Stay Hydrated

How motivational design can support the caregiver’s role in patient participation

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Abstract

The research of this study was conducted at Malmö Hospital in collaboration with Region Skåne. In this paper various methodologies from interaction design are used to explore how patient participation in hospital can be aided and improved. It investigates what aspects of motivational design can be beneficial to healthcare. The literature used in this study analyses the current work values of Malmö Hospital and how it relates to motivational and service design. The study presents design findings based on a service mapping of the hospital along with an evaluation of the current working conditions. Finally, a concept is presented designed to enhance patient - caregiver communication by visualizing patient water balance.

Key words: Healthcare, hospital, motivational design, patient centricity, user centricity, service design, goal, visualization, water, balance
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1 Intro

In recent years, Swedish healthcare has gradually started to include the patient more and more in the patient’s own health plan. Historically the role of the patient has mostly been passive - a person that awaits medical attention and instruction. But as more and more evidence is suggesting, the more active a patient is in their own recovery, the better the health outcome is for the patient and the more the patient’s medical costs are decreased. This value development where patients needs and behavior are taken more into account has a potential to be very well served by the field of interaction design where user centricity is a core aspect.

Another development in the field of interaction design that can potentially lend itself well to this new trend in healthcare is motivational design. By offering many unique psychological insights in how to improve human motivation, motivational design could help designers to better understand user’s behavior and give them the tools to help themselves. While this will lead to more realized and user-centered design decisions, it is not without risk. Many aspects of motivational design have not been tested in a hospital environment, and therefore, they would have to be implemented with caution. This study will attempt to explore what aspects of motivational design could be constructive to healthcare and what would be detrimental.

The aim of this study is to explore how the caregivers role can be supported in this development. Methods derived from interaction design, and more specifically, service design, were used to explore the working situation at...
Malmö Hospital. Over the course of three months various stakeholders were identified and mapped out to pinpoint various problem areas.

The hope for this study is partly to explore the role interaction design can play in a hospital environment and explore what role, if any, interaction designers can play in developing the field of medical services.

1.1 Scope - Skånes universitetssjukhus

This study was conducted in collaboration with Region Skåne - the states administrative arm for the region of Skåne - and Skånes universitetssjukhus (SUS). SUS is a university hospital located in the region of Skåne in the southern part of Sweden. It was founded in January of 2010 when the different medical institutions of the three cities of Malmö, Lund, and Höör were combined into one large institution. This study took place in and around the hospital and its medical facilities in the city of Malmö. SUS employs roughly 12,500 people and has a yearly budget of 14 billion Swedish crowns. About 425-500 people seek treatment at SUS everyday and about 63,500 patients are admitted for care each year.

1.2 Focus

Over the course of the study, which spanned over three months, it became clear that the hospital had no shortage of challenges and problems that would be interesting for interaction designers to tackle. As of yet, SUS has no dedicated interaction designers in its employ, but as it will be shown in this study's findings, it has a workforce that is increasingly feeling a lack of digital solutions. The hospital has the foundation and means to implement the technology necessary such as personal health trackers, tablets, and smartphones for the wards, but has been slow to do so.

While the design opportunities at the hospital were numerous, it became necessary to narrow the findings into comprehensive topics. During the research and mapping phase of the study, the following topics were identified as being both relevant to the findings of the study and to show the most potential for designerly solutions.

- Patient Journal
- Information automatization
- Knowledgebank
- Patient participation

For this project I decided to focus on patient participation. Based on the findings presented in Chapter 4 and further supported by Malmö Hospital’s own value guideline presented in Chapter 2, this topic was found to present
the most design potential out of all the topics. At the same time, it was found that this focus would be able to relate to all the other focuses in a sufficiently thought-provoking and exploratory manor.

1.3 Research Question

*How can methods from interaction design help improve the working conditions for caregivers?*

*What aspects of motivational design theory can be implemented in healthcare in a constructive way?*

1.3.1 Theme

The theme of this paper revolves around the communication between the caregiver and patient, specifically how caregivers can motivate patients to maintain their water balance.

1.4 Limitations

Due to the fact that everyone who participated in this study worked at Malmö Hospital and all the findings were made there, the insights that were made in this study have a Scandinavian scope at best. It is not unreasonable to think that situations and values would differ from other hospitals, therefore, the findings that this study has generated should be interpreted in the context of their surroundings.

In addition, for ethical and legal reasons, this study has chosen to not to include patients in the research. The patient confidentiality policy of SUS hampered any meaningful interaction with patients while they were on hospital grounds. Besides this, the vulnerable state that a patient may be in leaves them open to distress and suggestion. Therefore, any attempt to extract meaningful design knowledge could leave them compromised or even hurt.

1.5 Target group

The main target group of this study is caregivers, a group which includes professionals like doctors, nurses, auxiliary nurses, and specialists. Of course, this study takes into account the perspective of the wider hospital staff, such as facility management, administration, maintenance workers, service personnel. The design solutions presented in this study will, however, revolve around caregivers.
2 Theory

This chapter will explore what kind of work procedures and guidelines are used by SUS, how they are implemented, and what their implications are. To explore how these might be supported and improved, this research will look at what perspectives and ideas the field of motivational design offers. Lastly, this research will examine what ethical quandaries are relevant to these particular topics and to healthcare in general.

2.1 Value-based Care

For the last couple of years Malmö Hospital has been working in the context of a concept called Value-Based Healthcare. In short, Value-Based Healthcare aims to improve the health of patients and their experience of healthcare while at the same time trying to make healthcare more efficient (Nordenström, 2014).

Conceptually, Value-Based Healthcare partly has a background in evidence-based medicine, and partly methods that have been developed and used in service and industrial sectors to improve efficiency and quality. It is a broad concept that lacks an exact definition, but is used by many different healthcare institutions all over the world. It could be seen as a sort of framework for actions, methods, and efforts within healthcare that lead to a better value for the patient (Nordenström). How the term ‘value’ is defined seems to vary depending on the institution. Nordenström tries to define the value of Value-Based Healthcare by tying it to terms like worth, quality, efficiency, and cost.

According to Nordenström, the only way to improve healthcare along these terms is to continuously and systematically implement scientifically generated knowledge in daily work life. This includes finding innovative ways to retain and utilize the knowledge and learning generated by caregivers in their daily work routine. It also means taking into account the perspective of patients and identifying through evidence the most optimal patient outcomes. Healthcare then has to coordinate its efforts based on the needs of the patient to include and cooperate with the patient in their own healthcare. Nordenström also stresses that the needs of the entire healthcare system have to be taken into account as well. This means implementing systems that fall back on values instead of productivity, which hospitals historically have. It also means implementing systems that support the value-based process and fit the needs of the caregivers, patients and society.
2.1.1 Patient Centricity

Putting the patient in the center of healthcare may seem obvious, but throughout most of modern medical history the focus has rested largely on the productivity of caregivers. According to Birker and Dahl (2014), as early as fifty years ago, there was little to no autonomy for the patient. Caregivers were often seen as an indisputable authority who were experts in their fields and not subject for questioning. If a treatment was deemed to be necessary for the patient, it was implemented, with little to no consultation with patients. Understanding the needs of the patient and helping them understand their own health condition came secondary to understanding and treating the patients ailments. Thus, the relationship between caregiver and patient has been strongly hierarchical in nature, where the patient is at the bottom patiently awaiting the instructions and judgement of the caregiver who is at the top. But that relationship has changed over time. Nowadays, the role of the caregiver is more of a consultant or a coach. Patients are often seen as experts on their own health, often armed with information that they have gathered themselves through digital means, like health apps or online medical journals (Birker & Dahl, 2014). In recent years more and more evidence has been published suggesting that an increase of patient inclusivity and autonomy leads to an increase in positive patient outcomes. Besides being mandated by Swedish law and being a question of human decency, Nordenström cites several studies showing that patient centricity leads to a better, safer, and more cost effective healthcare.

To give caregivers guidance towards a healthcare that is inclusive and cooperating with patients, Value-Based Healthcare puts particular focus on certain dimensions. Among these are, but not limited to, that the patient is respected and that their needs are the basis for their care. It is also important that the patient is taking part of their care plan, and that they have all relevant information and options for treatment available to them. Furthermore, that all treatment is based on scientific evidence. Adopting these dimensions does not guarantee a positive outcome for the patient, of course, but it does increase the chances of it, while at the same time support the innovative aspect of Value-Based Healthcare. As Nordenström puts it:

“The practical consequences of these individual-centred dimensions are extensive and includes an adaptation to individual patients needs and wishes, delivery of safe care and that the patient should always have relevant knowledge about their illness, participation in decision-making, that healthcare should be available and that there should be an openness about results” (2014)

Nordenström goes on to say that patient centricity has been shown to lead to a string of better outcomes for healthcare in general. Recent studies show that as patient participation increases, so does patient safety and the cost effectiveness of healthcare. Patient participation has also been shown to lead
to better systemic outcomes such as more concise measurements and evaluations of processes and individual health, more effective follow up treatments, less complications and injuries related to healthcare.

2.1.2 Lean production in Healthcare

To achieve its goals, Value-Based Healthcare borrows methods and processes from the industrial and service sectors. One of these methods, that is also being utilized at SUS, is Lean Production. The ambition of Lean is to improve quality. It was developed by the car manufacturer Toyota to identify and minimize all forms of waste in their production. In Toyota’s case, the value that they were trying to generate was high quality car manufacturing. The value that is trying to be generated in healthcare is a higher quality in terms of patient experience and positive patient outcome.

The core idea of Lean is that there will always be a waste of resources in any given organization, and therefore, there will always be room for improvement. What Lean tries to achieve is to identify what processes are wasteful and what processes generate value. Once these are identified improvements are made to support value generation and ultimately minimize draining of resources. But it is inevitable that new processes will not bring their own form of waste or that conditions might change in the future to make them wasteful again. There will always be waste in a system so there must always be an evaluation of the system. Therefore Lean is more a process than an actual goal (Nordenström, 2014). This entails a perpetual effort to improve all aspect of work throughout the entire hierarchy of an organization.

Besides being dependent on self-critical workers that trust their leadership, Lean healthcare is largely dependent on communication and continued evaluation within an organization that strives to be effective. According to Nordenström (2014), there is a clear lack of IT systems that effectively evaluate existing healthcare solutions and patient outcomes in Sweden. The IT systems that have been developed are more focused on tracking budget-flows and economics. The consequences of suboptimal IT systems has been shown to lead to a greater inconsistency of solutions between different medical units within healthcare, communication problems between organisations within healthcare, inability to properly document and analyse the outcome of actions in real time (Nordenström, 2014). For Lean to be utilized to its full potential, these issues will have to be addressed by healthcare in the future.

2.2 Motivational design

When researching how to support patient participation in a hospital environment, the field of motivational design theory offers many interesting
and constructive perspectives. Motivational design is an academic framework that aims to identify and support processes and principles which are conducive to behavioral change. It is largely based on psychology, and entails creative solutions to bring about change or reinforce a user’s motivations. For example, this could entail developing a skill or focusing on a task or adopting a certain value (Keller, 2010).

Ryan and Deci (2000) define being motivated as “to be moved to do something”. People can vary in level of motivation, but also, in orientation of motivation. The motives that one person may have to rise to action could be detrimental to another person’s call to action (Ryan & Deci, 2000). To distinguish between different types of motivation and the different reasons for goals, Ryan and Deci have developed what they call Self-determination Theory. In this theory they make a distinction between intrinsic motivation and extrinsic motivation.

Intrinsic motivation refers to actions that are taken based on a person’s inherent interests or satisfaction from the act. As Ryan and Deci (2000) bring up, intrinsic motivation has been very useful for educational purposes, possibly because it appeals to a person’s sense of creativity, curiosity, and exploration. They put special emphasis on that appealing to a person’s intrinsic psychological needs and interests, such as competence, autonomy, and relatedness, often leads to greater personal fulfillment (Ryan and Deci, 2000).

In contrast, Ryan and Deci (2000) explain or define extrinsic motivation as a person being motivated by external actors or factors. Actions taken because of extrinsic motivation are not because a person inherently wants to take them, but because they are compelled by outside circumstance, separate from a person’s psychological fulfillment. For example, a person could be motivated extrinsically by fear, reward, or promised success as an end goal. They do, however, make the distinction that there are various degrees of autonomy when it comes to extrinsic motivation.

The Self-determination Theory states that intrinsically motivated behaviors are often a key to feeling self-determination (Ryan and Deci, 2000). Extrinsic motivation, however, can be detrimental to feeling self-determination, unless the various processes of extrinsic motivation are internalized and integrated, thus, making them intrinsic. Ryan and Deci (2000) define internalization as a process of adopting a value or behavior. Integration is when a person starts to identify an adopted value or behavior with their sense of self.

Critical to integration and internalization, however, is what Ryan and Deci call autonomy and competence (2000). For a person to successfully internalize and integrate a new behavior into their everyday life, that said person needs to have a sense of autonomy. In turn, according to the Self-determination Theory, a person cannot have a sense of autonomy without a sense of competence. Thus, to achieve an intrinsic motivation there must first
be a sense of both competence and autonomy. Another term that Ryan and Deci bring up is relatedness. As Ryan, Patrick, Deci and Williams (2008) bring up, “people are more likely to adopt values and behaviors promoted by those whom they feel connected and in whom they trust”.

Ryan et al (2008) also present findings that indicate that when patients autonomy, competence and relatedness is systematically and structurally supported and encouraged in a hospital environment, patients are more likely to feel engaged with their own healthcare. The likelihood for inspiring and maintaining intrinsically motivated “healthy” behavior over a longer period of time is also increased. Understanding how to motivate a patient to participate in their healthcare is key to finding long term solutions that work for both the caregiver and the patient. The next sessions will bring up some example of how motivation might be stimulated.

2.2.1 Goal Setting and Visualisation

When looking into how one might support making patients’ health goals into more intrinsic goals, Goal-Setting Theory as presented by Locke (1996) offers some interesting perspectives. It is a psychological theory concerning the relationship between goals and behavioral outcome. According to Locke (1996), setting a goal for a person can be an extremely powerful motivator when that goal is in line with that person’s values. The more in line a goal is with a person’s values - or their psychological intrinsic perception of themselves - the more probable it is that the goal will be achieved (Locke, 1996). Goals also help a person formulate their own strategies of how to accomplish them. This in turn leads to a higher probability they will have a change in both behavior and, ultimately, value. Furthermore, accomplishing a goal can lead to an incremental increase in motivation, since accomplishing something makes people feel good about themselves.

In regards to goal-making, Locke (1996) presents several key findings. Commitment to goals is usually best achieved by making goals be perceived as attainable. Goals are often most effective when there is a clear feedback on the progress to attain it, regardless whether the nature of that feedback is personal, visual, or auditory. Furthermore, the degree of difficulty of the goal scales to the degree of self-satisfaction a person would feel by accomplishing the goal. As Locke (1996) stresses, if goals are set too difficult to achieve they can be demoralising, whereas a goal that is too easy to achieve will not affect a person’s sense of fulfilment, thus, proving to be meaningless.

Cheema and Bagchi (2011) stress the benefits of visualizing goals. They present findings that suggests that the more a goal is externally represented the more effort a person would put into fulfilling that said goal. Their findings suggest that there might be a slight advantage of abstractly visualizing a goal rather than textually describing it. Liaskos, Dundjerovic and Gabriel (2018) echo this point with their findings. According to them, visual presentations
of information, such as goals, are more likely to be experienced as “accessible” when it is presented spatially with charts or diagrams, as opposed to purely numerical. Their tests found that this can, in turn, lead to an increase in confidence, decision-making, and the creation of strategies for tackling a goal. In relation to this, Oviatt (2006) suggests that digital systems which minimize users’ cognitive load - meaning the amount of mental effort a user has to expend on comprehending a system - are more likely to be engaging to users. When a digital system is intuitive and easy to navigate, it allows the user to focus mental resources on other tasks, thus, increasing the chances that users will incorporate the system as a tool in their problem solving. Because of this Oviatt (2006) advocates that visual delivery systems should be based on a human-centred design. Design that takes into account a user’s values, behaviors, and needs will lead to more fluid interactions. (Oviatt, 2006)

2.2.2 Gamification

One aspect of motivational design that has gotten a lot of attention and traction in recent years is gamification. Deterding, Dixon Khaled and Nacke (2011) defines gamification as “the use of game design elements in non-game context”. In other words, gamification borrows aspects and fundamental functions of games in order to incorporate them into everyday systems and processes for the purpose of increasing user motivation. Huotari and Hamari (2012) build upon this definition and define gamification through a perspective of service marketing as “a process of enhancing a service with affordances for gameful experiences in order to support user’s overall creation” (Huotari and Hamari, 2012). In this way both the user and the service provider become “co-creators” of gamification when in context of a service. They both follow the rules of the game that they are part of.

Sailer, Hense, Mandl and Klevers (2013) identify three different aspects in which gamification can be fostered: the person, the environment, and the context. Person refers to the target group of the gamification, environment refers to where the gamification takes place, and finally, context refers to the content or the topic of the situation in which the target group will be engaged. If any of these three aspects are disregarded or emphasized in a disproportionate way, the overall gamification attempt will suffer as a result (Sailer et al., 2013).

Jia, Xu, Karanam and Voida (2016) bring up some problems that are related to the aspect of person and psychological personality traits in regards to gamification. According to their findings, psychological personality traits of users play a key role in how user will perceive gamified systems and services. They identify two specific psychological traits that have to be taken into special consideration when gamification of a service is attempted. The first being related to people who are extroverted and the second - related to people
with high levels of neuroticism. Extroverted people who have a large imagination and are particularly open-minded are less likely to be motivated by their digital representation as an avatar, for instance. They also suggest that people with high levels of neuroticism might be negatively affected by gamification, whereas people with low levels of neuroticism and high levels of emotional stability may not be affected at all (2016).

Richards, Thompson and Graham (2014) argue that besides trying to enrich a user's experience, gamification needs to take the context of deployment environment and stakeholder requirements into account to be successful. Citing a human-centered design, Richards et al. (2014) remind us that if only the user's experience is taken into account, the end product as a whole will suffer. The most sustainable products are made when everybody's perspectives are taken into account. Furthermore, they argue that after deploying a system, close maintenance and feedback are needed from both stakeholders and users, as well as potential third parties, for successful gamification (Richards et al., 2014).

Mekler, Bruhlmann, Opwis and Tuch (2013) explore whether aspects of gamification such as points, levels, and leaderboards are actually harmful to intrinsic design or not. While their findings show that there is no immediate decrease in intrinsic motivation, there is no increase either, at least in the short term. They argue that designers should be careful when implementing these aspects in any case since there is no data on how user might experience them in a long term scenario. (Mekler et al., 2013)

2.2.3 Personalized data and tracking

Helping caregivers gather data and track the patients’ health and behavior is not a novelty. As technology becomes more and more ubiquitous, so do the means by which caregivers can track patients’ readings. While much effort has been put into developing such technology, less effort has been put into making sure that it caters to a patient-centric healthcare (Skeels & Tan, 2010).

Personal informatics systems are increasingly used to gather biometric data and track physical activity, not just in hospital environments, but throughout society. Gulotta, Forlizzi, Yang and Newman (2016) bring up some valid problems when users engage with personal informatics. The most common problems they have identified are, but are not limited to, “an inadequate support for goal setting...”, leading to a “...misalignment for user and system goals, and a burden of system maintenance” (Gulotta et al., 2016). While Gulotta et al.(2016) bring up some suggestions for solving these problems, they acknowledge that the underlying problem could be that many users find it difficult to interpret the data gathered by informatics systems (Gulotta et
al., 2016). Translating and displaying the data gathered by personal informatics systems in a way that is meaningful to a user can be challenging. There are also many technologies that look to augment aspects of patient participation such as autonomy and communication with caregivers, but as Skeels and Tan (2010) point out, the implementation of these technologies highlights the vulnerabilities of the patient’s situation. It is more often than not the patient’s peace of mind that needs to be emphasized on and addressed, rather than actual medical actions and interventions (Skeels and Tan, 2010). In other words, just knowing that a caregiver is available for providing attention decreases anxiety. Similarly, patients uncertainty about their situation or status makes the waiting for those answers worse. But as (Skeels and Tan, 2010) showcase, providing awareness of a patient’s medical progress and displaying daily plans and events seems to be able to mediate these problems to some extent. They also present some arguments that suggest that giving patient’s access to their medical history and journal decreases anxiety. According to their findings, patients were remarkably interested in opportunities to learn about their medical condition and seek medical information by their own volition. (Skeels and Tan, 2010) state that “a combination of informational and motivational technology could help patients take more ownership of their health and work towards new behavior change goals”. They also point out that the patient’s visitors could potentially be seen as a design resource if they take an active role in the patient’s recovery. For example, a visitor could help a patient seek information about their condition.

2.3 Ethics

Hospitals are, of course, a very sensitive place for many people for many different reasons. This makes designing in a hospital a particularly meticulous process, as mistakes made in a concept could potentially have catastrophic consequences. A hospital is a large institution that is made up of smaller institutions, organisations and units, all of which may have their own political agendas. Considering the scale of this study, the possibility of impacting the relationships between these various players in a positive way is extremely small. On the contrary, it is probably reasonable to suspect that any impact of designer activity would be negative. Therefore, it was very important when conducting this study that these relationships were understood and respected. For example, any design solution that may work for the nurses may not work for facility management or doctors.

It is also important to understand the perspective of the patient. Whether a patient is visiting the hospital for something as simple as a routine check-up or something as severe as a life threatening operation, the patient is by definition, in a vulnerable and unusual situation. Gathering meaningful
design insights from anyone in this state is problematic, to say the least. Any findings based on such insights would be unreliable at best.

Healthcare as a service is about much more than a customer paying a professional to have ‘health’ delivered to them. Rather, it is about the very delicate, humbling, and humane relationship between the patient and the caregiver. A patient is not simply a customer who needs a service, they are human beings who first need to be understood before they can be properly cared for. Patients are more than often physically and emotionally vulnerable, and they need someone whom they can trust and lean on, besides being given the treatment they need. Understanding and supporting the dynamics between the caregiver and patient is essential when designing services for healthcare. The ramifications of not understanding could mean not just diminished efficiency or broken trust, but possibly also a loss of life (Polaine et al).

### 2.3.1 Security

As digital technology permeates society more and more, the need for digital security is increased and healthcare is no exception to that. Implementations of digital technology in healthcare have been slow, but steady (Nordenström, 2014). There is a lot of hope that IT is going to solve existing problems and make current systems more effective. E-health is a term that is being used to describe a number of digital services, such as electronic patient journals, electronic patient support, and systems that exchange medical knowledge between institutions (Nordenström, 2014). These systems offer many opportunities for healthcare institutions to improve their quality of service, but they also have the potential of supporting its values, not least, patientcentricity.

However, moving healthcare services and information into the digital realm means that it is vulnerable to attack by digital means. For example, in May of 2017 the WannaCry virus affected the National Health Service (NHS) of Great Britain so severely that it had to cancel over 20 000 appointments and operations with its patients (Independent, 2018). Besides being potentially disrupted, digital systems can leave both patients and caregivers open to exploitation. For this reason, it is imperative that patients have the options to have their patient data saved and published. As Nordenström (2014) puts it, this presents a problem, not only because there is an interest of research when it comes to patient data, but it would also present a disruptive inconsistency in healthcare solutions (Nordenström, 2014).

Birkler & Dahl (2014) recognize this problem too, but postulate that it may be solved by encouraging the patient to switch over to digital services in small increments, much like banks have. They do note, however, that until such a transition has been made, a non-digital alternative must always be given to
patients who wish to have it. They further argue that the alternative should always be there for redundancy, in case of a power outage or a hacking attack (Birkler & Dahl, 2014). Building a system where the patient can feel safe in their anonymity is key to sustainability.

2.4 Summary

As SUS is clearly interested in patient centricity and its implications, its methods to accomplish patient centricity are still standard. They have yet to implement potential existing technological solutions. Hospitals are complex and the solutions for them need to be grounded in evidence and thorough research. This study has presented some potential psychological theories that might help improve the hospital and patient centricity, along with their respective potential limitations. However, there is no guarantee that they will reach a positive outcome. While motivational design may offer some potential benefits like using goal-management and visual feedbacks to support the patient’s autonomy, and thereby, patient participation, it is also true that a poor implementation of these aspects can lead to an unmotivated patient. Similarly, while gamification may offer powerful tools for motivating the patient, it is of the utmost importance to be sensitive to the larger context of the hospital and a potential disaster of gamifying healthcare. And last but not least, security is a key factor when exploring design opportunities in a hospital. All concepts must be generated with security as a foundation and not an afterthought.

In the design process many of these findings will be echoed by the results of this study’s conducted interviews and observations. The final design concept will showcase a digital system that will take most, if not all, of these aspects in mind.

3 Method

The methods used in this study are derived from the field of interaction design. They are user-centric and investigative. A framework of service design, qualitative interviews, and contextual inquiry was used to gather design guidelines and insights. Based on these, a possible solution was conceptualized by sketching and prototyping.

3.1 Double Diamond

The foundational design model that this study is based on is called double diamond. It is an iterative model for focusing and refining the creative
process and is usually used in service design (thedesigncouncil, 2018). This is visually represented by two diamond shapes that can be broken up into two stages of development (figure 1.). The first is where a problem is identified, and the second is where a solution is identified. These stages can in turn be broken up into four phases of the overarching design process. The phases are as follows:

Discovery - in the first phase of the double diamond the designer starts from a narrow point of ignorance, but as more is learned about the design problem, the scope of research starts to widen.

Define - as insights are made, the scope of the project narrows down to specific problems, the most important aspects of the problem are identified and focused on.

Develop - during this stage the designer takes all the knowledge he has accumulated and all the insights gained and brainstorms, again opening up the process to potential solutions; this is where concepts are created and prototyped.

Delivery - the last stage is where a prototype or a concept is delivered for a specific solution, after this it can either go back to the ideation, otherwise, the whole process can start over where new research is conducted based on the final solutions.

In this model the scope of a project constantly opens and widens, always focused on finding the best ideas and solutions, and always in a state of perpetual inquiry, going back to iterate findings and solutions that did not work. This helps designers focus their projects on what matters, constantly shaving of ideas that are bad or do not matter and promoting constructive ideas.
3.2 Service Design

As stated earlier, this study was conducted using methods from the field of service design. Like in interaction design, service design puts the user in the centre of the design process, but unlike interaction design, service design takes a wider, holistic approach. Service design takes into account not just one or two stakeholders, but all stakeholders that might be affected by a service. By mapping out the different relationships between stakeholders that exist within a service and outside of it, designer gets a larger perspective of how value is generated and between who. This way, the final design concepts are more dynamic and operationally sustainable, which is usually crucial for a service (Forlizzi and Zimmerman, 2013).

This method makes the designer put on the role of a detective, in that you ‘stake out’ your service, make your observation, create your theory, and present your case to your stakeholders. The problem is that the answer often may seem obvious, but it is the designers role to show the stakeholders why the obvious answer should be taken seriously.

Polaine, Løvlie and Reason (2013) point out that when designing for public services such as healthcare, it is essential not to neglect the experience of receiving and giving care. (Polaine et al, 2013) argue that most people expect a deeper value from their healthcare rather than simple task performance or goods transaction. Healthcare - unlike many other services - is connected to many complicated human emotions. (Polaine et al., 2013) stress the need for designers to take these into account when designing services for healthcare.

3.3 Qualitative interviews

When trying to figure out what is going on, it usually helps to conduct an interview. If an interviewer has a good idea of what is going on, but perhaps wants to understand the reasoning or the motives behind something, it usually helps to conduct a qualitative interview. This means composing a set of questions before talking to someone in order to maximize the knowledge gained by an interview (Goodman et al, 2012). By keeping an interview semi-structured in this manner, the interviewer can potentially direct the conversation towards a fruitful end. Of course, there is always a risk of asking a question that can lead in an unfruitful direction. A good interviewer is often a good listener. It is important to not rely too much on structure and be able to adapt and direct the flow of the conversation.

3.4 Contextual Inquiry

During the discovery and mapping phase of the project a good way to get to know a user or a stakeholder and understand their needs is to spend time
with them in the context of their work-space. A common way to conduct this is through contextual inquiry, which is a semi-structured method through which you interview a stakeholder in the context of their day-to-day activities. This usually happens by planning and negotiating a good time and location for the contextual inquiry to take place in. Then performing the visit, gathering information, observing behavior, and asking for clarification when needed. A designer can spend one or several days following the stakeholder. The stakeholder takes on the role of a master/teacher, and the designer takes on the role of an apprentice, trying to gain as much insight as possible. Directly after the contextual inquiry the designer has a session with the stakeholder that would be a type of semi-structured interview where the two parties would discuss what happened, what was observed and noted, and try to develop a deeper understanding with the each other. The end-goal is to figure out what aspects of their day matter for the project. As Gaffey (2004) points out, this is an effective way of getting to know a stakeholders values, concerns, and problems.

“If you know your user’s values, you’ll be able to cater to those values in your design. If you know your user’s concerns you can address them (...) Issues provide opportunities if you can address them in your design, but they become pitfalls if you are unaware of them and fail to allow for their effect on users” (Gaffney, 2004)

Gaffney (2004) also stresses the importance of building contextual inquiry into your project as the insights gained will help shape the direction of the design. The less data you have, the more uninformed your design decisions will be and ultimately result in a final product that is not relatable to the user.

3.5 Affinity Mapping

Affinity mapping is a sort of workshop that designers use during the early part of a research to categorize and interpret data (Wendte, 2018). It is usually conducted during the defining part of the design process to pinpoint things like specific problem areas, lines of communication, and key findings. It is simple to perform and only requires markers, sticky-notes, and a large whiteboard. It works by writing down things which have been discovered in the project so far like observations, insights, key facts, and quotes. The sticky-notes are then placed on a whiteboard into different groups to categorize them. The hope is that this will lead to a framework for the designers in which they can narrow down the scope of the project. As Wendte (2018) points out, the first categories would probably not be the final ones - part of the exercise is to move around the sticky-notes several times in order to interpret the data in different perspectives and hopefully get more insight.
3.6 Sketching

When designing for complex ideas and problems, sketching is integral to the process. Sketches allow designers not just to showcase ideas in a quick and visual fashion, it also allows designers to see their ideas for themselves. It is hard to conceptualize complex solutions in the head, but sketching is a way to make that which only exists in the mind concrete. In this way, good ideas and bad ideas become more distinguished. Sketches also allow designers to communicate ideations with other people, and in turn, they open up the ideations to feedback. For this purpose, it is usually better that sketches remain ambiguous to enable for personal interpretation (Buxton, 2007). The more realized a sketch is, the less exploratory it is, because it will close off potential interpretations and new insights.

3.7 Storyboarding

Storyboarding is a way to illustrate a concept by putting it in a narrative context. This is done to explore a concept over a span of time or in a sequence of events, in order to get an overview of a concept or a problem area. It works like a comic strip, with one picture leading to another, building a coherent visual story. Using a coherent narrative to showcase a design concept, gives the designer the opportunity to share more complex ideas and processes, thus, opening up the possibility to receive more precise feedback (Whadid et al., 2011). Putting concepts in a visualized sequence of events also gives designers a chance to see for themselves if a sequence is missing or unnecessary, giving them a chance to iterate and enhance their concept.

3.8 Prototyping

Prototyping is usually done in the development phase of a project, when user data has been mapped and key findings have been articulated into a design problem. As opposed to sketching, prototypes are made to answer design questions rather than merely ask them. They could be anything from an illustration to a clay model or to a computer application. Prototypes are often made to clarify a design concept in order to introduce it to feedback. In the field of interaction design, the feedback generated from prototypes is often essential to insure that design concepts are in line with the users needs and wishes (Houde and Hill, 1997). For this purpose, it is often important that the designer knows who will test the prototype and explain what is being prototyped. This way, confusion can be avoided and real design question can be answered. The clearer the purpose of a prototype is, the better it can help designers explore design solutions (Houde and Hill, 1997).
4 Design Process

This chapter will detail the various findings that were collected at the hospital. Results and evaluation from interviews, observations, and affinity mapping will be presented. The concept that was developed based on these findings will also be presented in detail. Finally, a prototype based on the concept and the results from user testing will be showcased.

4.1 Interviews

Besides the unstructured interviews that were conducted as part of the service mapping of Malmö hospital, semi-structured qualitative interviews were conducted with key stakeholders. The key stakeholders were identified based on their oversight and insight regarding the caregivers workflow and relationship with digital systems. The participants included the Head of Facility Management, the Chief Nurse at the Special Surgeries, the Chief Nurse at the Orthopedic Ward, and one nurse working at the Orthopedic Ward.

The interviews were conducted over the course of the discovery and mapping phases of the project. Throughout the interviews many topics were raised and discussed, but the four topics presented below were consecutively brought up by all participants. These topics were also identified as bearing the most relevance for the research question. This section will present the topics as the participants experienced them, followed by a problem statement and subsequent design guidelines. Afterwards, the design guidelines will be evaluated.

Results

Patient profile

All participants expressed that there is a pressing need to centralize all patients journals on both a national level, administrational level, and on a ward level. Currently information regarding the patient is spread out over several systems and very few of these systems have the capacity to communicate with each other. When they do communicate, they do so poorly. Because of patient safety regulations, caregivers are not allowed to print documents with patient information. It was expressed, however, that it is simply helpful and timesaving for the nurses to have a daily updated excerpt from the journal with some basic patient information. For example, telephone numbers to relatives of the patient and group information. This would let nurses know what their responsibilities around the ward are and
what patients they and their colleagues are directly assigned to. A “mini-
journal”, so to speak.

Hope was also expressed that since more of the caregivers tools are being 
made digital in the future, the patient data they collect can be directly 
uploaded to the patient journal. It was felt that this would not just save time, 
but also help caregivers interpret and turn the patient data into information. 
Right now, caregivers have to write down patient readings - and sometimes 
make elaborate calculations about those readings - in many different places 
to make sure that everyone can find the readings. To this effect, the nurses 
have to spend a lot of time on “detective work” to figure out what kind of 
medicine a patient should receive and how much, for example.

At the same time, facility management would be interested to know things 
like what room needs cleaning and when and to what extent, or what kind of 
bed is being used or required. Hope was expressed that a centralized digital 
system could supply that sort of information.

“IT promises better management of resources for the benefit of the patient” 
- Head of Facility Management

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- **What if all patient and administration data was centralized in one 
  intuitive digital system?**

Design concepts would have to be open enough to be able to talk and fit into 
a larger digital platform. For example, all hospital staff could be given access 
to a system either through a personal work-device or by logging into a 
stationary console. The system would track the staff’s tasks and could give 
g them the ‘right’ amount of information to properly perform them. A caregiver 
would know what ward the patient is in without seeing their entire journal 
and compromising patient confidentiality. Service personnel could be 
informed of when to clean rooms. But what exactly the ‘right’ amount of 
information is for each worker would have to be carefully examined. Patient 
privacy would be a large concern as well, since information about the patient 
would be more accessible and, therefore, more vulnerable in a centralized 
system.

**Automatization**

When asked about what they hoped to see in the future, many participants 
said that they wanted to see more of their different systems used at the 
hospital not only be better at talking to each other, but also at “thinking for 
themselves”. They wanted to see systems that could sum up all the data and 
values that are collected from all the different institutions at the hospital, put 
them into the patient’s journal in real-time, and alert the staff about what
needs to be done next. For example, as soon as the lab reports a problematic level of blood sugar in a patient's journal, the nurses caring for that patient want to be notified of that update so that they can take action as fast as possible.

Furthermore, it was felt that it would be of great benefit if caregivers were provided with some sort of feedback for everyday small checks. One of the interviewees postulated that if a patient needs a catheter the system could create a “care-plan” for the caregiver notifying them when, and perhaps how, to renew or remove the catheter. Another interviewee further postulated that this care plan could be connected to the caregivers’ hypothetical mini-journal and all the other checklists that each and every ward has. For instance, a caregiver could be automatically given personal responsibility for inspecting the batteries on the defibrillator or order new laundry. As of now, that particular responsibility is hard to relay, it was described.

A great example for showcasing this is that right now each patient has a fluid-balance sheet in their rooms that the caregivers fill in every day to track how much fluid comes in and out of the patient. This includes the amount of fluids the patient takes in, such as drinks, blood transfusions, and drip, and takes out, such as peeing, vomiting, and diarrhea. The caregiver, then, has to calculate and sum up the total amount of fluids in the patient’s body based on their Body Mass Index (BMI). The problem was that sheets were often filled in, but rarely put in the journal. Either it was too hard to complete filling in the sheet or people simply forgot about it. Another problem was that since the sheets were tied to the room and not the patient, they were often lost, misplaced, or forgotten when a patient was moved to another ward.

Some participants thought that it might be helpful to have a word recognizing system that they could use to dictate directly into the journal. Others were a bit more sceptical about how much time this would actually save. Most participants said that the main reason they wanted to see automatization was to save time. When asked what the time would be used for instead, one participant replied that it could be used for work-planning. Another participant said that they would have more time to spend with the patient. When the same participant was asked how one can ensure that the time saved went to the patient, the answer was that they did not know.

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- Would information automatization bring the caregiver and patient closer to each other or would it push them away from each other?
- If the caregiver saves time, how do we ensure that the time is used productively?
While the technology to support information automatization in Malmö Hospital certainly exists and could conceivably be implemented, it is not so clear that this development would be without problems of its own. There are many design opportunities to support caregivers at Malmö Hospital in their workday. Future design concepts will have to be careful to always leave room and foster the relationship between the patient and the caregiver. Since healthcare is always interested in efficiency, it is conceivable that automatization may lead to a reduction of the caregivers’ role in healthcare. If designers are interested in fostering social interaction between caregivers and patients in a hospital environment, special consideration will have to be taken to manage the social vacuum that automatization may leave.

**Knowledgebank**

Many of the participants discussed that the wards have to get better at learning from each other and work more similarly to each other in the future. Malmö Hospital has been working with the *Lean production* process for several years now and all participants agreed that the process has been beneficial. Many felt, however, that solutions found to be working at some wards were not shared or communicated to other wards. One participant remarked that since wards often learn from their mistakes, there could be some value in having a way if highlighting and sharing mistakes between the wards. A mistake-bank, so to speak.

One participant felt that nurses and auxiliary nurses needed more and better channels to highlight their work. Doctors and district nurses have many venues to show how many patients they have cured or by how many percentages a district is healthier. Both doctors and district nurses have a quality-roster attached to their name that they can get credit for. It is harder for nurses and auxiliary nurses at the hospital wards to relay their achievements. The participant credited this in part due to the fact that nurses’ job in healthcare is more about building a personal relationship with the patient in the healing process and that this is harder to showcase and document. Several participants expressed that nurses need a way to showcase the quality time that they spend with the patients and credit it correctly.

Some participants voiced a concern that a centralized digital system would follow and monitor the work progress of the hospital staff. Some thought that it might be overbearing and controlling. Another participant acknowledged the risk but thought that it could also be a source of pride for the hospital staff. A proof of their individual accomplishments. The same participant postulated that tasks could perhaps be directed a bit more anonymously, like to a work team. The work team would decide internally how the tasks would be administered. This would also negate the problem of personal responsibility and in case of a prolonged sick leave, the tasks would always be remembered and executed.
How can nurses be helped to document their achievements without being controlling?
How do you showcase quality time?

Research on how to effectively document and showcase quality time in a working environment would be extensive, concepts should at least strive to be open enough to include a future solution. Based on the findings of the interviews, audio dictation and voice recordings might prove to be conducive to the desired outcome of the nurses. Including this kind of technology in concepts should therefore be taken into consideration when designing. Perhaps nurses could carry a dedicated device.

Patient participation

All participants agreed that the more the patients took part of their individual care plan the better. Right now it is rare for the patient to be aware of what the caregivers plans and goals for the patient’s recovery are.

One participant recounted one instance where a patient had lamented that the staff would not let her go to the bathroom with a wheelchair support, calling the staff “cruel”. In fact, the physical therapists had written in the patients journal that the goal for the patient was to make it to bathroom without any support, and the staff had simply tried to help the patient achieve that goal. The patient had either not understood the goal, or she simply forgot. Several participants felt that there was a need to keep the recovery goals visible for the patient. Not just so that the patient could be aware and motivated, but also so that the staff and visitors could help and motivate the patient.

Right now, the Orthopedic ward at Malmö Hospital is one of a few wards in Sweden experimenting with including patients in their own patient evaluation. The patient evaluation is usually made on a daily basis during the patient’s stay at the hospital. It includes things like how the patient came to be at the ward they are in, how they are feeling at the moment, whether they are afraid or anxious about something or not, and if they are ready to check out of the hospital. Generally, the patient evaluation is written by a caregiver in an administrative office. But in the orthopedic ward at Malmö Hospital patient evaluations are dictated and written with patients in their rooms. Reportedly, this made patients feel “understood” and “noticed”. All in all, it was described as positive.
“Everything works better if every patient has a dedicated caregiver assigned to them.” - Nurse

When asked if there was anything in the patient’s journal that the patient should not be shown, most participants agreed that while the journal should be mostly transparent for the patient, bad news should always be delivered in person, not through reading. One participant thought that maybe some diagnoses could be released after a certain time, so that the caregiver could have time to inform the patient. Another participant noted that there were some patients who felt that they did not want to know any bad news. The participant thought that the patient should have the control to know, and not to know, what they want.

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- **How can we help caregivers make the patient feel more included and aware in their recovery?**

The design should support the current trend of including the patient in their care plan as well making them aware and helping them understand it. The design should cater to and perhaps even encourage human interaction and communication between patient and professional caregivers and take into account the patient’s wishes.

**Evaluation**

There is so much going on at the hospital and qualitative interviews cannot possibly discover every single problem that exists there. What was attempted with these interviews was to identify problems which could be feasibly solved and produce relevant results in this study’s time span. However, it did not require a great effort to locate individuals who were willing to talk about how the hospital works and the problem areas they perceive. Healthcare requires innovation to thrive and there was definitely a willingness to foster innovation among all who participated in the interviews. All the aspects that the participants brought up were interesting and presented real design problems. It was important to narrow the scope of the project to focus on one aspect. While the aspects of a knowledge bank and automatization have large ramifications for the day-to-day work of caregivers, they would require too many resources to design for in a meaningful way. The digital patient profile is most probably an inevitable and natural development in healthcare, but for the purpose of this study it will be hard to design for. There are two reasons for this. The first being that it will require some sort of input from patients whose perspective this study has chosen to exclude. Secondly, it would be
difficult to prototype any concepts related to a digital patient journal that would have a sufficient level of fidelity to be exploratory.

This study will focus mainly on the patient participation topic, because it presents the most numerous and interesting design openings for interaction design. It is also the topic that relates back to the other topics in an open and thought provoking way.

4.2 Observation

As part of the service mapping, all of the visitations during this study at Malmö Hospital were focused on collecting as much data as possible. The key findings were made during the contextual inquiry, playing the role of the apprentice, observing and inquiring about the work. The subject of the contextual inquiry was a nurse working at the Orthopedic ward. In this section a number of resources and relevant factors that were observed will be listed.

Results

The design resources listed below were mainly identified in the Orthopedic ward (Ortopediska 1) of Malmö Hospital.

*Personnel whiteboard* - Next to the main entrance of the Orthopedic ward there is a whiteboard for the staff working there. This whiteboard shows which nurses are working there at the relevant shift, what room each nurse is assigned to, who stands by in case of emergency, who has administrative duties, who is attending an educational seminar, as well as which nurses are going to work during the next shift. The names of the nurses are denoted with magnets while things like rooms, shift times, and administrative duties are permanently marked (*figure 2*). It was remarked by the subject of the contextual inquiry that many staff members of the ward felt that there was a pressing need to make this whiteboard digital.

*Patient whiteboard* - In the administrative room of the Orthopedic ward the effort and actions relating to the patients in the ward are planned on a daily to weekly basis by the nursing staff. To make that task easier they utilize a whiteboard with the purpose of visualising the journey of the patient while they are in the ward. The whiteboard is a grid showing time, the days of the week, going from left to right, and the different room housing patients and the patient’s status going from up to down. The staff used different colored pens to show what kind of medication the patient is on, if and when a patient is going to be transferred to another ward, if the patient is going to have an operation, and when the patient is expected to be released from care. While
this whiteboard was described by many as being very useful and integral to
the day-to-day observations, many also remarked frustration with the
amount of steps they had to take to transfer what was on the whiteboard to
the patient’s journal. Apparently, there have been some efforts towards
making patient boards in other hospitals digital, but not even they could send
the updates to the patient journal in real time. There was also an expressed
need to have the administrative information of the whiteboard available on
hand for each caregiver working at the ward. Due to patient confidentiality
laws it was not possible to take photos of the whiteboard. For this reason it
was recreated from memory (figure 3).

Figure 2. The personnel whiteboard

Figure 3. The Patient whiteboard

Cellular phones - The Orthopedic ward has a handful cellular phones for
internal and external communication in the ward. These phones are very
simple pre-smartphone generation providing only the function of making and
receiving calls. Usually communications are made with other wards in the
hospital area with the purpose of exchanging information regarding the
patient, e.g. when they arrive/depart, or to contact facility management to
order medical supplies. It was explained that most wards have a handful of
these phones or of similar type.

TV-screens - Every room in the Orthopedic ward has a flat screen television
and remote control. Almost every room in Malmö hospital has these.

Care plan - While many of the hospital staff talked about the benefits and
need for patients to be more involved with their care plan, this study’s
observations were that a physical copy of the care plan was not always in the
patient’s room. When this was brought up with the nurse from the contextual
inquiry exercise, it was explained that the care plan is not always needed.

Medication trolley - In the corridor of the Orthopedic ward there is a mobile
medication trolley which is equipped with various medication that is readily
prepared for the daily dispensation of different medicines. It stands equipped
with its own laptop computer which is used to cross reference what medicine
each patient is scheduled to receive. The trolley also has its own cell phone and administrative papers on hand, along with checklists or very rudimentary guidelines, for example, a bedside report (figure 4).

**Food and fluid sheet** - Every room in the entire hospital is equipped with a sheet comprised of the status of water balance and calorie intake for every patient. The sheet is filled in by the caregivers and on it there is the patient’s name, the bed number, time period for the statistics, what kind of food they eat (if they have any special dietary requirements). The first half shows the water balance and the caregivers calculate how much liquid is taken in (drunk) and how much liquid is discharged (urine, vomiting). These are then tallied up and an average number is calculated showing the balance of liquid in the patient’s body. The second half shows how many calories are served and consumed throughout the course of the day along with how many calories need to be consumed by the patient every day (figure 5). A frustration was expressed with how easy it was to misplace the sheets among the rest of the staff and how hard it was to motivate all of the staff to fill in the blanks in the sheet. All sheets were also technically supposed to be added to the patient’s journal for later reference, but this effort was somewhat undermined by an incomplete set of sheets.

![Figure 4. The medication trolley](image)

![Figure 4. The food and fluid sheet](image)

**Evaluation**

Caregivers at Malmö Hospital have a lot of rudimentary resources in use right now and they work well, but they could be improved by the use of a wider range of digital resources. As it was observed, they have a lot of technology that improves day-to-day life in the hospital already, but this is mostly tied to
medical procedures and practices. The resources that support human efficiency are less developed, in comparison.

Through several meetings and seminars held at the hospital it was also observed that there was a large focus on redundancy. One lecturer explained that while the Swedish state currently has no expectation of a fall back plan for the hospital, SUS has a policy of being able to sustain itself for at least four days without any resources or help from the outside world.

Both the personnel and patient whiteboards present some interesting design problems. While making the personnel and patient whiteboards digital would present interesting design solutions for them would have widened the scope of this study too much. Likewise, the medication trolley seems to be too tied to existing medical practices and it was deemed to be more fruitful to look for opportunities to improve the caregivers work situation in other places.

The Fluid Sheet would be problematic to work with because it is in part dependant on patient perspective. However, it also represents a clear problem area for caregivers, while at the same time being able to be associated with many of the other identified problem areas in the hospital. Therefore, this study will focus mainly solving the problems surrounding the food and fluid sheet. Of course, all resources presented in this chapter will be taken into account for the final design concept.

### 4.3 Affinity mapping workshop

In this project affinity mapping was used to create an overview and understanding of what the different stakeholders of SUS goals and values are and how they relate to each other. It was also used to get a visual representation of the communication structure of SUS. The workshop was conducted with two colleagues from Malmö University (figure 6 & 7).

![Figure 6. Categorisation of facts and findings](image1)

![Figure 7. Affinity mapping colleagues Daniel Selleby and Fredrik Påhlsson](image2)
The results of the exercise could be summarized with the following problem statements:

- How can the goals of the care plan be made more transparent to the patient?
- How can communication between caregivers and patients be made more concise?
- How can the value of redundancy be integrated more effectively into patient centricity?

4.4 Conceptualization

Based on the accumulated findings of this project, a concept was developed with the purpose of exploring the identified problems with communication between nurses and patients. The concept that was developed was centred on the problem areas of patient participation in the food and fluid sheet.

The food and fluid sheet presented a substantial problem area for caregivers and at the same time it was representing a great opportunity to create an additional line of communication between the patients and the caregivers. To scale down the scope of the project it was decided to focus specifically on the part of the sheet regarding fluids. As already established, SUS values patient centricity because of its positive outcomes and caregivers are, in turn, very interested in increasing patient participation, as discovered in the conducted interviews. At the same time, the caregivers expressed a clear need for more digital resources. By digitally visualising the fluid sheet, so that it is visible for both the patients and the nurses, it partly explores how these design issues can be addressed. The proposal of this concept is structured in a way that other aspects, such as the resources of e-health, data automatization, digital patient journals, can be potentially incorporated into them at a later date.

Early sketching revealed that making a patient’s stay in a hospital more digital runs the risk of making the patient more passive. Many digital systems simply prioritize communication through that system and not in person, therefore, the importance of augmenting already existing exchanges between the caregiver and the patient proved to be more useful for this study.
Sketching out the patient and the caregiver’s combined user journey, helped distinguish their respective roles in this process as well as allowing the realisation of the potential role of a visitor (figure 8 & 9). The visitor can help the caregiver remind or encourage the patient to drink water if they too see a visual representation of the patient’s hydration levels. Sketching also revealed that water balance in the patient’s body is not a quota that the patient should strive to fulfil, but rather an average level the patient should seek to maintain and place themselves in (figure 10).

By replacing the water balance sheet with a digital screen, caregivers are allowed to visualize and to create the patient’s care plan in real time while being in the room with them. As discussed in Chapter 2, setting goals and visualising them increases the chances of the goals being fulfilled. Furthermore, it would give the patient a chance to deal with the particular aspects of the care plan in their own terms and time, thus, also increasing autonomy. According to the literature presented above, this is supposed to lead to a more intrinsic motivation, thereby, increasing the chances that the values of the set goal will be integrated in the patient’s long-term behavior. Representing the quantity of water balance with a spatial chart such as a colorful bar that goes up or down, also increases the chances of the patient engaging with it.

It is important to note that the digital representation of water balance should be passive, it should simply serve as a reminder of what the status of the patient’s water balance is. The encouragement to fulfill the goal of drinking enough water should be left up to the caregivers. This is due to the fact that patients are more likely to adopt the behavior of tracking their water balance if it is promoted by a person that is considered trustworthy and relatable, as
suggested by Ryan et al. (2008). Since what the patient sees in their room is a digital screen with a colorful progress bar, it is not unreasonable to assume that some patients might experience this as being game-like. As Mekler points out, points and levels could potentially be harmful to intrinsic motivation. Relying on caregivers to interpret and encourage the progress will hopefully mitigate this risk. This is also important for respecting the context of the hospital.

![Figure 10. Sketch depicting caregiver and patient in the design context. Here it was realized that water balance is not a quota, but rather a level](image)

From the perspective of the caregivers, this concept could potentially not only help with the communication of care plans between the caregivers and the patients, but also help with the management of care plans. With the help of digital resources such as smartphones, caregivers can get a quick overlook of patients' digital profiles - in what room they are in, in which bed, where their water levels lie, and if that person is in need of assistance. This would also help caregivers gather the data necessary for Lean production, even if that data would be purely qualitative. It would still support a feedback flow that could inform the process of reducing wastefulness in real time.

### 4.5 The Prototype

To test out the concept, a prototype was developed. This prototype showcased what a digital system would look like specifically for the caregivers. There were two reasons for this. First of all, what patients would see of this system would be mostly static and not interactive, and second of all, patients’ perspectives were not part of this study at any stage due to ethical and legal reasons. The prototype consists of a series of wireframes that were developed with the program “Marvel”. Contextually, the prototype exists in a narrative where it is part of a larger digital system which can access the patient’s
journal, medical history, and care plan. The system would also incorporate the functions of the patient and personnel whiteboard.

The first wireframe depicts an overview of a ward with rooms, beds, and patient statuses. Tapping on the first patient profile leads to the second frame which shows information about the patient - the actual level of water balance and the option to add or change the value. Also included here is an option to view the patient’s journal and care plan. Tapping the "add/change" value button leads to the third value frame which depicts a detailed list of when liquid would be taken in and discharged. The visual outlay of this list was based on the existing fluid sheet. On the lower right hand side of the screen there is a button where caregivers would sign for whatever values they have added or changed. Tapping this button leads to the fourth frame where the caregiver would sign by using a numerical code. In addition, the caregiver would also see what and when they have signed for. As stated earlier, the hospital uses several different methods of security verifications right now. The numerical code was chosen to provoke a discussion about digital security (figure 11).

The prototype was intentionally made to look like the already existing papers and administrative documents currently used by the hospital staff. Patient information and the fluid sheet were taken directly from the already in use sheets, and this was done for two reasons. First of all, it would base the prototype in the context of an already existing reality, making it more relatable to the target group. Second of all, it was made to accommodate an already existing design value, namely that digital resources should be based on real life resources. Creating an over dependence on digital resources can lead to reduction in redundancy.

Figure 11. The wireframe prototype
The purpose of this prototype was to manifest the final design concept of this study, incorporating the key findings and design guidelines which had been identified. Taking the sketches and ideas from the conceptualization phase and putting them into a more coherent and realized way, provided the research with perspective. It was also made with the purpose of continuing the dialogue that have been started with the staff of Malmö Hospital. The purpose was to see the staff’s reaction when when their statements where realized and shown in a visual and interactive way. More specifically, the purpose was to find out what the staff would think about the structure of the prototype, including how rooms and patients were presented and the visual outlay, and the perspective of security.

4.5.1 Testing

Testing of the prototype was conducted together with a nurse in the Orthopedic ward (Ortopediska 1) at Malmö Hospital. The tester was given a brief explanation about the purpose of the study and the questions that the prototype was trying to answer. The tester was partially guided through each step of the prototype and was encouraged to stop and reflect whenever necessary. As stated above, the prototype was placed in a narrative where it was part of larger digital system.

Result

The visuality of the prototype was met positively because “it would improve the day-to-day workflow”, and it was regarded as comprehensive due to its familiarity. The tester complained that the digital systems that are utilized now all use different fonts and colors, making it more frustrating to navigate, for example, to perform simple tasks like making reports, ordering medicine, etc. The tester also echoed previous findings that current systems used was particularly lacking visual elements. The tester did, however, note that the structure of the hypothetical system would need to be more coherent than was shown in the prototype. In other words, things like outlay and color scheme need to be more unified, because digital systems have to make sense for everybody including people who are not familiar with IT. The tester added that most of the staff in the Orthopedic ward was not familiar with IT. There was also feedback on the language part, namely, using more visual elements would be better, as it would make the system more approachable for non-native Swedish speakers. At the very least, there should be a number of different language options. Regarding security the tester did not provide much input besides noting the utility of having a single security-code that could work on all systems.
5 Discussion

5.1 Thoughts on the process

Working at Malmö hospital was a complex task. Mapping out all the different stakeholders and problem areas, building an understanding of their goals and sensitivities, required patience and meticulousness. In the beginning of the study the scope of the hospital was a bit overwhelming. There was a lot of different stakeholders, actors, and units. It was hard to be sure where to put energy and focus in the hospital operation area. Once key stakeholders were identified, they proved to be very cooperative and talkative, many of them had very intriguing ideas and perspectives and they were very keen to share them. Similar to the contextual inquiry, there was a lot of enthusiasm of having someone around who showed interest in the hospital’s day-to-day business and there were many inspiring exchanges during the entire course of the project. This was true all the way to the testing phase when precious time was allocated for the study’s benefit. Without this amount of positive attitude this project would not have been possible. In retrospect, the level of appreciation was incremental, the further the study got the easier it was to talk and engage with people. Primarily because the more that was learned about their values, the phrases and talking points that they usually used, the easier it was to get across the purpose of the study.

Using the methods of interaction design helped set a focus on the study. Working after the double diamond model helped pace the project, allowing constructive findings to be prioritized and developed over others. Coupling this with user centricity, a core aspect of interaction design, helped framed this study. By constantly returning to the user’s perspective - the user being the caregivers - and their views and needs, the project’s scope was never too broad and the relevant answers could always be found. The focus on user centricity also translated very well to SUS’s value of patient centricity, partly because it made the purpose of the study more relatable to the various stakeholders at the hospital, thereby making communication and understanding easier. It also helped the formulation of the final concept.

The field of motivational design lends itself very well to the field of interaction design because it helps interaction designers better understand and cater to the users underlying psychological needs and rationale. In this study, motivational design theory was used to inform the final design concept. Because hospitals are very sensitive places, even the simplest implementations could have dire consequences, and even exploring or suggesting certain concepts could lead to catastrophic results. Therefore, it was crucial to make design decisions which were based on the best possible understanding on their effect on human perception and behaviors.
5.2 Thoughts on the concept

The purpose of this study was to research ways to improve the working conditions of caregivers. User mapping helped to identify a number of interesting problem areas, but patient participation showed the most potential for meaningful design. In relation to this, the food and fluid sheets were used to explore the chosen problem area. The concept that was developed aimed to increase patient participation by visualising their water balance and encouraging communication between the patient and the caregiver. In this way patients would feel more involved in their healthcare and be motivated to improve their situation; it would help the patient help themselves. Caregivers would be given an extra way to communicate their patient’s care plan and track a patient’s health status. By offering a glanceable indication of how a patient is doing, and if there is a need for intervention. It allows the caregiver to easily see if the patient needs to drink more water and take action if needed. The concept also aims to support currently trending procedural values like Lean by providing hospital staff with an extra avenue for feedback. This feedback could be used to improve current procedures and help inform future ones.

While preliminary testing of a prototype showing the caregivers’ perspective of the water balance yielded positive feedback, it is important to note that testing was very limited in scale. To prove the validity of the concept, wider input and feedback would be required from caregivers and other hospital staff. More importantly, no patients participated in any part of this study, let alone, testing. This was made up for with the caregivers anecdotal insights and research literature.

There are a number of potential ethical implications to the concept. The first being that attempting to increase the intrinsic motivation of patients by visualizing their health goals might actually decrease their intrinsic motivation in some cases. As Mekler et al (2013) points out, people who possess certain psychological traits might be immune and possibly even harmed by visual feedback showing progress. Visualizing health goals would have to be presented by caregivers and discussed with patients in the creation of their care plan, and would always have to be optional. The wishes of those patients who simply do not want to see any more "bad news" would also have to be taken into account and respected. The second main ethical implication regards security. Storing any data on any system leaves it exposed to theft and tampering, patient data is no exception. Even if the data is stored on a closed system, it would still be accessible from multiple points of entry even if those points would be guarded by hospital staff. Making the patient’s care plan visual, even if it is placed in the patient’s room, could still potentially compromise the patient’s privacy.
5.3 Future Research

To develop the concept of this study further, additional iterated prototypes that include findings from the user-testing, such as a more unified visual outlay and language solution, would be required. Furthermore, the prototype that was developed for this study would need to be exposed to more feedback from a wider range of caregivers such as doctors and auxiliary nurses, and preferably from different wards and units of the hospital. Future iterations of prototypes could also try to include more values from the patient care plan that would help give caregivers a glanceable overview of their patient’s status. For example, calorie intake and exercise goals could be visualized as well (figure 12).

The concept was made deliberately open to include as many problem areas from the hospital as possible while still being constructive. Future development would expand the problem area of patient participation into other problem areas, such as data automatization and knowledge banks. This would mean widening the scope of the design area to including other hospital staff, like facility management and administration. Ideally, it will also include the feedback of patients who have stayed in a hospital ward for a longer time.

Figure 12. A possible future iteration of the prototype from the perspective of the patient.
6 References


