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THE HESD-MODEL: MERGING MULTIPLE PERSPECTIVES AND CREATING FLEXIBLE USE SCENARIOS FOR SERVICE DESIGN IN HEALTHCARE

Sarri, Tommaso; Kleinsmann, Maaike; Melles, Marijke
TU Delft, The Netherlands

Abstract

Designers are increasingly asked to create solutions for complex problems in for example healthcare. To serve the design of these complex systems, there is a need for new, design methods. While current design methods allow design for multiple users, they often restrict flexibility of adding new solutions to the final product service system (PSS). This paper presents the Healthcare Service Design Model (HESD-model), which was used as a method to design a PSS that supports teamwork and parental involvement in the context of child oncology. This method was developed by the authors, while carrying out a design project within the context of paediatric oncology. The design project concerned the design of a support system that improved the non-technical skills of different actors present in the hospital. A critical reflection of the model and the evaluation of the design outcomes of the model showed that the method allowed taking into account the viewpoints of multiple users as well as the addition of new solutions to the system, leading to valuable results for multiple users.

Keywords: Design Method, Product-service systems (PSS), Teamwork, User centred design, Design for healthcare

Contact:
Dr. Maaike Kleinsmann
TU Delft
PIM
Netherlands, The
m.s.kleinsmann@tudelft.nl

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1 INTRODUCTION

Nowadays product designers are more and more asked to design services. Service design is an emerging field that focuses itself on creating well thought user experiences (Stickdorn and Schneider, 2010). The approach of product designers towards service design is to create a combination of tangible products and intangible service components that together fulfil the needs of the user. This specific type of services design is often called the design of Product Service Systems (PSS) (Tukker & Tischner, 2006). Designers are particularly asked to design PSS, because they are very much user-centred and they are experts in investigating and evaluating the needs and demands of the user. They are capable of using tools such as context mapping to detect and determine the user needs (Sanders and Stappers, 2014). Furthermore, they are also capable of doing concepts tests with the user when the concept is ready.

However, who is *the user* of a PSS? Take for example the care process in child oncology. This care process is a complex system that consists of multiple users that could be considered as a group of interconnected individuals. These individuals do not per see share the same demographic data or social characteristics. When looking at the care process in more detail, we see that each of them has his or her task in the care process. The oncologist is responsible for the medical treatment, while the nurses are responsible for taking care of the patients' well-being, while being treated. As a result, all actors have their own specific goals, responsibilities, expertise and working area. The goal for the oncologist, for example, is that the medicines are taken and the goal for the nurse is that the child feels as good as possible during and after taking the medicines. The design of the PSS should take these multiple users into account and the solutions created should embrace the demands of these multiple stakeholders. So, in order to create a PSS that fulfils these user needs the design of PSS requires an accurate design process that considers product design issues as well as social processes (Morelli, 2006). In other words, the PSS should generate cohesion between the stakeholders. Morelli (2006) proposed a three-step approach to create this cohesion:

- Identify the users that are part of the network
- Creating possible PSS scenarios
- Represent a PSS in all its components

The work of Morelli has its origins in the development of technical systems that became more social due to the fact that industrial production shifts from models of mass consumption towards mass customization. As a result Morelli adopted tools from engineering fields (e.g. systems engineering) to fulfil his three criteria for designing PSS as stated above. Morelli's methodological and formalized approach could be termed as a service engineering approach that was first determined by Ramaswamy (Secomandi and Snelders, 2011). The service engineering approach determines the service as *'a sequence of activities that provide functions, chronologically organized as unity* (Secomandi and Snelders, 2011, p. 25)'. The engineering elements guide the actual deployment of the new service process. The result of a service engineering design process is a highly controlled system that does not allow much flexibility.

However, this paper is about a design project that requires a high level of flexibility of the PSS. The case presented in this paper is situated in child oncology. Within child oncology, management aims to create a high-quality work environment in which medical staff can work together at full potential in collaboration with the parents of the child. In practice, however, it is not always transparent how to embed or facilitate such collaboration. The challenge here was to investigate how design can support and enhance such teamwork, while at the start of the project it was unidentified what the role of the parents was and what knowledge and/or tasks they could contribute to this team. Additionally, providing care for children suffering from cancer requires the flexibility to react upon widely divergent, and sometimes unforeseen situations. Often these situations are solved on an ad hoc base and the solutions cannot always be registered. This hampers organisational learning as well as transparency of the care process. This is another reason why there was a need for a flexible approach towards the service.

In order to improve teamwork and to maintain the flexibility required at a paediatric oncology department, there was a need for a service design approach that was related to the improvement of the service quality. Edvardsson and Olsson's service conception fits this need (Secomandi and Snelders, 2011). According to Edvardsson and Olsson a service comprises three elements: (1) *the service outcome*, which are formed by the customer processes (they require an active participation of the customer) as well as by the service prerequisites (= resources needed to make the service possible).

(2) *the service process,* which is a prototype for the activation of the customer processes upon each unique customer encounter. (3) the *service system* that comprises all resources necessary (Secomandi and Snelders, 2011).

The paper proposes a design method that follows the three-steps that Morelli (2006) proposed, that we combined with Edvardsson and Olsson's conception on service design.

The paper starts with an explanation of the basic steps of the model. The proposed model was assessed through a design project in paediatric oncology, the case study is described step by step in the following pages. Every step in the model has been taken by choosing a method that seemed most fitting for it's contextual needs. It continues with a more detailed explanation of the design tools and techniques proposed for each step in the process. The paper ends with a reflection on the design project and method proposed.

2 THE HESD-MODEL

This section shows the Healthcare Service Design Model (HESD-model), that we used as a method to design a PSS that supports teamwork and parental involvement in the context of child oncology. The iterative nature of the model has been inspired by a design process proposal by Gardien, Djajadiningrat, Hummels, & Brombacher (2014).

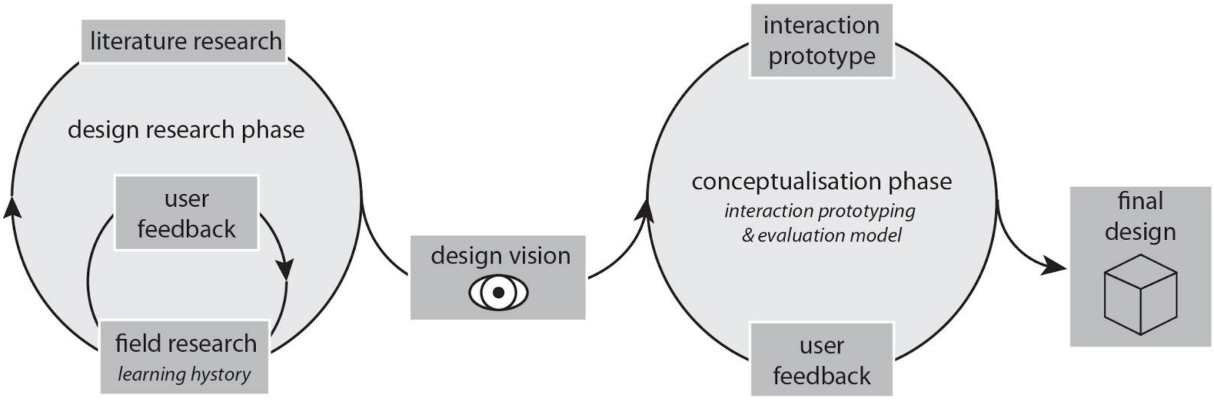


Figure 1. The HESD-model

Figure 1 shows the HESD-model. The HESD-model consists of a *design research phase* and a *conceptualisation phase*. The *design research phase* contains Morelli's first two design activities (1) Identify the users that are part of the network and (2) Creating possible PSS scenarios. The *conceptualisation phase* includes the third design activity Morelli proposed; (3) represent a PSS in all its components. The section continues with a more detailed description of the two phases.

2.1 The research phase

The main two main activities of the design research phase are (1) literature research and (2) field research. The designer carried out the literature study in parallel with the field research. It supported the designer in defining a (theoretical) framework for an accurate analysis of the social and psychological dynamics in the team. It allowed the designer to check theory of social- and group dynamics with working practice in paediatric oncology and the other way around, enabling him to spot differences and similitudes and defining the problem area of the design project.

The HESD-model proposes to use *the learning history method* as a tool for executing the field research (Roth and Kleiner, 1998). Learning histories form an approach foster collective learning (Roth and Kleiner, 2000, p.xiv) and is based on an ethnographic form of storytelling; the *jointly told tales* (Van Maanen, 1988). Jointly told tales make it possible to incorporate experiences of the different actors with the (objective) viewpoint of the designer (Roth and Kleiner, 2000, p. 190). The designer creates the jointly told tales that are based on observation and interviewing techniques. Through observing the actors' experiences the designer detects so-called interesting situations. These are outcomes, events, policies and behaviours out of the ordinary. The designer tries to interpret these situations and s/he interviews the actors involved to evaluate the interpretations made. In this paper, we used the method for mapping the different stakeholders and their working processes. The method allows the designer to evaluate teamwork in an organization built on collaborative processes in a relative short timeframe (e.g. a context mapping study would take much longer).

2.2 The conceptualization phase

In the conceptualization phase, we used the interaction prototyping and evaluation method, to simulate and test how users will experience future interactions (Boess, Pasman & Mulder, 2010). The method is created for the quick evaluation of assumptions that a designer has and wants to explore. This method consists of four steps that can be repeated as in a loop: (1) Make a quick scenario sketch of expected future interactions. (2) Create an interaction prototype, a rough and simple version of the design aspects you want to explore. (3) Users use the prototype to act out the envisioned interaction. (4) Evaluate the experienced interaction qualities of the prototype, bring these qualities to the final design. In this project three interaction prototypes were made to further explore the interaction context and problem of medication intake, before reaching the final design.

3 DELIVERABLES OF THE DIFFERENT STEPS IN THE HESD-MODEL

Each phase of the HESD-model should result in tangible outcomes (e.g. visualization or prototypes) with tangible outcomes that act as boundary objects supporting clear communication of different analysis steps, design vision and PSS design solutions.

3.1 Results of the design research phase

The first result of the design research phase is a stakeholder map. Figure 2 is an example of such a map. The map was created based on the results of the learning histories that were evaluated with paediatric oncology staff members of a child oncology department in an academic centre. Previously done literature studies pointed out four important characteristics to define the paediatric oncology team: shared identity (Tajfel, 1981), social structure (Sherif & Sherif, 1969), face-to-face interaction (Bales, 1950) and common fate (Lewin, 1948). Based on these characteristics, the participants for the research were selected. Meanwhile, field study pointed out the paediatric oncology team could be divided in different sub-teams, according to expertise and responsibilities and aspects of the healthcare process: the medical team, the research team, the psychology team and the educational team. The inner circle shows the people who experience face-to-face interaction with the patient most frequently. The second circle represents the boundary of the paediatric oncology department of the AMC, everyone situated outside works across different departments.

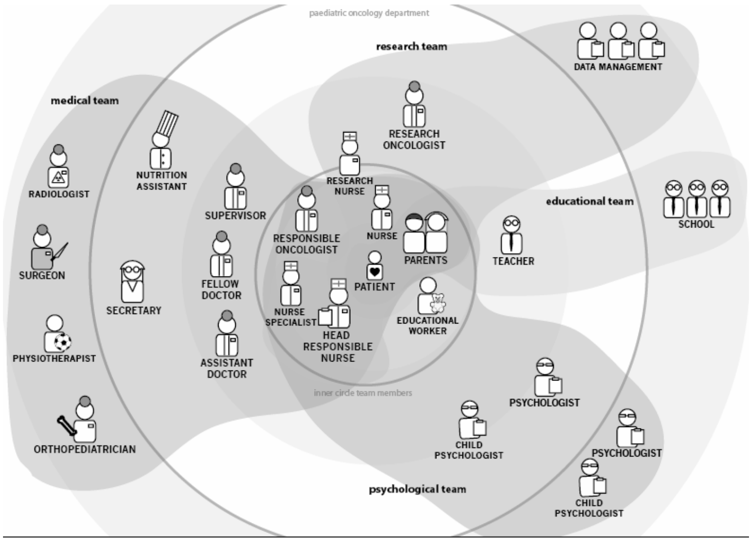
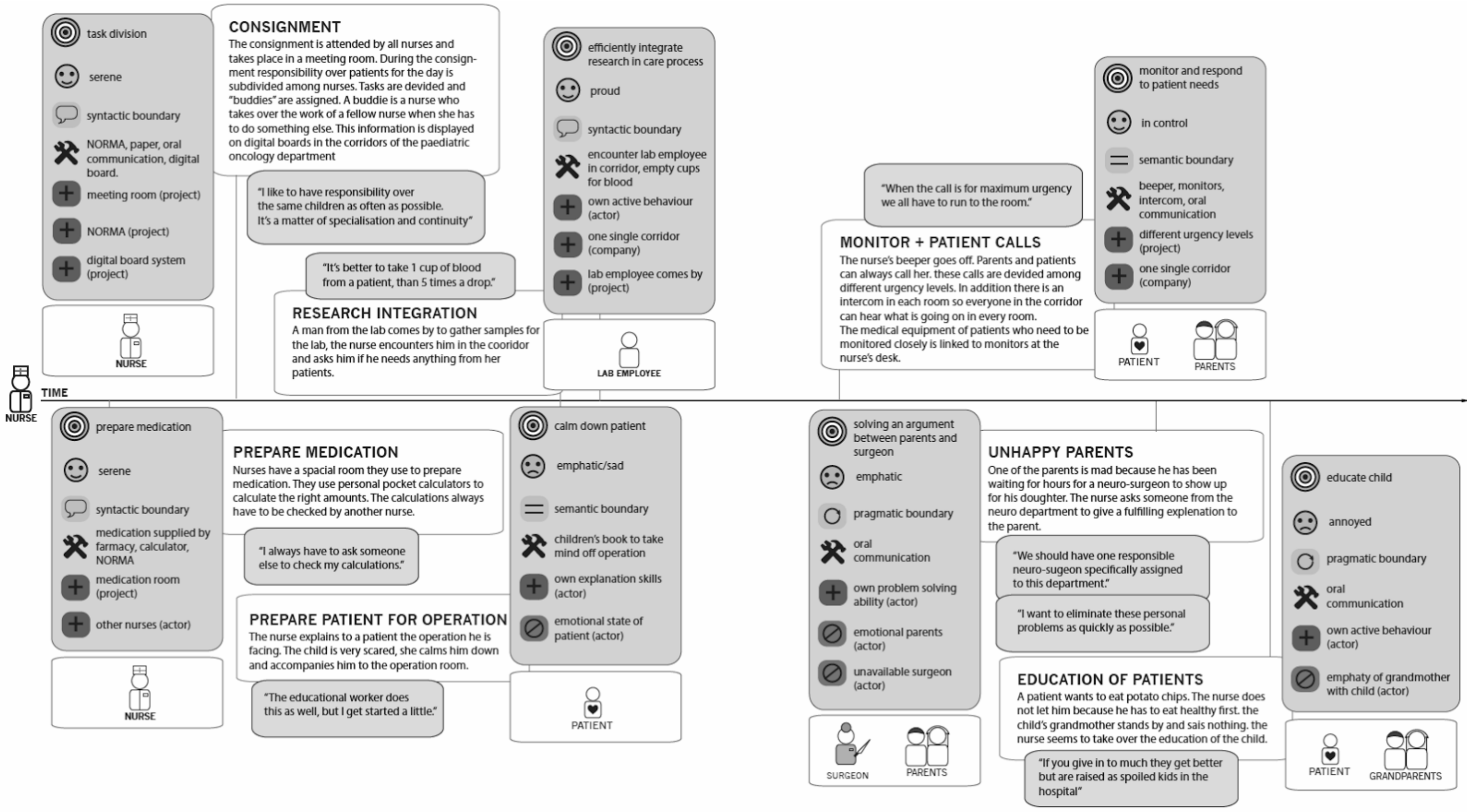


Figure 2. Paediatric oncology team map

The second result of this phase is tangible personal timelines of the core actors. In the different personal timelines, the individual goals, barriers, knowledge boundaries, emotional states and tools found through the learning history method have been merged. These personal timelines support (1) detecting the other actors involved in these situations (2) the understanding of the actor's working practice perspectives, therefore empathizing with them (3) localizing problematic situations and (4) detecting important action sequences.

The personal timelines describe the chronological order of situations in daily working practice. The various situations are described through an engaging quote and an explanation. Important factors for teamwork like personal goals, emotional status and tools used have also been added. Figure 3 shows an example of a personal timeline of a nurse.



CONSIGNMENT
The consignment is attended by all nurses and takes place in a meeting room. During the consignment responsibility over patients for the day is subdivided among nurses. Tasks are devided and "buddies" are assigned. A buddie is a nurse who takes over the work of a fellow nurse when she has to do something else. This information is displayed on digital boards in the corridors of the paediatric oncology department

"I like to have responsibility over the same children as often as possible. It's a matter of specialisation and continuity"

"It's better to take 1 cup of blood from a patient, than 5 times a drop."

RESEARCH INTEGRATION
A man from the lab comes by to gather samples for the lab, the nurse encounters him in the cooridor and asks him if he needs anything from her patients.

"When the call is for maximum urgency we all have to run to the room."

MONITOR + PATIENT CALLS
The nurse's beeper goes off. Parents and patients can always call her. these calls are devided among different urgency levels. In addition there is an intercom in each room so everyone in the corridor can hear what is going on in every room.
The medical equipment of patients who need to be monitored closely is linked to monitors at the nurse's desk.

PREPARE MEDICATION
Nurses have a spacial room they use to prepare medication. They use personal pocket calculators to calculate the right amounts. The calculations always have to be checked by another nurse.

"I always have to ask someone else to check my calculations."

PREPARE PATIENT FOR OPERATION
The nurse explains to a patient the operation he is facing. The child is very scared, she calms him down and accompanies him to the operation room.

"The educational worker does this as well, but I get started a little."

UNHAPPY PARENTS
One of the parents is mad because he has been waiting for hours for a neuro-surgeon to show up for his doughter. The nurse asks someone from the neuro department to give a fulfilling explenation to the parent.

"We should have one responsible neuro-sugeon specifically assigned to this department."

"I want to eliminate these personal problems as quickly as possible."

EDUCATION OF PATIENTS
A patient wants to eat potato chips. The nurse does not let him because he has to eat healthy first. the child's grandmother stands by and sais nothing. the nurse seems to take over the education of the child.

"If you give in to much they get better but are raised as spoiled kids in the hospital"

Figure 3. Personal timeline: nurse

3.2 The design vision

The insights gained in the design research phase of the project, allowed to: (1) determine the role of the parents (2) further specify the design goal (3) create an interaction vision.

First, the developed personal timelines supported the designer in understanding how parents can use their knowledge and experience to support the medical team in the care process of their child. It became clear that there is a great opportunity for people without a professional medical background (like parents) to add value to the shared knowledge of the team and to increase the emotional well-being of the patient.

In most cases these types of tasks are already fulfilled by parents, but without the right management and tools, causing a very low efficiency. Based on this insight, the timelines indicated medication intake as a particularly problematic situation. Additionally, the patients and parents confirmed that medicine intake is one of the major difficulties the patients have while being hospitalized. Therefore the designer chose to focus on design efforts on medication intake through parental involvement. Medication intake affects their physical as well as their emotional - and social well-being. Furthermore, medicine intake also serves as a clear example of what role parents can have in their child's care process. The research showed that the parents could serve as an interpreter between child and paediatric oncology staff. By doing this, they build a "comfort zone" around their child. By giving this task explicitly to parents they will not interfere with other medical work, add their own experiences to the team's shared knowledge and be taken serious by the other actors in the network.

For this further specified design goal an interaction vision was created. What interactions should take place in order to allow parents to increase the patient's emotional well-being when taking medication? How should they communicate their child's social and emotional needs in this situation? How should the rest of the team react to this?

In absence of predefined tools fit for this particular situation, the different actors involved seem to actively gather and develop new methods and tricks to support the child in taking medication. Therefore, the final PSS solution should include a high level of flexibility, allowing parents and staff to add new these solutions for medication intake. Also, it should create a shared language among them to communicate the social and emotional needs of the patient. The designer envisioned this PSS interaction. Figure 4 shows the perspectives and tasks of the different actors involved.

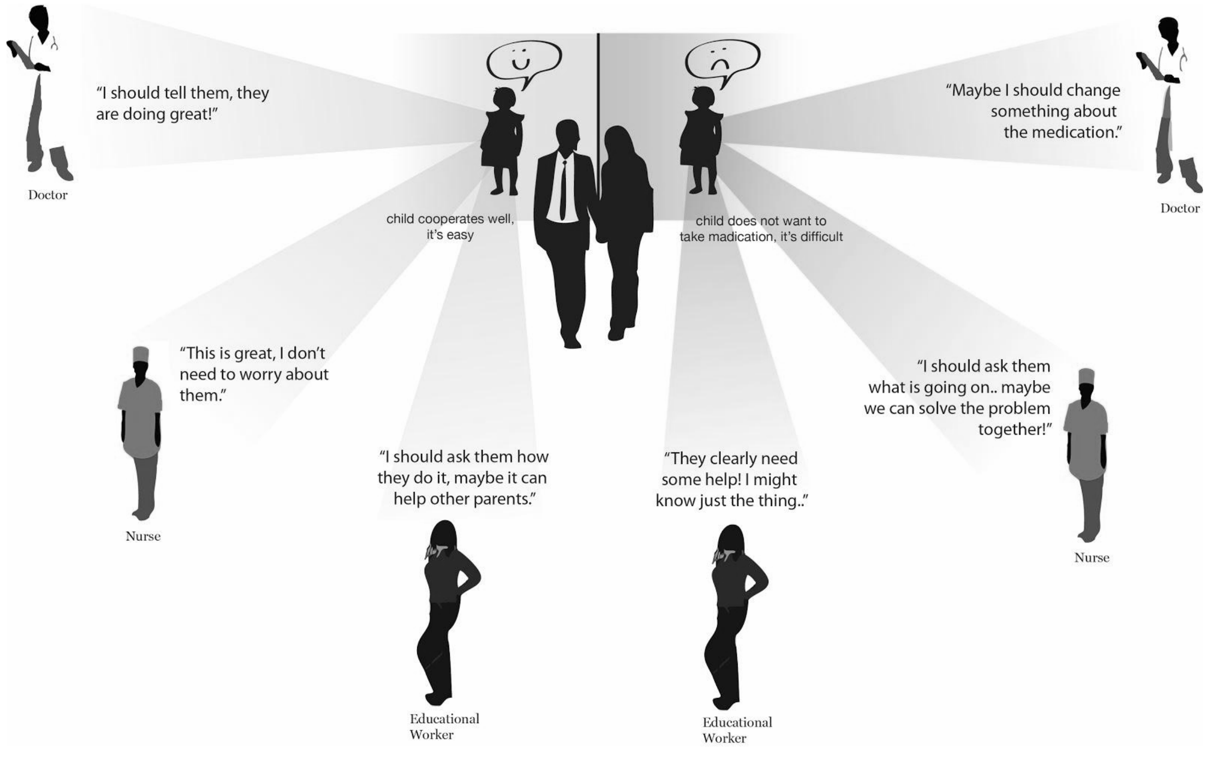
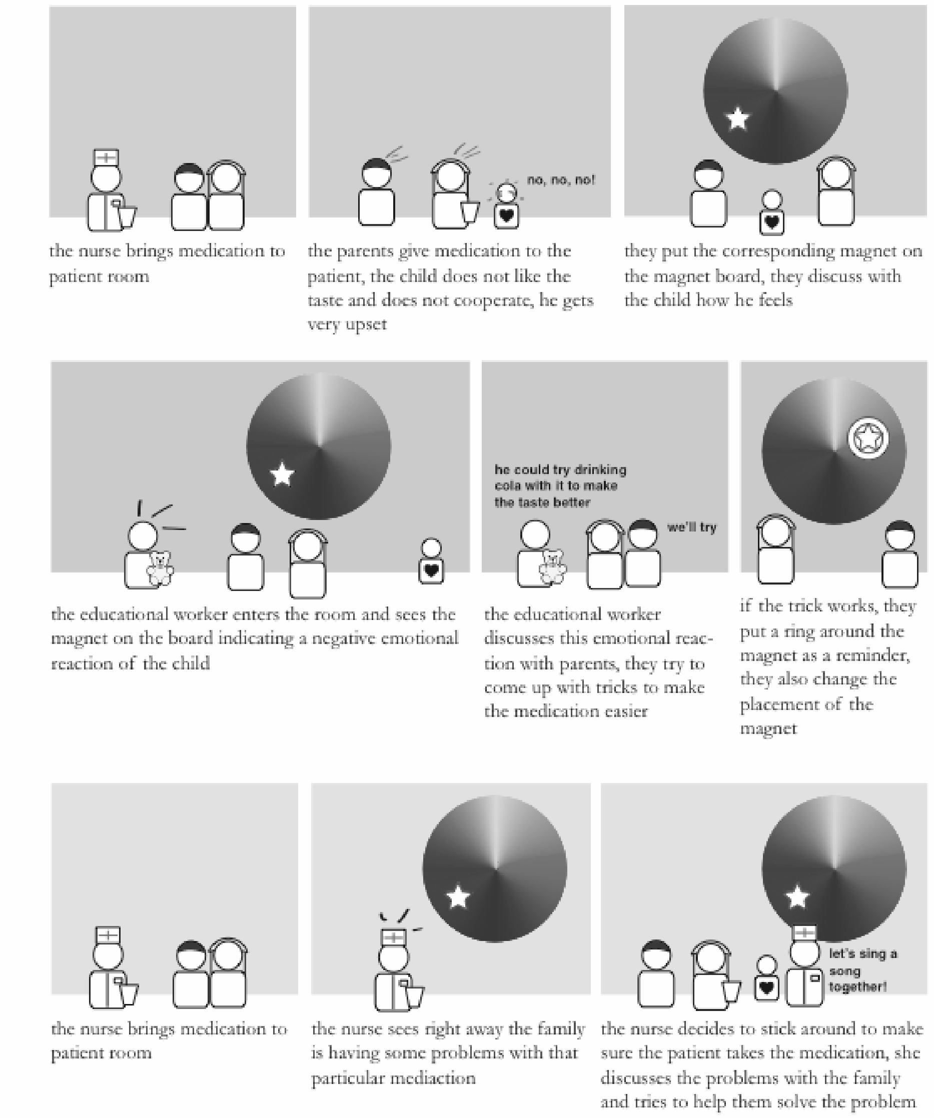


Figure 4. Envisioned future interaction

3.3 The results of the conceptualisation phase

The designer made three different interaction prototypes during the conceptualisation phase and users evaluated these before the designer created a final design. This allowed the designer to explore different interaction sequences and gain important insights on the specific problems around medication intake. The close relationship gained with users during the research phase due to their high involvement, allowed the designer to be able to present very sketchy and unfinished models of his ideas. Since users already had a general understanding of the project, they took these iteration loops seriously even though the prototypes were “unfinished”. This allowed the designer to quickly gain new knowledge about important problems around medication intake and actively involve users in the creation of the final design.

The previous described steps resulted into the *GetMe:* a magnetic board that allows parents to translate and communicate their child’s attitudes towards different medication types. It is a graphical representation of Russell’s core-affect model (Russell, 1980), that allows plotting and categorising human emotions using two dimensions: a positive or negative attitude and a high or low arousal. The magnets represent different types of medication that the patient has to take. By placing the magnets according to their child’s attitude towards that particular type of medication, parents can communicate the emotional responses of their child. This allows the paediatric oncology staff members to reflect, evaluate and change prescriptions in order to improve the child’s quality of life. In this way the whole team, including parents, can co- operate efficiently to overcome problems that make medication intake stressful and difficult. Figure 5 shows the different user scenarios.



the nurse brings medication to patient room

the parents give medication to the patient, the child does not like the taste and does not cooperate, he gets very upset

they put the corresponding magnet on the magnet board, they discuss with the child how he feels

the educational worker enters the room and sees the magnet on the board indicating a negative emotional reaction of the child

the educational worker discusses this emotional reaction with parents, they try to come up with tricks to make the medication easier

if the trick works, they put a ring around the magnet as a reminder, they also change the placement of the magnet

the nurse brings medication to patient room

the nurse sees right away the family is having some problems with that particular mediaction

the nurse decides to stick around to make sure the patient takes the medication, she discusses the problems with the family and tries to help them solve the problem

Figure 5.Storyboards

4 DISCUSSION & CONCLUSION

The three types of design activities that can be carried out by designers as described by Morelli (2006) appeared to be a good starting point for the creation of the HESD-model. However, to be able to create PSS solutions with a higher amount of flexibility for the actors, it was important to add Edvardsson and Olsson's conception of services. This conception enables the designer to create a supportive system in which parents can add rules and solutions of their own. In this way the desired PSS acts as a flexible interaction framework, in which users can freely create new solutions. The coming paragraphs will assess the attainment of Morelli's three points during the described design process. Furthermore, they will reflect on Edvardsson & Olsson's conception to service design.

Since paediatric oncology is a very hectic environment, it is of great importance to find participatory tools that are not time consuming but still allow high user involvement and co-creation to maintain the user centred approach that is crucial for successful product service systems. The Learning History method suits this need. It only requires a time investment from the designer, without interfering too much with the working practice of the users. The method not only allowed to quickly map the complete paediatric oncology team, but it also supported the determination of the relationships between the staff, the parents and the technological devices currently available in the hospital. Approaching the organization as a network of interconnected individuals allows for a great amount of flexibility in the PSS, but neglects the hierarchies that are strongly present in the healthcare environment. This can be of great influence on the final design, which will be treating all users as hierarchically equal, supporting less the actors in need of more control over the process. In this case the overall satisfaction of oncologists was lower than the satisfaction of nurses, educational workers and parents, who are placed lower in the hierarchies in the paediatric oncology context. We can however conclude that Learning History, after being used successfully in social, organizational and innovation management methodology to increase the shared knowledge and communication in a multidisciplinary team, has proved to be an efficient and useful tool to gain knowledge about different perspectives and attitudes of the actors involved in paediatric oncology as well. Furthermore, the learning history method allowed to add a very relevant factor to these relationships: *chronology*. It enabled to gain a deep knowledge about the dynamics of everyday working practice in paediatric oncology and how relationships between actors changed over time. This means that Learning History can also be used as a tool to approach at the same time the first two design activities described by Morelli. (1) The identification of users (cultural factors, social factors, relationships with others and technology) and (2) the creation of current and possible new PSS scenarios.

Creating personal timelines from the gained insights supported the designer in creating detailed representations of actor's individual perspectives on shared experiences and shared situations. This helps designers to gain a deep understanding of the time-related social connections between the actors present in the system. In addition to this, it also created a notable amount of empathy with the different actors involved. This supports designers in predicting and imagining future interactions to translate this into a concrete design vision (see Figure 4). It also supported the designer in the creation of fast feedback loops with the users.

In order to be able to communicate the characteristics of the designed PSS with the staff members and the parents, it is important to find ways to visualize the different time sequences, touch points and physical element present in the system.

Morelli used graphical representations and descriptions of physical and virtual elements, front and back office, space and movement and characteristics of agents. In this project, the designer had chosen to use (rapid) prototyping in combination with storyboards. Physical prototypes not only support the communication of the elements involved in the PSS, they also allow to test and assess the envisioned interactions before actually implementing the design solution. Creating interaction prototypes, in an early stage in the design process, also allowed the designer to quickly evaluate simple secondary interactions needed for a successful PSS. Furthermore, these prototypes also allowed a quick identification of bottlenecks in the PSS.

In addition to the prototypes, storyboards were used to show the actors what interactions were envisioned with the prototype and how other actors will interact with the prototype.

Edvardsson and Olsson's approach combined with Morelli's three-step approach on the tasks designers could carry out to create successful PSS provided a design model that supported the design of a PSS in which actors are supported to add their own new solutions to the PSS whilst creating a possibility to share these solutions with others in the system.

The designer evaluated the final design with parents of a child who suffers cancer. They all expressed that this PSS solution reflected what they are able and willing around medication intake. They also confirmed it made clear to them and the rest of the medical team what a parent's defined task is, giving them a voice in the care process of their child.

As stated before, the proposed HESD-model is partly inspired by the design process proposal for the design paradigm of knowledge economy as proposed by Gardien, *et al.* (2014). However there are a few crucial differences. First of all, instead of using a traditional contextual ethnographic research approach into user activities, the users are already involved in the initial research by evaluating their own observed actions. Additionally, the flexibility in the design phase in Gardien *et al.*'s process proposal will be generated by previous contextual experiments and so-called user generated scripts. In the HESD-model this is, obtained by a constant feedback from users throughout the iterative design loops in the conceptualisation phase. Second, this high user involvement in the HESD-model also allows a high flexibility in the final design by generating design solutions, which can serve as service prerequisites, allowing users to add their own solutions to the system. The model of Gardien *et al.* serves a broader purpose than design for healthcare. It could be an interesting subject for further research to test if the HESD-model can also be applied in other areas in which there is a complex system of actors involved and in which a system requires high flexibility.

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