobe XD. (2019). Adobe Systems. Desktop and Mobile smartphone applications. Available on Mac OS, Windows, App store and Google play. Accessed 13 february 2018.

[91] BankID. (2019). Finansiell ID-Teknik BID AB. Mobile smartphone application. Version 7.12.21. Available from App store and Google play. Accessed 11 february 2018.

[92] Care to Translate. (2019). Care to Translate AB. Mobile smartphone application. Version 1.1.1. Available from App store and Google play. Accessed 11 february 2018.

[93] Facebook Messenger. (2019). Facebook, Inc. Web and Mobile smartphone applications. Available on the internet, App store and Google play. Accessed 11 february 2018.

[94] Figma. (2019). Figma. Web and Mobile smartphone applications. Available on the internet, App store and Google play. Accessed 13 february 2018.

[95] Framer X. (2019). Framer BV. Web and Mobile smartphone applications. Available on the internet, App store and Google play. Accessed 13 february 2018.

[96] Kry. (2019). Webbhälsa AB. Mobile smartphone application. Version 2.7. Available from App store and Google play. Accessed 11 february 2018.

[97] Skype. (2019). Microsoft Corporation. Desktop and Mobile smartphone applications. Available on Mac OS, Windows, Windows Phone, App store and Google play. Accessed 11 february 2018.

[98] Slack. (2019). Slack Technologies, Inc. Desktop and Mobile smartphone applications. Available on Mac OS, Windows, App store and Google play.

Accessed 11 february 2018.

[99] Sketch. (2019). Bohemian B.V. Desktop and Mobile smartphone applications. Available on Mac OS, Windows, App store and Google play. Accessed 11 february 2018.

[100] Your.MD. (2019). Your.MD. Web and Mobile smartphone applications. Version 3.0.4. Available from App store and Google play. Accessed 11 february 2018.

[101] QnA Maker. (2019). Microsoft. Cloud-based API service. Available from Microsoft. Accessed 18 february 2018.

Websites

[102] 1177.se. (2019). 1177 Vårdguiden. [online] Available at: https://www.1177.se/ [Accessed 21 Apr. 2019].

[103] Bowman, E. (2017). *The Value of Concept Testing for User Experience Design*. [online] Lireo Designs. Available at: https://www.lireo.com/the-value-of-concept-testing-for-user-experience-design/ [Accessed 4 Jun. 2019].

[104] Chalmers University of Technology. (2018). *About Chalmers*. [online] Available at: https://www.chalmers.se/en/about-chalmers/Pages/default.aspx [Accessed 26 Nov. 2018].

[105] Cambridge University Press. (2019). *FEATURE | meaning in the Cambridge English Dictionary*. [online] Available at: https://dictionary.cambridge.org/dictionary/english/feature [Accessed 11 Mar. 2019].

[106] Christensson, P. (2019). *GUI (Graphical User Interface) Definition*. [online] Techterms.com. Available at: https://techterms.com/definition/gui [Accessed 28 Feb. 2019].

[107] Conversa Health, Inc. (2019). *Engage and Manage Patient Populations Automatically with Conversation - Conversa*. [online] Available at: https://conversahealth.com/ [Accessed 13 Feb. 2019].

[108] Encyclopedia Britannica. (2019). *Gestalt psychology | Definition, Founder, Principles, & Examples*. [online] Available at: https://www.britannica.com/science/Gestalt-psychology [Accessed 4 Mar. 2019].

[109] Fontawesome.com. (2019). *Font Awesome 5 Icons*. [online] Available at: https://fontawesome.com/icons?from=io [Accessed 5 Apr. 2019].

[110] Innovationsplattformen.vgregion.se. (2018). - *Verklighetslabb – där innovationer testas i verkligheten - Innovationsplattformen - Liferay DXP*. [online] Available at: https://innovationsplattformen.vgregion.se/nyhetsblogg/-/blogs/verklighetslabb-dar-innovationer-testas-i-verkligheten [Accessed 4 Jun. 2019].

[111] Nielsen Norman Group. (2019). *UX Prototypes: Low Fidelity vs. High Fidelity*. [online] Available at: https://www.nngroup.com/articles/ux-prototype-hi-lo-fidelity/ [Accessed 14 Feb. 2019].

[112] Picker Institute Europe. (2019). *Picker Principles of Person Centred Care*. [online] Available at: https://www.picker.org/about-us/picker-principles-of-person-centred-care/ [Accessed 5 Feb. 2019].

[113] Sahlgrenska. (2018). *About the hospital*. [online] Available at: https://www.sahlgrenska.se/en/about-the-hospital/ [Accessed 26 Nov. 2018].

[114] Shneiderman, B. (2016). *Ben Shneiderman*. [online] University of Maryland. Available at: https://www.cs.umd.edu/users/ben/goldenrules.html [Accessed 28 Feb. 2019].

[115] Institute for Patient-Centered Design, Inc. (2019). *Institute for Patient-Centered Design, Inc.*. [online] Available at: https://www.institutepcd.org/about [Accessed 7 Mar. 2019].

[116] The Interaction Design Foundation. (2018). *5 Stages in the Design Thinking Process*. [online] Available at: https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process [Accessed 28 Nov. 2018].

[117] Tognazzini, B. (2014). *First Principles of Interaction Design (Revised & Expanded)*. [online] askTog. Available at: https://asktog.com/atc/principles-of-interaction-design/ [Accessed 28 Feb. 2019].

[118] Usability.gov. (2019a). *Interaction Design Basics | Usability.gov*. [online] Available at: https://www.usability.gov/what-and-why/interaction-design.html [Accessed 14 Feb. 2019].

[119] Usability.gov. (2019b). *Use Cases | Usability.gov*. [online] Available at: https://www.usability.gov/how-to-and-tools/methods/use-cases.html [Accessed 4 Jun. 2019].

[120] User Experience Professionals' Association (2017a). *Stakeholder Meeting | Usability Body of Knowledge*. [online] Available at: https://www.usabilitybok.org/stakeholder-meeting [Accessed 1 May. 2019].

[121] User Experience Professionals' Association (2017b). *Cognitive Walkthrough / Usability Body of Knowledge*. [online] Available at: http://www.usabilitybok.org/cognitive-walkthrough [Accessed 1 Feb. 2019].

[122] Unsplash.com. (2019). *License / Unsplash*. [online] Available at: https://unsplash.com/license [Accessed 4 Jun. 2019].

[123] Vinnova (2019). *Sweden's innovation agency*. [online] Available at: https://www.vinnova.se/en/about-us/swedens-innovation-agency/ [Accessed 1 Mar. 2019].

[124] ÅF Consult. (2018). *At a glance - About ÅF - ÅF*. [online] Available at: http://www.afconsult.com/en/about-af/at-a-glance/ [Accessed 26 Nov. 2018].

A

Survey Form

Sängliggande patienters uppfattningar om sjukvården.

Denna enkät syftar till att samla in uppgifter angående inlagda patienters upplevelser kring deras sjukhusvistelse med fokus på kommunikation med vårdpersonal, nyttjande av digital teknik samt uppmuntran till involvering i deras egen behandling.

*Obligatorisk

Ange i vilken utsträckning du uppfattar följande påståenden angående dina egna erfarenheter av sjukvården.

Rangordna din bedömning enligt 1-5 utefter att du som patient upplever dig ha:

1. **Snabb tillgång till hälsorådgivning.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

2. **Tillförlitlig hälsorådgivning.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

3. **Effektiv behandling av sjukvårdare.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

4. **Pålitliga sjukvårdare.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

5. **Kontinuerlig vård.** *
   Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

6. **Smidiga övergångar och förflyttningar.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

7. **Involvering i beslut.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

8. **Respekt för preferenser.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

9. **Tydlig och gripbar information.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

10. **Support för egenvård.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

11. **Involvering av och support för familj och karriär.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

12. **Emotionell support, empati och respekt.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

13. **Uppmärksamhet på fysiska och miljömässiga behov.** *
Markera endast en oval.

	1	2	3	4	5	
Stämmer inte alls	◯	◯	◯	◯	◯	Stämmer till fullo

Ange det svarsalternativ du anser dig stämma bäst med dina egna erfarenheter och preferenser inom sjukvården.

14. **Hur ofta använder du digitala verktyg, exempelvis smartphones och datorer, för att kommunicera med omvärlden och ta reda på information?** *
Markera endast en oval.

	1	2	3	4	5	
Aldrig	◯	◯	◯	◯	◯	Väldigt ofta

15. **Hur ofta använder du appar och hemsidor i olika former för att ta reda på information och behandlingar gällande sjukdomar av olika slag?** *
Markera endast en oval.

	1	2	3	4	5	
Aldrig	◯	◯	◯	◯	◯	Väldigt ofta

16. **Hur viktigt är det för dig att engagera dig i din vård på dina egna villkor?** *
Markera endast en oval.

	1	2	3	4	5	
Inte viktigt	◯	◯	◯	◯	◯	Väldigt viktigt

17. **Hur viktigt är det för dig att förmedla din aktuella vårdstatus på dina villkor till dina nära och kära?** *
Markera endast en oval.

	1	2	3	4	5	
Inte viktigt	◯	◯	◯	◯	◯	Väldigt viktigt

18. **Önskar du ha möjlighet att förse dig själv med information utan att behöva tillkalla sjukvårdare?** *
Markera endast en oval.

- ◯ Ja
- ◯ Ibland
- ◯ Nej

19. **Uppfattar du dig som besvärlig för vårdpersonal vid diverse efterfrågningar gällande information eller praktiska tjänster på sjukhuset?** *

Markera endast en oval.

- Ja
- Ibland
- Nej

20. **Vet du i allmän bemärkelse vad en chatbot är?** *

Markera endast en oval.

- Ja
- Inte helt säker
- Nej

21. **Anser du att det saknas digitala verktyg som har möjligheten att förse dig med rätt information på det sättet du önskar enligt dina villkor?** *

Markera endast en oval.

- Ja
- Kanske
- Nej

Tre slutgiltiga frågor

22. **Vad önskar du kunna ta reda på för typ av information utan att kontakta vårdpersonal?** *

23. **Vad för typ av funktioner skulle du vilja se i ett digitalt verktyg som ska stötta sängliggande patienter?** *

24. **Vad kan göras i syfte att förbättra din vistelse som sängliggande patient?** *

Tack för din medverkan!

B

Interview Form

Vårdpersonals redogörelser kring kommunikation med sängliggande patienter.

*Obligatorisk

1. **Vilken är din arbetstitel?**

Situation

2. **Vilka uppfattar du är de mest förekommande frågorna från patienter?** *
3. **Hur uppfattar du att ni arbetar med patient-centrerad vård?** *
4. **Hur kommunicerar ni med patienter via digitala verktyg?** *

Problem

5. **Vilka utmaningar existerar i ditt arbete kommunikationsmässigt?** *

6. **Vilka utmaningar stöter du på vid kommunikation med patienter?** *

7. **Vad för typ av information uppger patienter att de saknar?** *

Inverkan

8. **Upplever du som vårdpersonal på något sätt att patienter inte är tillräckligt informativa?** *

9. **I vilka sammanhang uppstår det situationer där patienter begär information eller hjälp som ej är av relevans för dina specifika arbetsuppgifter?** *

10. **När och hur ofta krävs det av dig som sjukvårdare att du behöver spendera tid på olika kommunikativa utmaningar?** *

11. **Vilka övriga problem och utmaningar är tidskrävande ur ett kommunikationsperspektiv?** *

Nyttofrågor

12. **Hur ser du att digitala verktyg kan förändra vården ur patientens perspektiv?** *

13. **Hur ser du att kommunikationen med patienter kan förändras med hjälp av digitala verktyg?** *

14. **Vilka möjligheter ser du med att effektivisera annat vårdarbete genom implementering av patientcentrerade digitala verktyg?** *

Tack för din medverkan!

C

Survey - Ung Cancer

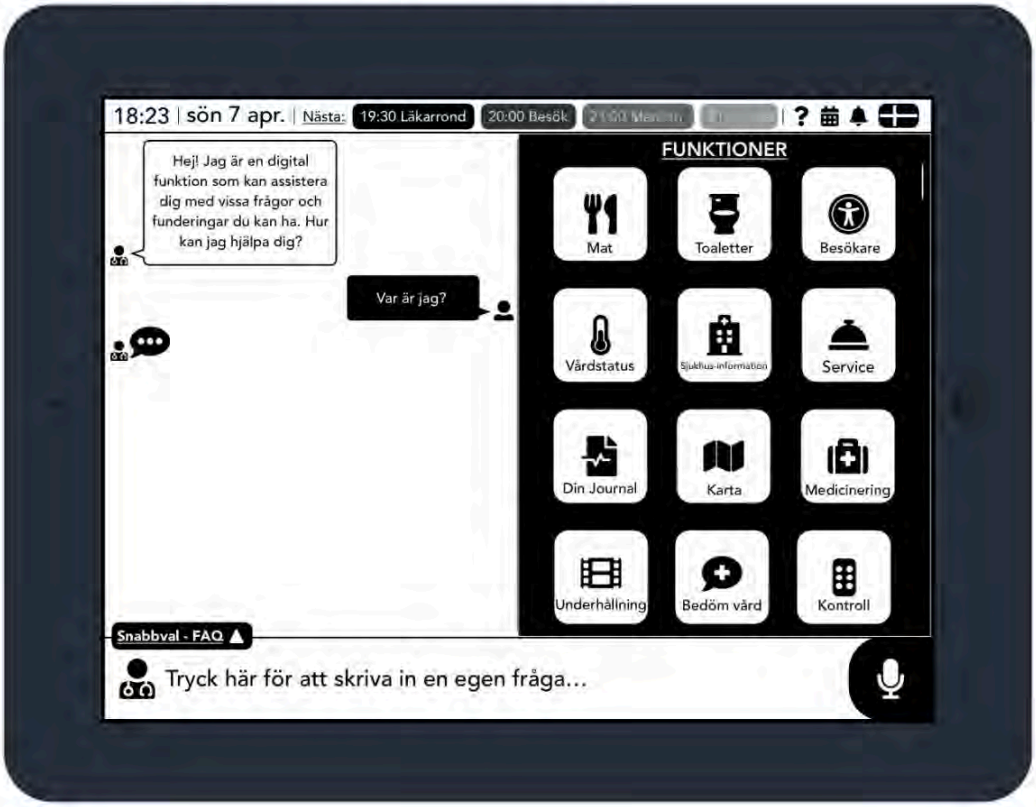
Added section to the original survey form from *Appendix A*.

Sängliggande patienters uppfattningar om sjukvården.

Grafiskt gränssnitt

På bilden ser du en skiss på ett grafiskt gränssnitt i en tablet. Detta är ett exempel på hur ett digitalt verktyg skulle kunna se ut för att ta reda på information du söker som sängliggande patient. Exemplet bygger på en idé om att använda sig av en så kallad "chattbot" samt olika funktioner som syftar förbättra patientupplevelsen.

Skiss av GUI (Graphical User Interface)



Vad ser du för värde i att ha tillgång till en "bedside-tablet"?

Ditt svar

Anser du att något bör tillföras eller negligeras i prototypskissen ovan?

Ditt svar

Tänker du på något i övrigt som bör tas hänsyn till funktions- eller designmässigt?

Ditt svar

BAKÅT NÄSTA

Sidan 5 av 6