General Discussion
Chapter 8
Aim

In this thesis, we aimed to investigate and explore if and how boundary objects [1–6] and their perspective can contribute to the meaningful design of innovation for the healthcare sector. We investigated how boundary objects’ social focus could be constructive in innovation processes. We tried to find answers on how four identified dialogical learning mechanisms that boundary objects can trigger [5] seem to fit with different design methods and products like prototypes and explored if those learning mechanisms can be identified and applied in projects aiming to form, develop, and integrate innovation in the healthcare sector.

Main findings

To get insight into the current application of boundary objects in healthcare, we conducted a systematic review described in Chapter 2. This study aimed to (1) determine whether the four dialogical learning mechanisms can be linked to studies on health innovation that mention boundary objects as a concept and (2) assess whether these learning mechanisms provide insight into the stage of the design process. Twenty-five papers were included. One or more mechanisms were identified in each included study. The concept of boundary objects has found its way into healthcare and health contexts. Although the idea of a boundary object was introduced to describe how specific artefacts can fulfil a bridging function between different sociocultural sites and thus has a social focus, the focus in the included papers was often on the boundary object itself rather than the social effect. The reflection and transformation mechanisms are underrepresented in the included studies. Nevertheless, based on the findings in this review, pursuing to trigger the reflective mechanism during design, development, and implementation projects can have benefits for a more fluid and smooth integration of innovation into daily practice.

Methods as boundary objects

Chapter 3 describes the application of methods as boundary objects to explore the worldview and needs of children with Autism Spectrum Disorders (ASD) in their daily life context. Different design methods were applied in the study. All methods functioned as boundary objects. Most methods aimed to identify user needs, aiming to trigger the identification mechanism and reinforce the social roles of the participants. A few methods were mainly applied to coordinate the sessions and give the actors an active role, like the cards that allowed participants to structure the flow and order of the sessions. The findings resulted in three authentic and lifelike personas. Those personas exposed a new perspective in the project, showing that the children with ASD were pursuing different goals than the professionals providing their social skill trainings. The personas triggered processes of perspective making and taking by the other stakeholders, which led to reflection and a new problem space. Concluding that to develop a successful intervention, the children’s needs must be more explicitly addressed in the design.
In Chapter 4, a second study is described in which design methods were applied to explore user needs of a specific user group, in this case, chronicle ill people and their network. The creation of lifelike personas and performing a desktop walkthrough appear to be suitable methods in bridging the knowledge gap in mapping user needs between clients and care professionals. The applied design methods acted as boundary objects and helped to identify and address vital user needs. Also in this study, insights integrated in later applied methods led to perspective making and taking, where care professionals found out that their initial perspective was incomplete and insufficient aligned with the perspective of their patients. This perspective led to a new problem space in which taking the actual patient-user needs as a starting point can be an essential step in successfully integrating and adapting innovative technology in healthcare. This study shows that using design methods as boundary objects can trigger the reflective mechanism in which different stakeholders come to new perspectives through perspective making and taking.

**Prototypes as boundary objects**

In Chapter 5, a prototype of a so-called zero-fidelity simulator was developed to discover whether a learning experience can be elicited with minimal fidelity. The prototype functioned as a boundary object by providing two-sided actions and interactions between activity systems and simulates boundary-spanning activities that innovators experience in their daily practice. By simulating different actors in a rich and complex context, the simulator is training the participant to deal with health innovation, training the organizing and coordinating skills of the future innovator, and thus, training the future innovator to deploy the coordinating mechanism strategically. In a debrief session, the aim is to trigger the reflective mechanism by opening the different perspectives of a complex healthcare setting. Proper reflection in this regard can lead to other behaviours in the future.

As a result of the insights gathered in Chapter 3, Chapter 6 and Chapter 7 present the development of two prototypes as boundary objects. In Chapter 6, a digital comic creator, It’s me, was developed to facilitate and enact a horizontal interaction structure between high-functioning children with ASD and their peers. The design research approach we used in this study, which aimed to design an intervention that successfully functions as a boundary object, was beneficial for the acceptance and adoption of the intervention. Because the tool is addressing different local needs, all stakeholders identify with the developed. In the design process of It’s me, the learning mechanisms of identification, coordination, and reflection passed in sequence among stakeholders, where adoption and integration in practice is a logical next step towards transformation.

Chapter 7 describes the development of an escape room–based serious game to trigger social interaction and communication between high-functioning children with ASD and their peers: AscapeD. AscapeD was designed as a boundary object. As a result of approaching the serious game as a boundary object, the process has not led to a new
tool for a specific activity system, but led to a mediating tool that contributes to different involved activity systems objects without attempting to achieve consensus between them. AScapeD adapts the various stakeholders’ local needs and constraints and obtains a different meaning from the various activity systems. This perspective eventually resulted in an inclusive design and triggered all mechanisms along the way.

Reflections on the findings

Boundary objects in healthcare

Boundary objects have found their way into healthcare and health contexts and their presence is growing since 2008. In existing studies we were able to identify the learning mechanisms as described by Bakker and Akkerman and they seemed to tell something about the stage of a project or innovation. However, we do see that boundary objects in healthcare are mainly used to shape and organize multidisciplinary work, close to Star and Griesemers [1] original explanation, or to surface differences in, for example, the interpretation of a concept within different contexts or disciplines. Oswick and Robertson [7] refer to ‘barricades and mazes’ that generate conflict and reinforce boundaries and existing differences, something that Langley et al. [8] also described as an element of competitive boundary work. In terms of change management, this phenomena can be an opposing and maybe unwelcome side of the identification mechanism. In the study of Kajamaa [9], we saw this effect. At first, in what seems a fluid development and implementation process, they applied the identification mechanism to identify different stakeholders’ needs. After implementation, one event led to a breakdown of trust between stakeholders, which led to the project’s withdrawal. After this event, the boundary object was primarily used to name the significant differences between stakeholders and compete for a position without the other.

In our review we also found out that although the concept of a boundary object was introduced to describe how specific artefacts can fulfil a bridging function between different sociocultural sites [10] and, thus, initially has in essence a social focus, the focus in different studies was often more on the boundary object itself rather than the social effect. Various labels were given to boundary objects. We saw, for example, a differentiation between ‘designated boundary objects’ and ‘boundary objects-in-use’ [11–13]. Islind et al. [14] describe three other types of boundary objects: Narratives as open boundary objects in the first phase; metaphorical boundary objects as semi-open boundary objects in the second phase; and structured boundary objects in the third phase, in which you can draw parallels with a focus on product development. Nevertheless, also in these studies the dialogical learning mechanisms were identified.

In the review the reflection and transformation mechanisms were underrepresented in the included studies. Two studies describe the transformative effect of boundary objects from a historical perspective [15,16], describing a long timeline of a particular development. The reflective mechanism was least identified in all papers. However,
in the papers in which the reflective mechanism was triggered [9,17–20], there was a much smoother process of adaptation and integration of the innovation or tool afterwards. There was more shared ownership of the problem and solution in the processes described, and there was more consideration of other perspectives along the way. This reinforced the idea of reflection as an essential step in a design process, especially in a more complex setting with multiple stakeholders, needs and interests. When these are appropriately addressed in the design through a boundary objects’ focus and, at the same time, get addressed within the design, more mutual understanding arises. This leads to a natural emerging change space in which everyone is willing to move forward [21,22].

Because triggering the reflective mechanism seems essential to increase the chances of innovation in a complex context with different stakeholder needs and goals, we pursued this in our case studies. Design is almost impossible to formalize [23,24] and, therefore, unpredictable. Planning a moment when reflection occurs is also challenging to predict, but when the boundary object perspective is in the locus of focus, identifying a moment of reflection is far less challenging. In our context analysis [25] to explore the worldview and needs of children with Autism Spectrum Disorders (ASD) in their daily life context (chapter 3), it was the aggregation of broadly collected insights into a persona that exposed a new perspective for other stakeholders. In our case study exploring user needs for applying Ambient Assisted Living (AAL) technology for chronically ill people (chapter 4), we had to bring the personas to life in an interactive desktop walkthrough session to open up new perspectives for the stakeholders. Yet, in both cases, the penny dropped, and the moment it occurred was with the right focus, very tangible to catch. When perspective making and taking occur, a whole new and much richer change space emerges, making the entrance to a transformative process suddenly very accessible as reflection aligns the compasses of all stakeholders. Pursuing this social alignment [26] can open up a renewed perspective on shaping innovation in healthcare. This adds to other insights on the use of design methods where methods are much more than formal steps of a design process to be robotically followed [27,28]. Methods have to be consciously applied to achieve some change in the world [29].

In the other case studies, we found that prototypes, or sometimes only their design rationale, were able to trigger the reflective mechanism and opened up new perspectives on the initial problem. In all prototypes, we saw that the different stakeholders recognized something that would help them pursue their goals, and thus we saw the interpretive flexibility feature of boundary objects among different stakeholders. For example, AscapeD addresses the various stakeholders’ local needs and constraints and obtains a different meaning from the different stakeholders. For children with ASD, a serious game is a tool that contributes to their goal of better connecting with peers. For social skills trainers, it is a tool that allows them to see how children with ASD put social skills into practice. Combining this feature with triggering the reflective mechanism led to acceptance and adoption of the tools in practice, as the review’s conclusions suggested.
Based on the findings in this thesis, for future design and implementation projects, the social focus of boundary objects can add value in innovation projects. Pursuing the reflective mechanism has benefits for a more fluid and smooth integration of innovation into practice, especially in more complex contexts with many different stakeholders and goals. The boundary object perspective avoids the pursuit of consensus, which often proves unfeasible in complex practices with many stakeholders. The boundary object perspective aims for social alignment by creating a shared awareness that there are multiple perspectives and needs without the need to overcome or persuade them. That awareness can lead to a shared change space in which innovation can flourish.

Integration in Design for Health

Design research is increasingly finding its way to the healthcare sector [30–34] to respond to a world with more open, complex, and increasingly networked problems. Design holds the promise to offer suitable strategies for complex problems and actively involve stakeholders during the development and implementation of innovation [35,36]. Design research could play a role in bridging the gap towards innovation by combining academic study and the problem-solving attitude of design [37–40]. Due to different causes, the worlds of healthcare and design already are increasingly converging. There is a shift in focus towards patient experience and values in healthcare, increasing the quality of life and patients’ participation in care and treatment [41,42]. In the design discipline, developments towards phenomena like experience design [43], value-sensitive design [44], and people's involvement in design through participatory design [45–47] seem to have a good fit with the shifts in the focus of healthcare. The focus of emerging design disciplines on innovation, transformation, and services within organizations [48] also can solve the problems around implementation and adoption. However, as Kuipers concludes in his thesis [49]: ‘Especially design-in-the-large is lacking in Health innovation projects, where implementation often replaces the crucial phase of social system development. Social system development should be an integral part of a design process for successful adoption.’, where design-in-the-large and social system development is considered as the social focus within the design process. The results of this thesis provides more tangibility to that social focus, where the four learning mechanisms could serve as a compass in the design process.

Figure 1. Design Research Framework II.
The Design Research Framework [50,51] has provided insight into the design process in multiple studies, including case studies within this thesis. Added in the version in figure 1 is social alignment, where social alignment ends where setting the objectives begins. This means that the social design process begins when the design process begins and only when processes of perspective making and taking have taken place it makes sense to set (shared) goals for the artifact or solution to be definitively designed. From that moment on there is support and shared ownership and starts the integration and adoption of the innovation into practice. Positioning the reflective mechanism in the heart of the design process, which fits the findings of this thesis, seems essential for design for health.

Figure 2. Design research-cycle

A more straightforward representation of the integration of this thesis’s boundary object perspective into the design process can be found in figure 2. The presented design research cycle represents the iterative character of design research, illustrated in figure 1 by the spiral. In each iteration, a back-and-forth movement between design and research is the heart of design research. Based on the work of Dorst [37], Stompff added the evaluation of the frame [52] to consciously evaluate whether the design research process is moving to the most constructive and appropriate frame to solve the initial problem. Based on this thesis, a conscious evaluation of the social aspect of design seems legitimized to guide the process ahead. The four learning mechanisms provide a compass to focus the evaluation and formulate future steps.

Integration in managing innovation in health

Also, for processes where the innovation is not mainly designed but purchased, the insights from this thesis can be of added value. Policymakers regularly make decisions about whether or not to spend money on innovation. When it concerns an innovation for a single activity system, this often goes well. Consensus is quickly reached, and there is broad support within the activity system to introduce an innovation. This makes that adoption and acceptance are not an issue. When it comes to innovations that affect different activity systems, it is often the case that, to not delay a decision any further, a decision is taken without really exploring ‘which stakeholders are affected by this innovation and what are their specific needs?’. One of the findings in a recent longitudinal
study about the effects of implementing an electronic health registration (ehr) system on health workers was that working with the trolleys that came with the ehr-system missed a good fit with their daily work. A consciously designerly way of thinking combined with the consciousness that there were more stakeholders with different goals and needs at the front end could have possibly made a big difference here. The awareness of the presence of this large stakeholder group coupled with some serious curiosity about their needs and constraints could have led to a sharpened set of functional requirements, which could have affected the decision-making process and prevented to conclude that there was a mismatch with specific user needs years later. This could have prevented drawing such conclusions years later.

Chapter 3 and 4 show that a mix of more ethnographic design methods and some creative workshops are excellent tools to explore the context and stakeholders and identify specific needs and perspectives. Also when the next step is purchasing an existing innovation. By just taking a little bit more time on the front-end, the study in chapter 4 prevented the setup of advanced ambient assisted living arrangements in apartments for chronically ill people by identifying the specific needs and wishes of the patients themselves. The patient perspective led to the consciousness that every technology which patients would not necessarily need could function as a black mirror for the limitations they experience in life. A more flexible setup to tailor ambient assisted living technologies to the patients sounds like a logical solution, but was not present before the study took place. So, the choice would have been different without taking some time to explore different perspectives and needs.

The boundary object perspective teaches us, unlike many other frameworks in change management where consensus must be enforced sooner or later, that consensus is not necessary to move forward constructively. Instead, being mindful of differences and aligning them through boundary objects can lead to better long-term results than an endless search for consensus.

Conclusions

This thesis investigated and explored if and how boundary objects and their perspective can contribute to the meaningful design of innovation for the healthcare sector. The concept of boundary objects has found its way into healthcare and health contexts. In our review, we saw that boundary objects in health are primarily used to shape and organize multidisciplinary work or to surface differences in, for example, the interpretation of a concept from different contexts or disciplines. We also found that the focus in the literature on boundary objects in healthcare was often focussing on the boundary object itself rather than the social effect. In contrast, boundary objects were introduced to describe how specific artefacts can fulfil a bridging function between different sociocultural sites. The reflection and transformation mechanisms are underrepresented in literature, but pursuing the reflective mechanism in design, development, and implementation projects is beneficial for a fluid and smooth integration of innovation
into practice. Our case studies show that it is indeed significant to trigger the reflective mechanism during the design and innovation process. By applying methods and prototypes as boundary objects and by approaching interventions to be developed as boundary objects, we see good effects in terms of acceptance, adoption, and creating (co-)ownership of the innovation. The boundary object focus and perspective adds value to existing change and innovation frameworks by not pursuing consensus but harmony in differences. Results of this thesis are useful for both the growing design discipline in health as for policymakers in healthcare which have to come up with innovative strategies to meet the challenges healthcare faces today and in the future.

**Future work**

The concept of boundary objects is growing in interest, the concept itself is in healthcare literature subject to its characteristic of interpretative flexibility. Although the interpretation within this thesis can also be questioned, more unambiguous use of the concept in healthcare is desirable. Including an examination of the origins of the concept can be recommended. With the interpretation within this thesis, we think we have stayed close to the original concept. We have linked the concept to a state-of-the-art article by Akkerman and Bakker [5] to describe various dialogical social effects.

Based on the findings of this thesis, both the review as the case studies advocate the pursuit of triggering the reflective mechanism in innovative processes. In all the studies in which this occurred, it benefited the innovation process. Curiously, as a theme, it does not appear much. Even in a review of boundary work by Langley [8], the reflective mechanism is not discussed, while the parallels with the other mechanisms can be drawn. Future research could focus more on this mechanism to investigate if it is as beneficial as it seems in this thesis.

As Kuipers [49] concluded in his thesis: healthcare can benefit from ‘designerly ways of knowing.’ Although the marriage of cultures in healthcare and design comes with its challenges [54], healthcare innovation can benefit from this marriage. In the introduction, we have already outlined that these two worlds are increasingly joining forces, and the emergence of design in the world of healthcare is growing. This thesis is also an expression of that phenomena, but, at the same time, a drop in the ocean. Therefore, it must continue to be said: more research based on the rich design culture in healthcare could be beneficial in facing healthcare’s’ challenges of the future.
And how did it end up with the boy? He is doing fantastic; the booklet will probably get a second life as a boundary object at its sister’s in around a half year from now.

The alert reader will already have noticed, but the Lumie book also triggered the four mechanisms as a boundary object. At first, it triggered the identification mechanism by reinforcing the roles of both my son and me. My son was reinforced in, by his own words, getting “a really big boy.” But the following day, I was reinforced in my role as a parent, as I couldn’t say no to reread the story together at 05:50 in the morning. In the following period, the book coordinated talking about the topic without really changing anything in goals. Until the afternoon, my son told me he was ready to give his pacifier to the Lumies. The ritual symbolized the reflective mechanism, which changed something for both him and me. He fulfilled a task in the story and embraced his new identity as “a really big boy”. I knew I had to look after him and support him in getting used to it. This opened a shared new transformative space in which we both moved forward.
References


16. Stewart H, Watson N. A Sociotechnical History of the Ultralightweight Wheelchair:


47. Bate P, Robert G. Experience-based design: from redesigning the system around the patient to co-designing services with the patient. Qual Saf Health Care. 2006;15: 307–310.


