UX travels

A study on translating user experiences through boundary interventions in networked human-centred design

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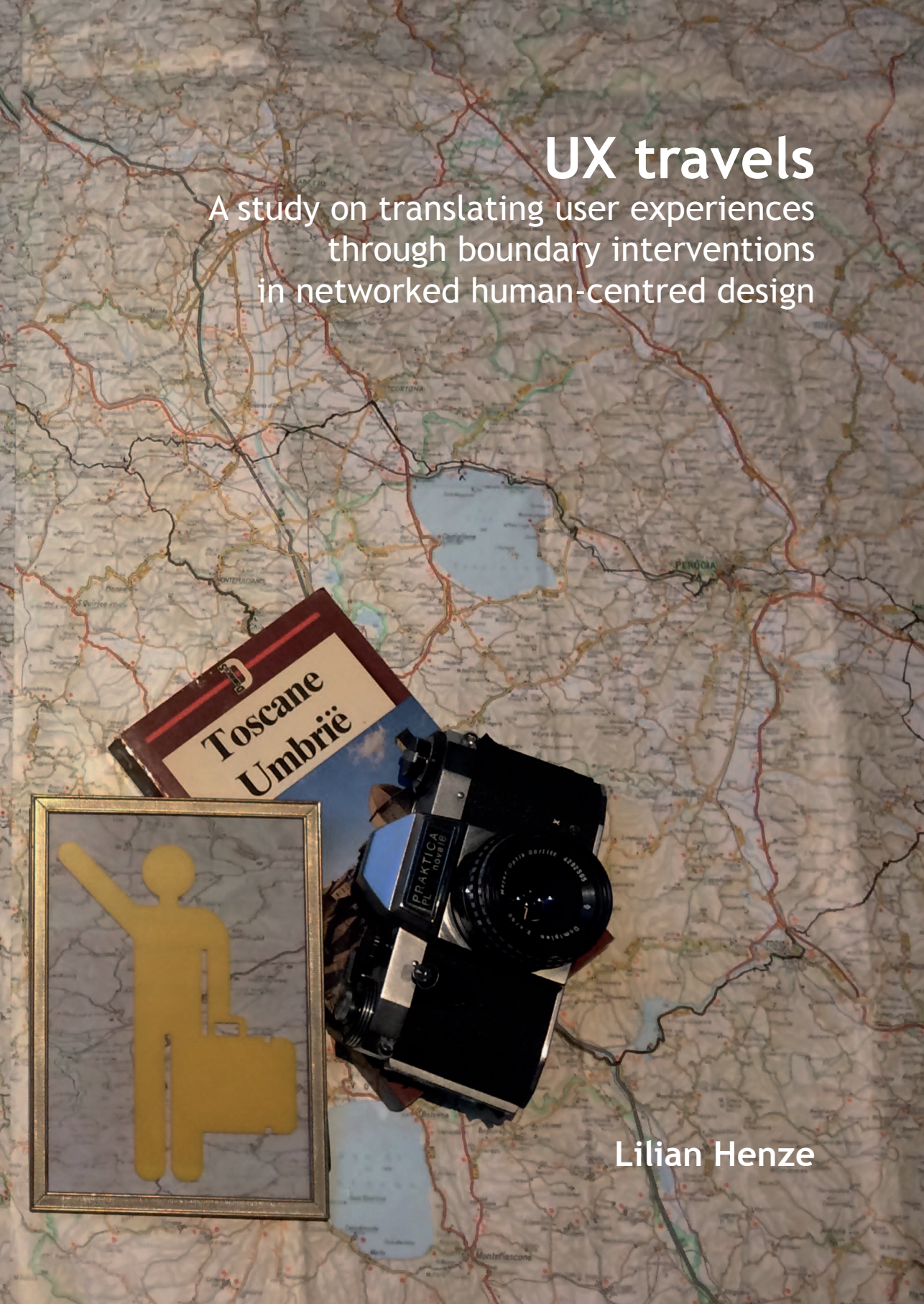

Lilian Henze

UX travels

A study on translating user experiences through boundary interventions in networked human-centred design

DISSERTATION

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'*Travel is fatal to prejudice, bigotry and narrow-mindedness*'

Mark Twain (The Innocent Abroad, 1869)

Content

1 Introduction

A provider of professional coffee machines received complaints about a machine that was used in self-service situations. The main complaint concerned excessive coffee spilling and, as a result, the required cleaning of machines and counters. The provider decided to put stickers with instructions on the machines in an attempt to solve this. However, the spilling continued. The coffee machine provider therefore asked our design research agency to conduct user research at locations where the machines were in use, to identify the source of the complaints. The research findings revealed that the spilling mainly occurred with novice users who regularly put their cup under the wrong outlet. As a consequence, the coffee ran into the drip tray instead of the cup. No differences in user problems were found between locations where the provider had put stickers on the machines to instruct users where to place their cup, and locations where the provider had not put these stickers. In addition, the research revealed that users were confused about which button to push to get the coffee of their choice. The research concluded that the user interface of the machine did not provide a positive user experience (UX) for both customers and restaurant staff in self-service settings.

When informing the designers of the results of the user research, the designer indicated that the original design targets professional use behind the counter. He had focused on a professional user who would frequently use and maintain the machine. This designer worked in a design team together with an ergonomist, product manager, marketeer, and engineers. This team had informed the designer on how coffee machines are used in professional practice, and together they delivered a machine that was user-friendly for professional users, provided high-quality coffee and was commercially successful on the professional market. The complaints started after marketeers launched the machine on the self-service market, and introduced it in self-service settings in several European countries. In an attempt to solve the spilling problem, the product manager and marketeers provided stickers. They created these stickers in consultation with the complaining managers in the self-service restaurants. However, this solution did not resolve the coffee spilling issues.

Informed by the research findings, the provider decided to ask the designer of the original machine to redesign the user interface of the machine. He commissioned our agency to support the designer by gathering insights on user experiences in self-service situations. With our user research we provided new insights into novice users, that together with earlier insights on professional use, informed the redesign of the user interface. Once in use, this redesigned user interface was to the professionals' and novice users' satisfaction. The provider no longer received complaints; he even received compliments on the positive user experience created by the user-

friendliness of the machine. The lesson learned was that UX insights are essential for better decisions makings on user interface designs. In new design projects, the product manager had always strongly recommended testing the UX of user interfaces, with a focus on the usability of the designs. The main criterion for testing was that at least 90% of the users would get their desired product from the machine without any problem. Unfortunately, after the product manager retired the importance of usability testing was no longer recognised, and the 90% requirement was neglected.

This example illustrates an interesting phenomenon: somewhere along the process of developing new products, adjustments to the original design appear to have an unfortunate impact on the user experiences. The design team had originally gained insights into how user operate and experience a coffee machine in a professional setting, and used these insights to create a product that met the requirements of these professional users. However, when the coffee-machine was brought onto the market for non-professional users, the context in which the machine was used had changed. The company did not consider whether and how this change of context would influence the user experiences (UX). Over time the UX insights were lost.

Other user experience researchers have reported the phenomenon illustrated above as well. They confirm that insights on how users understand, operate, and experience products get lost. For example, Norman and Tognazzini (2015) observed that Apple, a company '*known for designing easy-to*-use, *easy-to-understand products'* (p.1) seemed to neglect user-friendliness at some point, ignoring basic usability needs. Tognazzini wrote the first edition of Apple's Human Interface Guidelines in 1987, to ensure that their products were intuitive in use and could be used even without a user-manual. These guidelines were used by designers who were involved with designing Apple products, both designers working at Apple's design department and external designers. However, by 2000, Apple no longer included the basic usability principles in its Human Interface Guidelines, while insights on how customers[1] experience the visual design of its products became dominant in the guidelines. Apple had shifted the focus from making easy-to-use products, to making products with a striking visual design. Later on, in 2015, the basic principles were again included in the guidelines. However, Norman and Tognazzini (2015) noticed that the designers at Apple's design department seemed to disregard these basic principles in Apple's guidelines, while external application designers[2] actually did use them. Norman and Tognazzini observed that as a consequence, design decisions since have been made without using the basic usability principles. These design decisions influenced

1 The term 'customer' refers to a person who buys a product or service, while a 'user' operates or uses the product.

2 External developers use the Apple Humane Interface Guidelines (https://developer.apple.com) when developing apps that integrate with Apple platforms as macOS and iOS, and are approved for the App Store.

the specifications of the final product, leading to beautiful products with severe usability issues. Just as in the example of the coffee machine, people at Apple used to incorporate UX insights in making design decisions, but over time, some of the gathered insights were disregarded and disappeared from Apple's design guidelines. As a consequence, design decision led to a product with a lesser UX because they were made without considering basic UX insights.

The phenomenon of neglected UX insights has inspired the current PhD research into how designers could prevent UX insights being ignored and how the use of UX insights in design projects could be encouraged. Before introducing the approach of and methods used in this research on how to prevent UX insights from getting lost, the following sections describe the role of UX insights in product and service development.

1.1 UX insights in design projects

Today's designers generally agree on the importance of using human-centred methods to gain insights into the needs of the people they are designing for, and to keep focusing on these needs when creating design solutions (IDEO.org, 2015). The following short historical overview of how people's needs were taken into account in design reveals that it is becoming increasingly challenging to keep that focus during the entire design process.

In the 1980s, Victor Papanek (1984) advocated that design should be responsive to people's true needs and in the years that followed, designers adopted this responsiveness and focused on designing usable or user-friendly products, or, in Norman's words (1990): user-centred design. Knowledge of human factors, such as anthropometrics and cognitive abilities, supported the design of user-friendly products. However, this knowledge was not enough to create solutions that fitted people's needs. In the 1990s, the focus broadened to include designing for satisfaction of use and experience. Green and Jordan (1999) observed that designing for experience requires additional knowledge:

> *Usability issues are now taken seriously in the product creation process within many organisations. However, if human factors specialists concern themselves only with usability, they are still falling short of assuring the optimisation of a person's experience with a product* (pp. 5-6).

Jordan (1999) argues that human factors specialist should concern themselves with pleasurability to assure optimisation of person's experiences: *'To achieve product pleasurability ... is a challenge that requires an understanding of people - not just as physical and cognitive processors - but as rational and emotional beings with values, tastes, hopes and fears'* (p. 210). Jordan (1999) also proposed a hierarchy of user needs to take into

account when investigating how users experience a product, and adding pleasure to the functionality and usability requirements. In the following years, usability professionals became user experience (UX) professionals and broadened their focus from usability to UX. The importance of UX was evidenced by the fact that the worldwide Usability Professionals Association[3] changed its name into the User Experience Professionals Association (UXPA) International.

Also, the focus of product design shifted. At the beginning of the 21st century, service design emerged as a field of practice and as a discipline (Kimbell, 2009). Service design aims to create solutions for both the service user and service provider throughout the service's lifecycle. Service design takes a human-centred approach to the development of the processes, technologies, and interactions that are required for the delivery of services (https://service-design-netork.org). Product and service designers' objects of design are products and services that are part of a system of products and services. Such a product service system (PSS), can be described as: '*…an integrated bundle of products and services which aims at creating customer utility and generating value'* (Boehm & Thomas, 2013, p. 252).

The design agency IDEO gives an account of their approach that emphasises human-centredness of designing PSSs. They describe their Human-Centred Design (HCD) process as a means to: '*...create products, services, experiences, and social enterprises that have been adopted and embraced because we've kept people's lives and desires at the core'* (IDEO.org, 2015, p.9).

The short history described above demonstrates the shift towards human-centred design approaches with a varying focus, from design for usability to UX design, with the focus expanding from products to products and services. In the design practice UX becomes more important, and the objects of design are products and services that are connected in a PSS.

In short, understanding people's needs and the design process that is based on these needs, has become more challenging with the expansion from user-centred product design to human-centred PSS design.

In line with IDEO's description of the main principle of HCD (IDEO, 2015), namely 'keeping people's lives and desires at the core', the current research studies design efforts that take people's needs into account. Therefore,

3 UXPA supports people who research, design, and evaluate the user experiences of products and services. The association was established in 1991 as UPA with 50 members, changed the name into UXPA in 2012, and has now 2400 members in 30 countries around the world (https://uxpa.org).

Human-Centred Design[4] (HCD) of products and services is the focus and the guiding principle of this thesis. The research aims to do justice to UX, i.e., to prevent UX from being disregarded, and to make the new knowledge generally applicable to other design processes. In this thesis, the term UX refers to people's need to have an optimal experience when using products and services, including functionality, usability and pleasurability. UX insights refer to the knowledge, and understanding, of user's aspirations and needs that guide the design of products and services.

The following section addresses challenges in understanding UX, and the use of gained UX insights to inform a human-centred PSS design process.

1.2 The challenges of a human-centred design process

The example introducing this chapter, showed that somewhere in a process of designing a PSS, UX insights no longer informed design decisions. In a human-centred design (HCD) process, designers use design methods and skills to gather information on UX, interpret this information to form UX insights and use these insights in creating and delivering solutions that users will be experiencing as fitting their needs. In PSS design, people other than designers make design decisions through using interpretations of user's aspirations and needs, and balancing them with technological opportunities and business requirements. An HCD process, where people, technologies and organisations are involved, requires decision makers with skills to: '*…gather and integrate specialist knowledge from humanities and behavioural sciences, and translate this knowledge into design parameters'* and '*…gather and integrate knowledge on new technologies into design opportunities*' (Stappers, Hekkert, & Keyson, 2007, p.3).

This section introduces the challenges of gathering and integrating UX insights in a human-centred PSS design process. It describes an HCD process and the importance of UX insights in this process.

For describing a human-centred design process different models exist. An exemplary model of a design process is the Double Diamond model (Design Council, 2007). This model highlights the problem-solving capacity of design, and describes the process in four phases of problem-solving: Discover, Define, Develop, and Deliver. The model splits the design process in two main phases

4 Terms used to refer to design processes with user-concerns at the centre, taking UX into account, differ over time and design perspective. As a result, confusion and discussion on when to refer to users or humans exists. Some say a user strictly refers to those directly interacting with a product, while human refers to a broader context of a product in use. Should it be user-centred, human-centred, user experiences, human experiences? For this thesis the labels user and human have been used interchangeable. Design is about balancing human needs with technological opportunities and business requirements. In this thesis, human-centred design acknowledges this balancing act and aims at integrating UX insights, knowledge on technologies, and business requirements in design. For consistency, the term *centred* is used throughout the dissertation.

with in each main phase a diverging and a converging phase. The first main phase involves exploring (diverging) and defining (converging) problems and solutions, followed by developing (diverging) and delivering (converging) solutions in the second main phase. Differently put, the first main phase stresses ‘designing the right thing’. Best solutions are sought through exploring ideas, and making and evaluating prototypes for conceptualisation. In the second main phase the focus is on ‘designing the thing right’. Products and services are developed in detail, and realised and brought to the market.

Another model, the Circular Model of the Product Innovation Process (Buijs, 2012), describes a design process as a continuous process in which a company develops new products and services. The five stages in this model are Product Use, Strategy Formulation, Design Brief Formulation, Development, and Market Introduction. The stage of Product Use connects the last and first phase in an innovation process; in this stage, evaluation of product use triggers innovation. Where the Double Diamond model focuses on design activities, the focus of the model of the Product Innovation Process is on planning and managing design processes. Although in both models the phases have different names, the activities are similar; both models concern exploring, conceptualising, developing, and realising. In each of these phases, decisions are made that could eventually influence UXs; so called design decisions. When exploring needs, design decisions will be made on what needs will inform conceptualisation. When conceptualising, choices are made what concepts to develop. When developing a PSS in detail, specifications of the products and services in the PSS are decided upon. The model of the product innovation process indicates that when realising a PSS, additional decisions on production and distribution of the products and delivery of services are made (Buijs, 2012). Figure 1.1 shows the different phases with key example decisions for a specific phase.

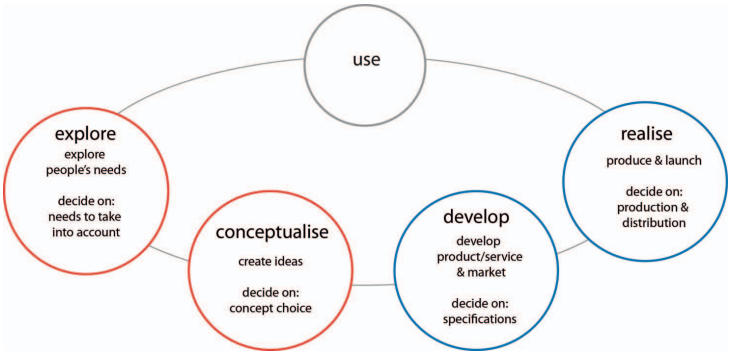


Figure 1.1: Phases in a PSS design project and design decisions made in the distinct phases (based on Van Boeijen et al., 2013). The red circles indicate the phases aiming at making the right thing, the blue circles indicate the phases aiming at making the thing right. The ‘use’ phase connects the ‘explore’ and ‘realise’ phase.

In the phases of exploring and conceptualising decisions are taken to decide on the right product/service to develop, while the decisions in a develop and realise phase are taken to decide on the right production and provision of the product/service. UX insights potentially get lost along these phases. Therefore, the following example details what can happen when designing a coffee machine, to indicate where UX insights get lost. The description indicates how throughout the process of exploring, conceptualising, developing, and realising, different people gather, communicate, and use information to make design decisions.

A coffee machine, as in the example introducing this chapter, is often not a standalone machine, but is part of a PSS. Figure 1.2 visualises the coffee machine as part of a system of products and services providing coffee-experiences. The touch screen on the coffee machine provides operating the machine and banking services. Maintenance services include maintaining the brewing system and updating software of the machine.

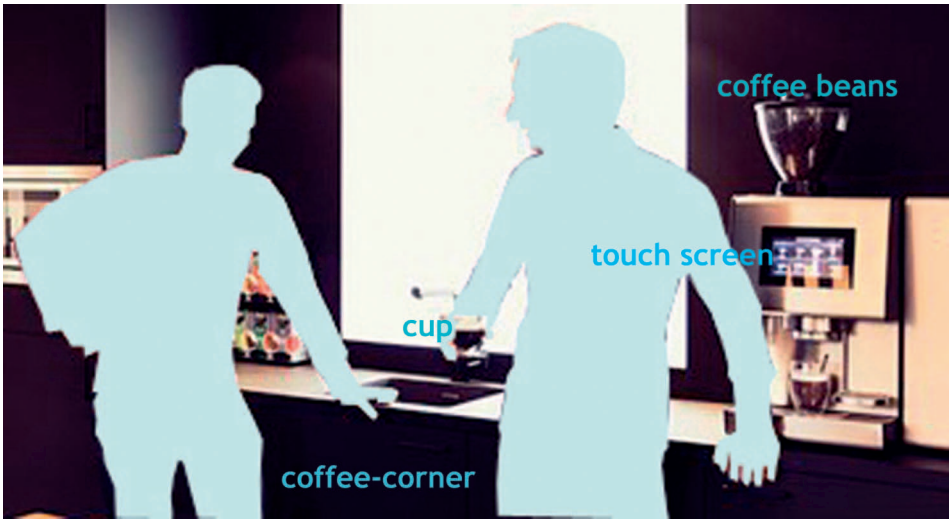


Figure 1.2: A coffee machine is part of a system of products (e.g., coffee beans, coffee-corner, cups) and *services* (*e.g.*, *banking services*, *maintenance services*).

In the following, the example of a coffee machine is used to illustrate the importance of UX in a human-centred design PSS development process.

First main phase of development: exploring and conceptualising
In the phase of exploring people's needs, designers often explore potential use and context of use, and consult other disciplines, e.g., psychology and sociology, to gather UX insights. When gathering UX insights it can be difficult to understand the relation between UX and concepts to create. It helps to distinguish different aspects of UX to understand that relation. These aspects are: the properties of the product, user characteristics, and context of use (Roto, Law, Vermeeren, & Hoonhout, 2011; Forlizzi & Ford,

2000). Properties of the product are those already existing in the proposed design (e.g., aesthetics, functionality, interactive behaviour), properties that are a consequence of use (e.g., wear and dirt) and the product's image (e.g., popular brand). Aspects related to the user can be for example the user's mood, expectations, motivation to use the product, and the user's mental and physical abilities. Contextual aspects can be social aspects (e.g., other people involved when using a product), physical aspects (e.g., using a product in a poorly illuminated room) and technical aspects (e.g., connection to internet). These UX aspects help to gather and communicate UX insights that inform design decisions on the right product and service.

For example, the way a coffee machine communicates its functions and how it responds to the interactions of the user with the machine, influences part of the user experience. Figure 1.3 shows an example of interactions of a user with a coffee machine: making a selection from a huge variety of drinks using a touchscreen, paying for the coffee by using a card reader, and taking the cup that was put under the right outlet.

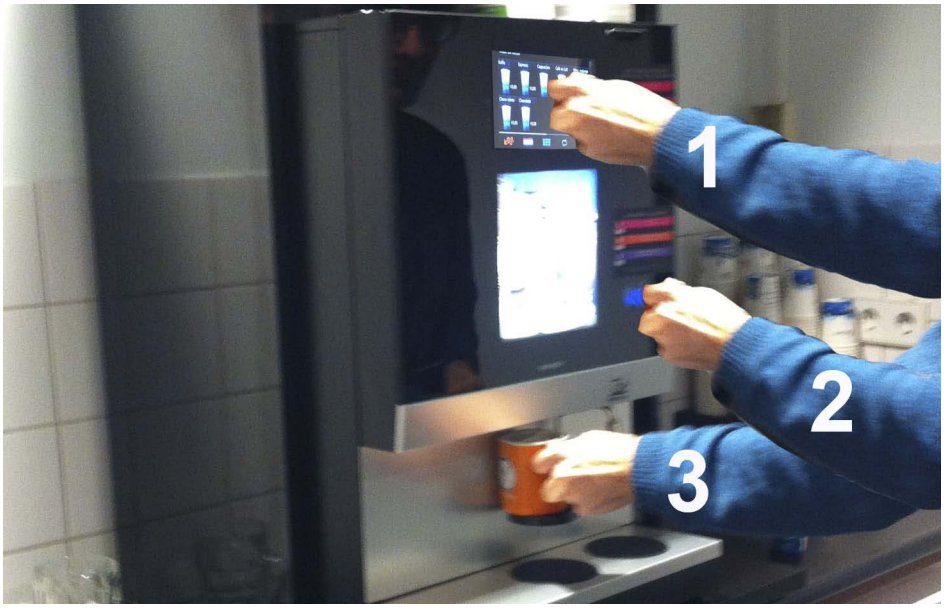


Figure 1.3: An example of interactions with a coffee machine. Users have to select what they want on the touchscreen (1) and have to pay for their drink by holding their card in front of the pay unit (2) before they can get their coffee (3).

Other examples of aspects influencing user experience of a coffee machine are the atmosphere of the room the machine is in, and the mood of users and their expectations when having a coffee.

A variety of methods and tools exists for communicating the rich UX information and insights that arise from user research. Examples are using scripts to envision the insights on experiences (Henze & Kahmann, 2003),

participation of design teams in the research, and analysis in workshops where designers are invited to explore, discuss, and interpret presented data (Sleeswijk Visser, 2009). Other examples are personas and design documentaries. Personas are fictional characters based on actual data that depict a target user population (Pruitt & Adlin, 2006). Design documentaries show rich reality of the situations and people in a film (Raijmakers, Gaver, & Bishay, 2006).

The communication of the results of the exploration of people's needs is used to decide on the requirements that will guide conceptualisation: what UX insights will be taken into account? Making these decisions involves balancing UX requirements with technological and business requirements. During conceptualisation, ideas are selected based on meeting the user requirements, and technical and business requirements. Again, results of user tests to evaluate concepts are part of the information used to decide on what concept to develop.

The description of the phases of exploration and conceptualisation above indicate that UX insights can get lost because of such rich information with so many insights being communicated to inform design-decisions-making. The many aspects of UX, and interpretation and communication of rich information on UX when exploring, make it challenging for designers to inform other decision makers on UX requirements for conceptualisation. Designers need to communicate in such a way that other decision makers understand the importance of insights for a valuable UX, and can use these UX requirements in future design-related decisions along the entire development process. A challenge is in making UX insights actionable for evaluating concepts, in concert with technical and business insights.

Second main phase of development: developing and realising
During the phases of development and realisation, adaptions on the designer's proposal will be made to meet technical and business needs. Observations of the practice of designing coffee machines showed that these adaptions are made by others than the involved designers. For example, adaptions of the user interface are made by service engineers of a coffee machine, for maintenance purposes such as adding error messages that appear on the screen. User research proved that these messages make the information on the screen less understandable for a user (internal P5 reports of user research e.g., Henze & Kahmann, 2012).
When selling, delivering, and making a product ready for use, changes can be made that influence UX. For example, where and how a coffee machine is installed could have an effect on user interactions. Examples are the programmed settings fitting the technical requirements for eco-mode settings, Internet connections necessary for payment, and settings of heating time. These settings can strongly influence the users' waiting time in between selection, payment, and dispensing. When the machines are in use, regular

maintenance (cleaning, filling, and technical services) and software updates are carried out. This maintenance possibly leads to small changes of the product and the context of use. Even marketing and sales departments seem to unintentionally influence the UX with the machine, as in the example where marketing and sales decided to introduce a professional machine in self-service situations. Sometimes, changes are made in requirements and specifications, as decided on in earlier development phases: for example, other users than the targeted ones, or different context of uses than originally specified.

These examples show that requirements based on UX insights can be overruled by technical and business requirements when decision makers are not aware of how their adaptions influence UX. UX insights can get lost in the development and realisation phases when not actionable for those who make design decisions in these phases.

Where UX insights get lost

The previous description of a coffee-machine design process provided examples where UX insights can get lost in each of the phases in an HCD process. In the exploration stage communication of the many UX aspects involved in the results of user research makes it challenging to make UX insights actionable. Then user testing in the conceptualisation phase could influence if, and how, UX insights will be used in deciding on what concept to develop. In the following phases UX insights can get lost in the process of balancing UX, technical and business requirements. Finding this balance is becoming more complex as more requirements and more people are involved in decision making. Norman & Tognazinni (2015) understand this as: *'Good user experience can only flow from a system where marketing, graphic and industrial design, engineering, and usability all work together in a collaborative effort to make life better, more enjoyable, and more productive for Apple's customers.'* They emphasise that different design decision makers[5] need to be aware of the value of UX insights to collaborate in providing a good user experience.

The examples show that in a PSS design process many people and disciplines are involved: people with different values depending on their expertise in the process of product design, service design, or business development. Most of these people are potential design decision makers. Because of the many people involved in a PSS design process PSS design can be seen as a networked process. PSS design happens in a heterogeneous network of design decision makers. The networked character of PSS design makes it challenging to prevent UX insights getting lost.

5 In this thesis design decisions refer to decisions that influence the final specifications of a final product or service, and how this product or service will be experienced. Design decision makers refer to actors in a development process making decisions that influence UX.

1.3 Networked human-centred design

For understanding where and how UX insights can get lost, the current research focuses on designing products and services in such a networked process. Developing products and services is not the solitary work of designers; they work in a team with other professionals. During the early phases of design, a design team regularly meets to discuss decisions to make the product right (Van Kuijk, 2010). A design team often consists of designers, a marketing manager, a product manager, and a project manager. Each team member has specific skills and experience, and contributes specific criteria. For example, in the case of designing coffee machines, these skills and experiences concern: creating graphic user interfaces, engineering the brewing system, and designing the look and feel of the machine as a whole. Designers also act as user researchers, often in a temporary collaboration with professional user researchers, and generate ideas and prototypes. Marketing managers are responsible for the coherence between market and user research. Product managers synchronise and connect the designers' and marketing activities in order to develop a solution that meets the many, sometimes conflicting, requirements. For example, user requirements aim at having a good cup of coffee after an easy and pleasurable interaction with the machine, and this in a pleasurable environment. Providers of the machine, and the machine's ingredients, need a machine that works without problems: it delivers many cups of coffee, properly connects to other products and services (e.g., for payment), and is easy to maintain. At some point in the design process, the designer delivered (e.g., a prototype, technical specifications, user test reports and presentations on the design process and decisions) and handed these deliveries over to the project manager to share them with other people involved in further development.

In later phases of a design project, after designers delivered prototypes and specifications, design teams change (Norman & Tognazinni, 2015) and consist of engineers who develop technical components, software developers who develop the software to support interactions, marketing managers who develop services related to the product, sales managers who prepare the marketing and sales of the product and related services, and the product manager now focusing on manufacturing of the product and implementation of the services. The design team does not consider basic design principles, on how to meet human needs, as often as human-centred design desires in these later phases (Norman & Tognazinni, 2015).

The examples above show the challenges of orchestrating the different actors involved and making PSS design a networked human-centred process. One challenge is how to communicate the importance of UX to these many different actors. Another challenge is how to keep UX insights actionable in a process in which many actors are involved who not necessarily work together directly. The examples indicate aspects to further explore in order to learn

how designers could support to make PSS design a networked human-centred process. These aspects are: what designers delivered, how and who they delivered to, and who were involved in further sharing the deliverables.

The challenge not only concerns the many actors involved, the problems addressed also form a challenge in a design process. Friedman, Norman, Stappers, Voûte, and Whitney (2014) stress in their vision on the future of design: *'Most of these problems involve networked systems of people, groups, and artifacts, including intelligent systems, partially or fully automated, with different levels of communication among components.'* In other words, designers address problems to be solved by addressing the context of problems and understanding the networked character of the problem. In conclusion, networked human-centred design can be described as a process of developing a system of products and services that meet people's needs, involving many different disciplines, organisations, and technologies.

The focus of the research is on the role of designers and the methods they use in networked projects to ensure that UX insights are considered in both designing the right products and services, and designing the products and services right. In this thesis 'designers' refer to people carrying out design activities. These activities include research to inform the design process, e.g., user research.

1.4 Goal, general questions and approach of the research

The current research directs towards an understanding of how design can facilitate the many actors in networked design projects to apply a human-centred approach. Design decision makers are those actors in a networked design process who make decisions that influence UX. When these actors apply a human-centred approach, they include UX insights in their criteria when deciding on specifications of products and services. The previous sections showed the difficulty to accomplish a human-centred approach throughout an entire PSS design project; some actors involved in the complex process of designing products and services do not take UX insights into account. The current research addresses the role of designers in accomplishing networked human-centred design.

Goal and questions
The current research serves to create knowledge of networked human-centred design and aims to construct a framework of networked human-centred design that explains how designers can ensure UX insights are recognised, i.e., that UX insights inform design decisions. In addition to the creation of knowledge, the research aims to serve the design practice by applying the framework for the development of tools and guidelines for designers.

The main research question guides the research:

1. **What can designers do to prevent UX insights from getting lost in a networked design process**?

The following subquestions support answering the main question:

2. **How and where do user insights get lost in networked design projects?**
3. **What barriers and opportunities can be identified to make networked design a human-centred design project**?

The expertise of designers in PSS design is of great value for understanding the role of designers and creating knowledge about what designers can do in a networked design process. Accordingly, case studies on real-life networked human-centred design projects are included in the research to involve designer's expertise. The choice for case studies is also supported because studying well-chosen real-life cases is a proven approach in producing knowledge of people acting in specific contexts (Flyvbjerg, 2006). For the current research on networked design, cases are chosen that are about design projects with many different actors together developing a PSS.

Research Context: P5 and CRISP PSS 101

Opportunities for case studies in real-life to study networked human-centred design processes have been provided by participation in the CRISP PSS101 project and experiences in design projects at P5 consultants. In the CRISP PSS 101 project, academic researchers and practitioners from product and service design collaborated in creating knowledge, methods, techniques, and tools for networked human-centred design of product service systems. Participating in this project opens the opportunity to create knowledge about designer's expertise together with academics with disciplinary backgrounds and experience regarding HCD and PSS design. P5 consultants[6], professionals in human-centred design, offer expertise gained in 25 years of experience in doing user research and communicating UX insights in design projects. Together, the CRISP PSS101 project and P5 projects, offer the possibility to include a tradition of HCD in the research and develop knowledge regarding PSS design.

Approach

The current research uses an exploratory research approach to study real-life networked human-centred design. The exploratory research focused on how UX gets lost, how designrs work and what happens in the practice of PSS development. By exploring practices of PSS design, the research aims to reveal currently unknown aspects that influence whether and how UX insights are kept alive. By inquiring practitioners about their experiences in design projects, understanding of how they work is sought. A participatory approach

6 As co-founder and co-owner of P5 consultants, I have access to expertise in, and data on, doing HCD and can turn this access to account in the current research.

enables participants in the research to share experiences and knowledge, and apply this knowledge in their own practice. With this participatory approach academics and practitioners jointly generate knowledge by reflecting on the design process in real-life networked human-centred projects. Facilitating designers to share their experiences and methods will most certainly lead to a deep understanding of how designers work.

Generative tools are a proven means of sharing experiences and tacit knowledge (e.g., Sleeswijk Visser, Stappers, Van der Lugt, & Sanders, 2005; Sanders & Stappers, 2012). The current research uses such generative tools and thus benefits from my experience in design facilitation in design research. The research follows a research through design approach; the development of a tool for designers is used to gain insights on designers' needs in their role of facilitating actors in applying a human-centred approach through all design phases. Exploration of design projects, and a search for theoretical constructs of networked human-centred design, inform the construction of a conceptual framework. This framework guides the research and tool development (Stappers, Sleeswijk Visser, & Keller, 2014).

Throughout the research I take a research and a design role, by including design in the academic research on the phenomenon of user insights getting lost in networked design. The design role refers to the development of a tool for designers during the second phase of the research; the tool development process is used for generating knowledge during the research, and the developed tool serves the practice of designers. This is in line with Stappers and Sleeswijk Visser's experience that research through design introduces different research roles in a single academic research project (Stappers & Sleeswijk Visser, 2014).

My prior knowledge and experience as P5 researcher could present a researcher bias when reflecting on the practicality of the results of the current research for future P5 projects. This could lead to the conclusion that doing user research is one of the solutions to preserve UX insights. During the research, self-reflection is essential to avoid bias and prevent that the research results are influenced by the researcher's position. A 'diary style' record of events and experiences during the research, consulted before drawing conclusions on the different studies, supports my personal reflection (Malterud, 2001).

The research is conducted in two phases; in the first phase practice and theory are explored to find building blocks for the construction of a conceptual framework of networked design. The first phase results in the adaption of the general framework of networked design into a description of a framework of networked human-centred design. In the second phase this framework is evaluated by applying it to studies on networked human-centred design projects. Application of the framework also informed the development of tools for networked human-centred design.

1.5 Thesis outline

The chapters in this thesis follow the research process. The current chapter introduces the phenomenon of UX insights getting lost in a design process, the research questions, and research approach. The next chapters follow the different steps in the research process: exploring practice in **Chapter 2**, exploring theory in **Chapter 3**, using the results of exploration to make a framework of networked human-centred design in **Chapter 4**, and using this framework as a lens to study design practice in **Chapter 5**. In **Chapter 6** the knowledge gained through the research is converted into guidelines and a tool for the practitioners in networked human-centred design. The research process concludes with a reflection on the research in **Chapter 7**.

Figure 1.4 visualises the thesis outline in a road map. This roadmap shows a main road to a framework of networked human-centred design and tools and guidelines for designers for keeping UX insights alive. Parallel roads illustrate how theory and practice informed the research. The PSS 101 project provides the studies in **Chapter 2** to explore the practice of networked design. Theoretical concepts mainly form the input for **Chapter 3** and a literature review on networked design provides key theoretical concepts for the construction of a framework of networked human-centred design. Cases from PSS101 and P5 support the studies in **Chapter 5. Chapters 5 and 6** provide a contribution to theory and practice. For theory, the contribution concerns knowledge of the concept of boundary interventions in a human-centred design process. For the design practice, the contribution concerns guidelines and a tool. The guidelines in **Chapter 6** provide the PSS101 project withmethods and design practice (with P5 as a representative of practitioners) with a tool.

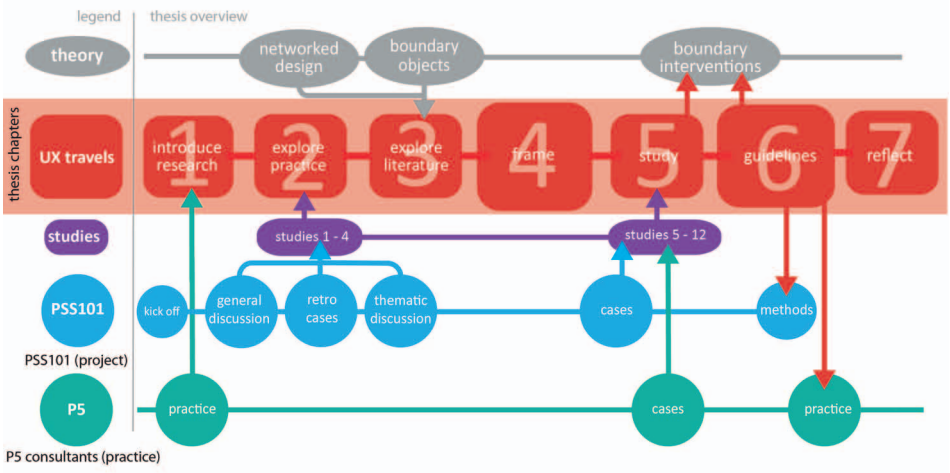


Figure 1.4: Thesis overview, illustrating the thesis chapters (red blocks) describing the road to the two main results: a framework of networked human-centred design in Chapter 4 and design guidelines in Chapter 6.

Exploration of practice of networked design

2

2 Exploration of practice of networked design[7]

The current research addresses the problem that UX insights disappear in networked design projects. As introduced in the previous chapter, networked human-centred design can be seen as 'a process of developing a system of products and services that meet people's needs, involving many different disciplines, organisations, and technologies'. This chapter presents exploratory studies into the practice of designing products and services in PSS development.
Four studies are conducted, addressing the current research subquestions on where insights get lost and barriers and opportunities exist in networked design (Chapter 1). The studies aim at providing an understanding of the designers' problems to address to prevent that UX insights get lost. The next section introduces the context in which the studies take place.

2.1 Context of the studies: the PSS101 project

The studies take place in the PSS101 project, one of eight projects part of the Creative Industry Scientific Programme (CRISP). In CRISP, a consortium of industry, academics, and creative professionals aims at developing understanding of PSS design. More specifically, PSS's that provide *'...a holistic and fulfilling user experience...'* (Van Erp, De Lille & Vervloed, 2015).

In the PSS101 project, practitioners and researchers work together to deliver understanding of, and tools and methods for, PSS design. Starting point of the PSS101 project team was their vision of a PSS: networks of providers continuously collaborating with networks of clients. In general, these collaborations would aim at optimal service provision and client feedback. During the process of PSS design a temporary network of creative industry would be involved, collaborating with both providers' and clients' networks. The PSS101 project team started the project off with learning lessons from their track record in PSS development.

The PSS101 project team consisted of a core-team of ten team members, extended with extra expertise when appropriate during the project. Seven industrial and three academic partners in the core-team represent practitioners and researchers. These partners have various disciplinary backgrounds e.g., human-centred design, industrial design, software engineering, change management, service design, organisational development, and 15-25 years of experience in projects regarding PSSs and/or networked collaboration. Together these partners aim at finding methods and tools to apply in the practice of human-centred PSS design, and gaining

7 This chapter is partly based on: Henze, L., Mulder, I., & Stappers, P.J. (2011). *Conceptualizing Product Service Networks: Towards an Initial Framework*. In K. Thoben, V.Stich, & A. Imtiaz (Eds.), Proceedings of the 17th International Conference on Concurrent Enterprising: ICE 2011 (pp. 157-165).

knowledge to build a framework of methods and tools for PSS design. The team takes a participatory research approach to gain this knowledge; practitioners act as researchers motivated to apply gained knowledge in their daily practice. Practitioners and academics together reflect on ongoing PSS design projects and exchange knowledge and experiences acting as co-researchers. Throughout the project the team is involved in most activities, enabling multidisciplinary discussions on traditional and new PSS design methods. In short, the PSS101 activities take place in three project phases, which are: (1) exploration of methods and tools by collecting and analysing completed case experiences, (2) iterative design and evaluation in case studies, and (3) consolidation of findings. See Appendix 1 for an elaborate description of the PSS101 project and its activities.

In reflective sessions during the exploration phase of the PSS101 project, practitioners allow deep understanding of their practice by sharing, often confidential, detailed information on what happened in design projects and analyse and discuss these details together with academics. The focus of the sessions converges from a general understanding of networked design to a selection of methods and tools for networked design. In the first two sessions, kick off and general discussion, the project team aimed to align their vocabulary on what PSS design is and their focus of the project. In the following sessions the team reviewed retrospective PSS design cases from the practice of the industrial partners, sharing experiences and knowledge to build a shared understanding of PSS design. The retro cases took place in three subsessions, each at a dedicated location. In the next (two) thematic discussions, we brought the insights of the retro cases together and zoom in on fields of methods and knowledge we select to create a framework of methods and tools. In the last of the sessions in the exploration stage, industrial partners in the PSS101 team exchanged views on what they learned so far and what they want to apply in their practice: low-hanging fruit. Figure 2.1 shows an overview of these reflective sessions. The project continues with case studies iterating the initial framework towards an established framework (Appendix 1).

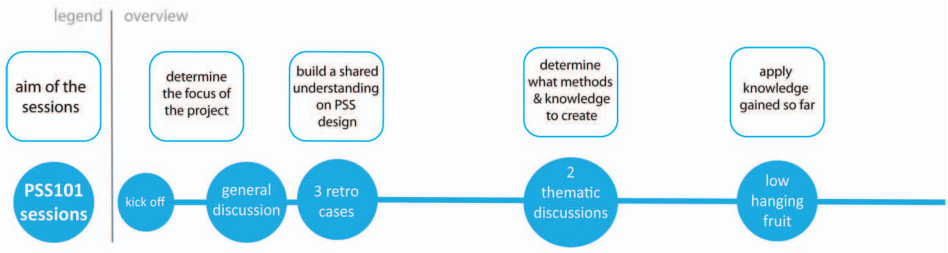


Figure 2.1: In the first stage of the PSS101 project five reflective sessions (blue circles) took place with specific aims (squares) to determine detailed objectives in the remainder of the project (continuing blue line). The first two (on the left) are general sessions to agree on a focus of the project, followed by more specific sessions on PSS design cases (three retro cases) to build a shared understanding, two 'thematic discussions' to determine what to create, and at the end of the first stage a 'low-hanging fruit' session.

The aim of, and participatory approach in, the reflective sessions to understand PSS design form an ideal context for exploring the practice of networked design addressing the problem of UX insights getting lost. With the PSS101 team, participants are available who are motivated to actively share knowledge and practices on human-centred PSS design.

The studies embedded in the PSS101 sessions

Although embedded in PSS101 sessions, the aims of the studies slightly differ from the PSS101 sessions' aims. The sessions were organised as part of the PSS101 project, with the goal to find opportunities for project-partners to increase their knowledge of human-centred PSS design, while the embedded studies support the current research on the disappearing of UX insights in networked design. Embedment of the studies in sessions with the PSS101 project team opens an opportunity to gather unexpected insights, minimising the researcher's bias towards doing human-centred design. With the broader context of PSS design, other aspects of keeping UX insights alive could emerge than when the focus is exclusively on UX insights. Figure 2.2 elaborates upon an overview of the PSS101 sessions, as shown in Figure 2.1, and relates the current studies to the sessions in the PSS101 project. The sessions that determine the focus of the PSS101 project led to a first description of networked PSS design. These first sessions are seen as a pre-study: the result of these sessions guide the studies 1-4, studies aiming on finding aspects of networked design influencing keeping UX insights actionable.

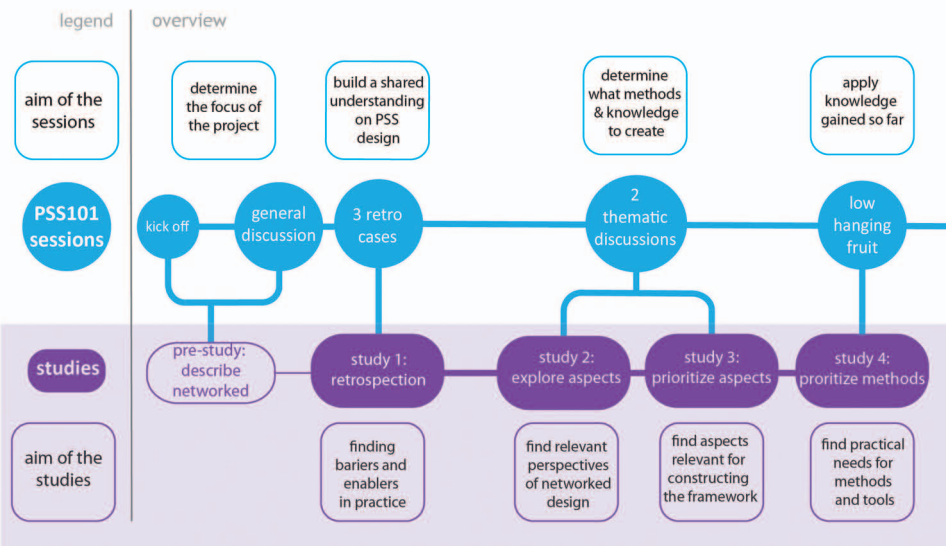


Figure 2.2: Overview of how the studies (purple blocks) embed in PSS101 project sessions (blue blocks). The PSS101 sessions provided the context of the pre-study and the studies 1-4. The aims of the studies are slightly different from the aims of the project sessions.

Figure 2.3 concentrates on the overview of the studies, and separately shows the studies. The first three studies converge from gathering general insights

on what happens in practice, towards finding relevant aspects for constructing a conceptual framework of networked design. Study 1 (retrospection) aims at finding barriers and enablers in networked HCD. Study 2 (explore aspects), brings the results of Study 1 together, aiming at finding aspects to take into consideration when framing networked human-centred design. The expected result of Study 2 is an overview of relevant aspects. This overview has been used in Study 3 (prioritise aspects) as a stimulus for participants to prioritise aspects of networked design. Study 4 (prioritise methods) seeks relevancy of the found aspects by zooming in on what methods and tools practitioners need in their networked design projects.

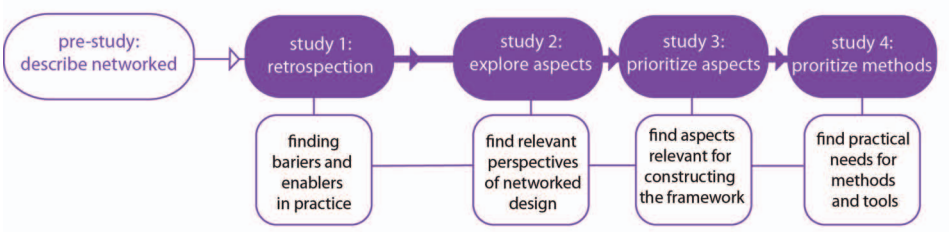


Figure 2.3: Overview of names and aims of the pre-study (on the left) and studies 1-4. The result of a study forms the input of the next study aiming at converging from general insights on networked design to relevant aspects for framing networked human-centred design.

Where the PSS101 sessions aim at increasing and deepening understanding of methods and tools for PSS design, the studies focus on why UX insights disappear in networked design. The next section describes the chosen method that supports both aims.

2.2 General method of the studies

The participatory approach chosen for the PSS101 sessions supports the PSS101 co-research and the studies. This section describes the method for the current studies to inquire practitioners on their experiences in PSS design with the aim to find those aspects of networked design that influence keeping UX insights alive. The participatory approach and set-up of the reflective sessions were chosen to support the participants' motivation to act as co-researchers in the PSS101 project. The participatory approach enables participants in the research to share experiences and knowledge, and apply this knowledge in their own practice. In the studies I am lead researcher[8] and facilitate the sessions enabling participants to share experiences and knowledge, and support participants to gather individual insights on PSS design and reflect together on these gathered insights.

Participants
Participants were academic and industrial professionals with disciplinary

8 Collaboration with co-researchers in the studies could create confusion who-did-what. To identify who did what research activities in the studies I use the personal pronouns 'I' and 'we' to refer to my activities and activities together with co-researchers respectively.

backgrounds and experience regarding PSSs as industrial design, software development and service design. All participated in the studies acting as co-researcher, open to create new knowledge by combining academic and practical experience. The variety in disciplinary backgrounds, and experiences of participating industrial and academic professionals, provided a sample that represents practice of networked design and barriers and enablers in sustaining a human-centred approach in networked design.

Set-up
Procedures and materials aimed at helping participants to actively gather, share, and review insights on PSS development. Participants acted as co-researchers, inquiring each other on their experiences and knowledge using generative research techniques. These techniques, described in e.g., Sanders and Stappers (2012), involve a combination of techniques of facilitating participants to reflect on past experiences and future needs. In the studies, participants reflected upon experiences in PSS design practice and shared their understanding of networked design. They presented their projects, and reflected by writing down their individual reflections and clustering individual reflections into maps of experiences and needs. Through this technique, participants were invited to share and reflect on past experiences and insights on future needs with other practitioners and academics. For each study materials were prepared to trigger and support participants to share and map their experiences and, sometimes tacit, knowledge.

In general, the studies followed the same procedure with a carefully prepared presentation to kick of each session. The next sections describe the specific set up for each study and materials used in these studies.

Data collection
Participants generated the data for the studies in what they said and made. The studies were videotaped, and I made field notes with personal observations and interpretations[9]. Together, the used materials (e.g., co-created posters), the videos, and field notes provided a precise record of conversations and actions during the studies. For analysis, videos were partially transcribed documenting conversations on the subject of networked design. The used transcription software (NVivo) provided a direct link between transcript and video footage. When transcribing, annotations were made allowing to return to the video observations when additional data were needed for analysis.

9 The field notes provided an opportunity to separate my different perspectives as practitioner (P5 user research) and academic (lead researcher). From my perspective as practitioner, I now and then brought up reflections in the conversations and added notes on posters. These reflections were included in the transcripts and materials of the studies as experience from practice. Field notes concerning my reflection as researcher were labelled as interpretations.

Data analysis
Transcripts and materials (participants' reflective notes on sticky notes and comments written on posters next to the sticky notes) resulted in large amounts of data. For analysis, I coded quotes in the transcripts with the themes derived from the research questions. These themes were: networks involved, barriers and enablers designers experience in doing HCD in a networked environment, general methods and tools for PSS design, and more specific methods and tools keeping the user insights alive. In simple worksheets quotes were combined with materials they were related to, resulting in matrixes of related data. The combinations were coded around the same themes used for selecting quotes: networks, barriers and enablers, and methods and tools. As an example, when participants in the sessions were positive about specific approaches the specific quote was coded as enabler, negative responses were coded as barrier.

Data and interpretations emerging from one study are brought in the next studies to allow co-researchers to discuss data and interpretations. Results from the pre-study guided Study 1. Results of the studies 1, 2, and 3 guided the studies 2, 3, and 4 respectively.

The following sections describe these studies following a similar structure: a method part, specifying the method of the study, followed by a description of main observations found in the study, discussion of the study, and a conclusion on what results guide the next study. The final section of this chapter brings the studies together with conclusions of the exploration in networked design practice.

2.3 Pre-study: examine networked design

In the pre-study participants examined the networked character of PSS design, and decided on a shared perspective of the PSS101 team on doing PSS design. The pre-study aims at a preliminary framework of networked collaboration, describing this shared perspective.

Method of the pre-study
The PSS101 team participated in the pre-study. In this study I acted as co-researcher and moderator, allowing to address 'UX insights getting lost' in the broader focus of the PSS101 team on finding methods and tools to apply in the practice of human-centred PSS design. As said before, the pre-study was embedded in the first two PSS101 sessions: 'kick-off' and 'general discussion'. These sessions followed the same procedure: I gave a short presentation of what we already shared in earlier meetings, and proposed how to cluster lessons learned to share experiences and knowledge. During the sessions, participants were asked to write their personal reflections on PSS design on sticky notes, and together cluster these notes by grouping them and naming the groups of notes. Materials used were handouts with a summary of the

presentation and a visualisation of possible involved networks. The summary supported participants in refreshing their learnings so far and in making individual reflections. The visuals of possibly involved networks of creative industry, users, and providers, could serve as landmarks enabling participants to write down their remarks and cluster remarks. As an example, Figures 2.4 and 2.5 show stills of the video registration of the sessions where the project team clustered individual remarks. In session 1 (Figure 2.4) the participants did the clustering (grouping and naming) without given landmarks, the position of the groups on the white-board was arbitrary.

Figure 2.4: Clustering in session 1, participants are grouping (reflections on sticky notes) and naming (written text in blue) on a white board without landmarks.

While in session 2 (Figure 2.5) they used visualisations of networks, as landmarks for grouping indicating relevance of the groups to specific collaborations.

Quotes selected from the transcribed video were combined with photos of the grouped reflections, combining actions, what has been said, and what was written down for analysis. Figure 2.6 shows an example of such a worksheet.

Figure 2.5: An impression of the project team in the second project session grouping their knowledge in a predefined field bordered by A4s visualising networks of users, providers, and creative industry as landmarks

sticky note nr	sticky note text	discussion
1	story telling, ieders rol & perspectief, smeerolie tussen alle partijen	BasR: verhaal vertel je makkelijker door dan 7 bp op een slide. PJ: bedoel je personnas/scenario's/narratives? BasR: ervaringen die verschillende betrokkenen vertellen vanuit hun eigen perspectief. BasR: makkelijk als je ze visualiseert (overlap met visualisaties, boundary objects)
2	STOP service development model (TBM), keten diensten	TH: model dat gebruikt wordt voor het ontwikkelen van ketens en maken van business cases (waar moet je rekening houden bij de ontwikkeling van). Hoe redeneert de technologie poot.
3	concept development	PJ: toegevoegd omdat bij de roze briefjes helemaal geen 'nieuwe dingen genereren' bij zat.
4	prototyping	PJ: kernactiviteit die hier een rol bij speelt
5	rapid prototyping	KJW: in korte slagen prototypes maken (1x per week agile)
6a, 6b, 6c, 6d	co-creation	KJW die moet bij elke pijl, voor draagvlak en kennis LH: het maakt verschil of je tussen netwerken of binnen een netwerk aan het co-creëtrn bent. BR: ook binnen homogene klantgroepen (PJ tekent poppetje erbij) zie je dat bij co-cretaion de klanten ontzettend veel van elkaar leren.
7	co-production of services (leveren)	BasR: dit gaat over het leveren van diensten ipv het ontwikkelen
8	workshops, werkwijze, situatie	BasR: in de workshops is het heel duidelijk wat mensen samen doen. PJ: vooruitgang wordt geboekt omdat mensen bij elkaar zijn en activiteit samen doen.
9	service blueprints	KJW: in kaart brengen wat er allemaal gebeurt bij een service.
9b	joined sense making, boundary objects	
10	who takes initiative	PJ: bij klassieke manier vanuit business, soms met users en soms met designers. Ogen open houden dat initiatieven vanuit verschillende kanten kan. Slagkracht MKB vs grote bedrijven, dynamische kleine dingen activeren. LH: is er een link naar social innovation? BasR: bruggetje, bij zuidzorg initiatief genomen vanuit gebruikers/klanten

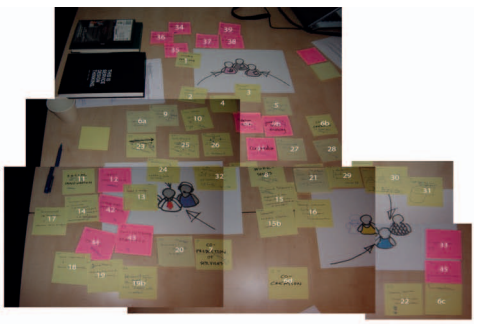


Figure 2.6: Example of the worksheet made for data-analysis of the pre-study. On the left a table with in the left column the number of the sticky-note with remark, the middle column the text on the sticky-note, and in the right column chunks of transcript related to that reflection. On the right, a photo of the during the study grouped sticky notes, the added numbers correspond with the numbers in the table on the left.

I coded the data in the worksheets around the themes networks, and methods and tools. Data coded as 'methods and tools' were linked to data coded as 'networks' in a matrix, providing insights on what describes networked in PSS design.

The next session reports the main observations of the two sessions of the pre-study.

Main observations in the pre-study
Participants openly shared experiences and knowledge during the pre-study. Participants were involved in lively conversations, shared individual reflections, and actively participated in clustering, reinforcing their motivation to act as co-researchers in the pre-study. For example, when I proposed to do interviews on cases with the business partners, one of the practitioners indicated: *'I want to visit business partners myself, when someone else does the interviews information comes in text and becomes distant.'* Another practitioner proposed: 'W*ould be nice if we could get some information on forehand to prepare, and then have a sort of workshop where we interact and ask questions.'*

In the kick-off session a short presentation reminded participants of the vision that PSS design would be a collaboration between networks of providers, clients/users, and creative industry. During the sessions participants actively inquired each other on knowledge of, experiences in, and visions on PSS design. They reflected from their own perspectives and disciplines on what others said and wrote down. These reflections led to a broad spectrum of over sixty remarks on what the PSS101 project should bring. The remarks varied from practical needs like *'Who should participate in a co-design team, and which knowledge should be in this team?'* up to academic remarks on the research as *'What knowledge domain is relevant?'* and *'Gaining transdisciplinary insights and applying these.'*

Figure 2.7 shows the remarks, clustered in eight groups with cluster-names summarising what participants wanted to learn in the PSS101 project:
- perspectives (how to think and work from different perspectives),
- measure & values (how to measure and communicate values),
- realise (how to implement a PSS),
- understanding (how to conceptualise a PSS),
- network (how to identify and understand networks),
- structure / organisation (how to organise PSS design and implementation),
- tools & methods (what are relevant methods and tools),
- scale (how to cope with differences in scale of different PSS elements).

Figure 2.7: Over sixty individual remarks (on the yellow sticky notes) were clustered in topics (blue texts in Dutch) participants wanted to learn more about in the project. At the end of the session, the clusters understanding, network, and structure/organisation were overlapping and still under construction. Only one individual (new skills) remark could not be added to one of the clusters, and was not recognised as a topic to take into account.

Participants aligned vocabulary of academics and practitioners on PSS design before deciding on what clusters to take into account in the PSS101 project. One remark was on new skills that one of the participants wanted to teach to design students. Other participants did not agree on adding this remark to one of the clusters, or if this remark would be relevant for PSS design and implementation. The clusters understanding, network, and structure/organisation were still under construction at the end of the session. Participants concluded that these clusters, together with tools & methods, could guide to improve their understanding of collaboration between groups of collaborating clients/users, providing organisations, and creative industry/ designers.

In the second session participants continued with sharing knowledge about networks and methods by bringing in literature and experiences. A rough visualisation of the three networks of users, providers, and designers supported grouping knowledge and methods. The visualisations provided a structure for considering relevance for specific networks, or collaboration between networks. Figure 2.8 shows the end result of clustering existing knowledge of theory and methods. Most theory and methods brought forward were on collaboration between networks of designers and providers (e.g., visualising, integrating, empathy, facilitating, documenting), and between the three networks (e.g., collective action, joined sensemaking).

Figure 2.8: The result of clustering knowledge (pink notes) and methods (yellow notes) around collaboration in and between networks of providers (puppets on the left), users (puppets on the right), and designers (puppets on top). The number of notes on the left show an emphasis on collaborations between designers and providers.

Participants confirmed that the intrinsic nature of PSS design could best be described as a networked human-centred process. Finding methods to deploy actual experiences of people in the users' network as drivers for (radical) innovation was mentioned as a main challenge for the PSS101 project.

Discussion of the pre-study

The analysis of the pre-study informed the set-up of a preliminary framework of networked design. Making a matrix of data on networks and methods in the worksheets provided an overview of who are involved in networks, what methods were used in these networks, and how networks collaborate. Summarising this matrix provided a framework of collaborating networks in PSS design. Figure 2.9 visualises this framework, showing heterogeneous networks and their overlapping boundaries. Overlapping boundaries of networks depict the collaboration between two or the three networks. Observations from the pre-study were mainly on service design with a role for product and interaction design to create material touch points (e.g., a user interface) as part of a service. As a result, the collaborating networks have been referred to as service networks.

These service networks can be distinguished in three different networks:

- The Service Design Network contains design professionals, researchers, consultants (business/strategy), and others collaborating in designing product service systems and environments. These professionals deploy design thinking and design-, research-, and facilitating skills.
- The Service Organisation Network involves policy makers (responsible for service policy, vision, and innovation), managers (managing service provision and development), providers (responsible for the service interfaces), and others. The people in this group work in public, private,

and volunteer organisations responsible for providing product service systems.

- The people included in the Service Experience Network are consumers and professionals using and experiencing product service systems.

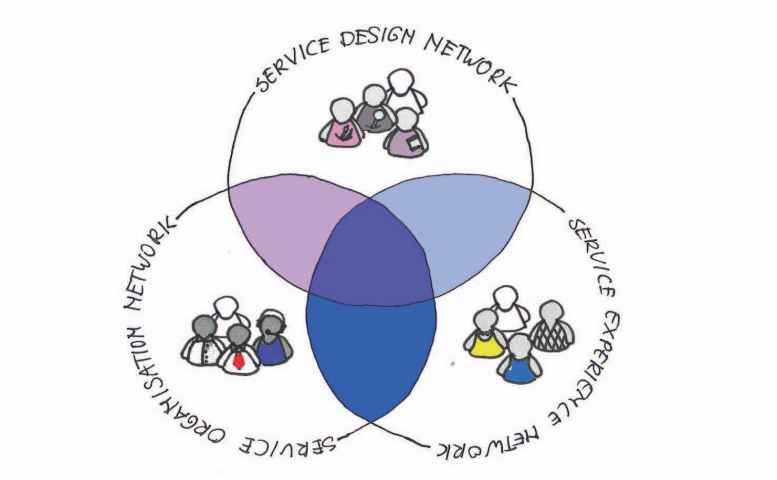


Figure 2.9: Networked collaboration in PSS development visualised as networks of service design, organisation, and experience. The emphasis is on the collaboration between the networks, depicted with the overlapping boundaries.

The emphasis in the PSS101 project is on how a Service Design Network can improve collaboration between a Service Experience Network and a Service Organisation Network when designing a PSS.

This framework of collaborating networks in PSS design serves as a preliminary framework of networked design to guide studies 1-4.

2.4 Study 1: retrospection of innovation projects

Study 1 aims to gain insights on what barriers and opportunities exist for designers in doing networked HCD. This study was embedded in the PSS101 sessions where the project team aim at building a shared understanding on PSS design. In addition to the general method of the studies, the following section describes specific observations, participants, setup, and materials for this study.

2.4.1 Method of Study 1

In this study participants were observed while reflecting on their experiences in specific projects together with academic researchers in three co-research sessions. The PSS101 project used the criterion that a project concerned collaborations between networks of organisation, experience, and design for selection of projects to reflect on.

Projects reflected upon

The projects reflected upon in session 1-3 were respectively a project in healthcare, print, and financial industry. Each project with different product and service combinations, and highlighting different collaborations. The following boxes shortly introduce these projects.

Box 2.1: introduction homecare and welfare innovation project

Homecare and welfare innovation

This design project aimed at developing a combination of homecare and welfare services and ICT products supporting both clients and caretakers. Ultimately the developed PSS would stimulate independent living. E.g., one of the concepts developed was a service to bring citizens together to help each other. Connecting the citizens is done by organising activities were people meet and get to know each other, a social worker recognising where help is needed, and a service hub (website) that makes the available services visible and accessible.

The project was subsidised, and thanks to the grant received it possible for the homecare organisation to explore new methods for innovation. The people involved in the project saw this as an opportunity to adopt a human-centred design approach: taking the user needs as a starting point and applying design methods. During the project they learned to apply service design methods and tools, a new way of working for the homecare organisation. They learned how to do design research (interviews and workshops with users), co-create concepts with users, create blue prints and business cases and to bring the concept (and human-centred process) to 'new' stakeholders. The project was open ended at the time of the retrospective workshop; results at the moment of the workshop were a Business Case report and concepts that were not yet brought to maturity.

In this design project many actors were involved including: external design researchers, bringing in the methods and tools of service design,
Human-centred ICT designers,
Providers of ICT and ICT infrastructure, and providers of buildtenvironment (architecture, construction), bringing in the technological knowledge.
Experienced project managers in homecare and welfare service projects, professional carers, municipal official(s), managers of technical infrastructure and products (ICT/ housing) bringing in the organisational knowledge,
The (potential) users of homecare services (both care clients and their caregivers) bringing in their experiences and needs when participating in user research.

Box 2.2: introduction innovation of print-services project

Innovation of print-services
In this project new print services and 'apps' (software) to support both service providers and clients are developed. The project started when a client asked for extra services, beyond technical support, for managing the use of the printers developed and provided by the print solutions organisation. The project is characterised by a user-centred design approach; a common way of working of the product designers and adopted by the print service designers (a new department at R&D of the print solutions organisation). Usability experts do field research and are interviewed on their insights by project stakeholders (mainly development). Based on these insights, co-creation with users and interviews with internal stakeholders take place to understand the needs of both users and business stakeholders (the service providers). In order to develop the business case additional research (trends, literature, sales data etc.) is done.

Research insights are then brought together in the 'investigation room' (with visualisations on posters of users, context of use, and stakeholder and value maps), and discussed with internal stakeholders. After concept design, prototyping and testing of the concepts the service is implemented in the print organisation and delivered to the client.

The development team consisted of internal usability researchers and GUI/ interaction designers (UX), and Internal software developers. Providers of printing hardware and software and ICT were actively involved in defining the technological boundaries. Sales managers, account managers, and R&D managers (both from the print company and client) were involved by bringing organisational knowledge in. Users of printers, service operators (set to work at the client), and managers from the client were involved bringing in user experiences and needs in the user research.

Box 2.3: introduction innovation of insurance services project

Innovation of insurance services

This project aimed at developing new insurance products and services with a focus on SME's in the catering industry. The innovation process was based on the collaboration of groups of clients and providers. In the project a context innovation approach was taken: taking the broadest context of a product or service as a starting point for innovation. This approach was new for the insurance company. New was the application of context mapping leading to rich client information. This information was brought into the organisation in the form of personas and involving stakeholders in sessions with clients.

Qualitative research was combined with quantitative research to develop a business case and a new way of working was launched with a mini-company mini-company. This mini-company was a means to allow employees to experience a new way of working without disturbing the current working procedures. It acted as an incubator or innovation space where concept development proceeded. Also, an internal toolkit to disclose client data was developed in this mini-company. The project was on hold at the time of the retrospection. Due to the financial crisis the resources for the project were no longer available. Some of the participants, who first met in the user research, continued sharing knowledge and skills after the design project was on hold.

The development team consisted of an external consultant (leading the project), design researchers (design students and their supervisors), business consultants and people working at the company in the role of innovators. During the development process providers of ICT brought the technological boundary conditions in, while managers (sales, customer relations, portfolio management), board of directors, and innovation managers (including mini-company members) were involved by bringing in organisational knowledge. During user research the SME's (restaurant owners) and their network, brought their experiences and needs for insurance products and services in.

Participants in Study 1

Nine out of the ten PSS101 team members participated; experts with expertise in service design research, strategic collaboration in innovation, software system development in print industry, solution architecture in business software development, innovation of homecare services, and academic researchers with expertise in industrial design. The PSS101 team member who brought in the selected project acted as host for the session. To include broader perspectives than the PSS101 team's views, the host of the sessions invited two to four colleagues, who were involved in the projects reflected upon, to participate.

Set up of Study 1

The specific set-up of the three retrospective sessions was developed, together with the industrial partner hosting the session, to take full advantage of deeply diving into the specific project and its context. The host also acted as moderator, and prepared the session in consultation with me. The set-up aimed at stimulating participants to reflect on the projects, both individually and together, in order to include all available knowledge. The three sessions followed by and large the same procedure: the hosting project partner, together with colleagues involved in the presented case, started the session showing the development process of a PSS design case to the other participants. For showing the process, and trigger inquiries, artefacts used in the projects were available for participants to see and touch. When presenting the case, questions could be asked to clarify what had happened in the case. During presentations, and inquiries on the presented case, participants noted their personal reflections. In the second half of the sessions

the participants examined the individual reflections by together talking through and grouping the reflections in themes on posters. With this clustering participants made a selection of most relevant aspects of PSS design to further explore.

Materials
We selected spaces for the sessions, and provided materials that were related to the projects, to present a context of the cases and trigger participants to deeply dive into the cases. The three retrospective sessions were held in spaces related to the respective projects: a meeting room at the homecare and welfare organisation, an investigation room with man-size posters on user insights at the R&D facilities of the print solutions organisation, and in a restaurant that was involved in the insurance innovation project. In the sessions, material used in the projects was available for inspection in the form of e.g., workbooks, reports, video, and posters. Figure 2.10 shows the investigation room of the print solutions organisation, with participants in the session surrounded by posters used in projects to share user insights.

Figure 2.10: Participants surrounded with posters on user insights of the innovation of print-services case in the investigation room, allowing participants to experience what happened in the case.

Figure 2.11 shows tools and reports used in the insurance innovation project, presented on a table in one of the restaurants that was involved in the innovation project.

Figure 2.11: Material used in the innovation of insurance-services case, in the form of toolkits used for context mapping and reports, available for inspection during the session in one of the restaurants involved in the case.

Different posters were prepared to support participants to gather, share, and inquire on reflections for each session. The posters provided a structure for clustering individual reflections, each poster with different starting points for sharing insights on networked design, allowing a broad range of points of discussion on networked design. For the first session, service design researchers had prepared posters with the main themes they estimated to be important in networked development: 'exchange of knowledge', 'forming networks', and 'organisational change'. For the second session the poster was empty, allowing participants to name and structure clusters. For the third session, an innovation consultant prepared a poster with a funnel model he developed. This model describes what he referred to as a 'contextual innovation process'. In this process, providers worked in close collaboration with networks of clients. The phases in this process, co-create, co-design, co-development, and co-ownership provided landmarks for clustering.

Data gathering and analysis

In these three sessions, observations of what participants said and noted provided the raw data. The method of data gathering and analysis followed the general approach: video registration, annotated materials, and field notes. Selected quotes from transcripts and annotated materials were combined, and these combinations were coded. The preliminary framework of networked collaboration provided themes used for coding together with the sub research question on what barriers and opportunities exist.

The individual reflections on the posters were brought together in simple worksheets, allowing participants in Study 2 to use these data for co-analyses. For Study 1, these overviews of reflections provided an impression of what participants brought in when clustering.

The following sections give an overview of main observations during presentation of the cases, followed by observations of the clustering at the end of the sessions. These main observations summarise data gathered, and illustrate how participants exchange experiences and together select what they find important topics to work on.

1.1.1 Main observations in Study 1: retrospection of innovation projects

Being in case related spaces, surrounded by artefacts used in the projects, seemed to enable active participation. Interaction with the available artefacts seemed to trigger sharing experiences in detail. The hosts presented cases by showing and explaining materials used in projects, inspiring participants to ask for clarification and value materials for use in their own projects.

Observations during presentations included examples of what happened in networked design and what participants valued as obstructions and opportunities. These examples identify approaches of PSS design as respectively barriers or enablers in networked design.

Identified barriers in the cases

Main observations on barriers in the three sessions concerned implementing new PSS concepts in the organisations responsible for further developing the concepts, and providing the products and services. Participants shared ideas on why implementation had been difficult, as the following quotes illustrate.

In the first session, one of the experts in homecare innovation shared his main frustration in PSS development even before his colleagues presented the homecare case: '*The organisations had not understood what we are talking about … we* [the development team] *had been standing alone with all our beautiful concepts and reports.'* During the presentation of the homecare case, the project manager explained his thoughts on why the concepts were hard to implement: '*Many organisations had been involved in developing the concepts, however at the moment we created the service blue print we found we were still missing many parties we needed to engage.'* One of his colleagues added: *'It is also difficult because the interests* [of stakeholders] *are complex, for example, in one of the municipalities we had tried to implement one of the concepts with a stakeholder who was both provider of the required technology and at the same time politically involved in the municipality.'* One of the R&D managers in the second session had experienced that service needs had changed over time, making it challenging to organise service delivery: *'…the client's demands change over time and you have to adapt the services to keep in compliance with these demands. This makes delivering services so different from delivering products because for service delivery a regularly face-to-face interaction with the client is needed.'*

Also, participants shared unsuccessful solutions for implementation during presentations in the sessions. In the homecare case, reports had been used

to communicate the results of design research and concept design to get organisations and municipalities engaged to implement the concepts. The homecare innovator mentioned why these reports seemed not successful: *'What we had done wrong is that we* [the design team] *just dropped the reports on the desks and later in meetings we were annoyed they* [people in the homecare organisation] *did not learn earlier about the developments. We forgot to introduce the developments face to face before we dropped the report.'* The design team in the homecare case had delivered a business case at the end of the project in the form of a social business plan to communicate both the social and financial benefits of the developed concept. However, this report did not lead to the expected engagement yet. As one of the colleagues in the design team suggested: *'…perhaps we should have communicated the social business plan in smaller steps, it is just too complex to understand all at once.'* In the third session, on the insurance innovation case, the expert in architecture of business software shared his concerns about the continuity of development processes: '*Making insights available with for example personas is one thing, but how to make people understanding how to apply this in their work is another, difficult, thing.'* A homecare innovator added that the client, or user, should be at the centre for all people in the organisation.

The quotes above illustrate points of improvement in making UX insights actionable to the many people involved in implementation. The main concern seems to be the poor connection and collaboration between departments in organisations providing products and services. As an example, the software architect said that working in big separated departments (silos) should be changed into working in small multidisciplinary teams. This suggestion of working in small teams would support connections and collaboration between people who now do not collaborate. This way of working was one of the following observations on positive experiences.

Identified opportunities in the cases

In the third session, two colleagues at the insurance company shared their positive experiences with a mini-company: a temporary department where people from different departments had been working together on service development following a new approach of involving client networks in innovation. As a result of working in the mini-company the people involved had improved their regular work, e.g., better communication with clients and better collaboration between departments.

When presenting the insurance innovation case, the expert on strategic collaboration emphasised the importance to connect the insurance company with their clients, the users of insurance services. He felt it was important to hear the users' stories because this had resulted in insights that could never be obtained with quantitative analyses. He also had experienced that making visualisations, as drawings and video, to communicate his approach to the insurance company worked better than texts and made people curious.

This was also observed in the first session, where homecare innovators said they had been surprised by the designers' reports that included visualisation. As one of the homecare innovators stated: *'It was such a relief that it* [reporting] *could be done differently from spread sheets. … a drawing gives an image, if you all have the same image in front of you it works so much better than a spread sheet.'* The service designer added that during the design they also had used co-creation sessions to communicate the way of working to the homecare organisation. For each co-creation session they had invited other people from the organisation, hoping this would lead to knowledge transfer. The homecare innovators had noticed that the materials, made in these co-creation sessions, had helped to engage colleagues in the design project:*'The materials, we used in the sessions, were on the walls in my office and triggered colleagues to stop by and ask questions about the development project.'* The materials had made the project visible, and had triggered colleagues to learn more about the project and got interested in co-creation as a service design method for innovation.

During the presentation of the insurance case, the context mapping method was seen as a means to connect to the clients. Although applying this method had been time consuming, expensive, and not delivering representative data, context mapping had resulted in rich insights. Gaining these insights not only served the development team, it also supported clients to improve their business when they had participated as respondent in the user research. For example, a side effect of doing context mapping sessions had been the creation of connections between clients. As an innovation manager of the insurance company mentioned: *'After the sessions the participants had been keeping connected and supported each other and each other's networks. For example, helping to find people who could make websites or could help rebuilding their premises.'*

During the print services case presentation, the presenter indicated that the human-centred approach had been more and more visible in the print solutions organisation. As an example, he mentioned the increasing use of personas: *'We had based the personas on our visits of people using our machines. We had made them man-sized and placed them besides the printers in development, this had been supporting the developers empathising with the users.'* When developing the print services the development team had widened their focus on the user to stakeholders involved in both purchasing and using the printers. With this approach they felt they had improved implementation of new services: *'We now make an analysis of all stakeholders and how they value the different aspects of the printers and services.'*

Based on this analysis the design team had made value maps: visualisations of the stakeholders' values. In reviewing these maps with colleagues, it had been clear that there was a difference between the results of the research

of the design team, and the insights of the head office based on analysis of trend reports. The design team experienced that having people from the head office in the investigation room had been supporting engagement of front office workers with the human-centred approach. It had been experienced that discussing research, surrounded by user insight posters and value maps, supported engagement with the developed concepts and human-centred approach.

In their practices, both the service design researcher and the expert on strategic collaboration had been experiencing that people from the head offices need business cases with clear cost and profit insights. They suggested that quantification of UX insights should be provided for the business cases. However, the print service developer experienced that quantification had only been necessary when there was no engagement with the concept; he suggested that an immediate intuitive acceptance of the idea is preferable.

Participants in the three sessions found the reflections on the presented cases very helpful in understanding how to improve networked design processes in their own practices. In the sessions it was observed that some participants advocated methods they used and strongly believed in, e.g., making value maps or involving user networks. They shared these beliefs firmly during presentations and exchanging views, by bringing these beliefs regularly into the discussions in the three sessions. Clustering individual reflections of the participants, at the end of the sessions, supported reviewing these beliefs amongst a variety of other views as the following observations illustrate.

Bringing individual reflections together at the end of the sessions
The clustering at the end of each session worked differently in the three sessions. In the first session participants hardly interacted and inquired each other when clustering, in the next two sessions they actively discussed providing data on why specific reflections were relevant for understanding PSS design. In the first session participants put individual remarks on three posters with pre-defined cluster names: forming networks, exchange of knowledge, and organisational change. Participants put notes on the posters without further clarification or rearranging notes, and thus these observations did not provide observations on the why of these reflections. In the second session, participants lively reviewed notes they had put on the posters, and actively rearranged notes until they reached consensus on the clustering and cluster names. In the third session, the cluster names were pre-defined following stages in a PSS design process: co-create, co-design, co-development, and co-ownership. As in the second session, participants reviewed and re-arranged individual reflections now looking for consensus on the relations between notes and phase in the design process.

In the second session, a main observation during clustering was the worry of participants on how to improve collaboration of different departments, or

disciplines, in doing human-centred PSS design and implementation. A R&D manager concluded that during a design process, stakeholders in the service (e.g., helpdesk operators, or engineers), should collaborate more intensively in order to share insights and create PSS solutions rapidly. Participants talked in detail about how to understand the different stakeholders in a PSS, and how to apply user research and new product and service concepts to support collaboration. Participants indicated that the presented value mapping was an interesting solution to get this understanding, but questioned how to communicate and apply these insights. As an example, the software architect indicated: *'When value mapping it might be difficult to quantify soft values… it is essential people trust information….'*

When grouping reflections on the insurance case on the poster with phases of an innovation process, participants found it difficult to understand where co-development stopped and co-ownership started. They grouped their notes mainly in between the two phases. Participants talked through the funnel model, where in different phases different collaborations between networks of users, organisers, and designers can be identified. The print service developer concluded that it is crucial to engage all stakeholders in the process to get concepts rolled out. He felt the mini-company is an excellent means to get people engaged; he would like to bring this way of working to his company.

2.4.2 Discussion Study 1

The worksheets with notes brought together provided an overview of individual reflections. This overview showed a broad variety of reflections, indicating that the influence of strong views of some participants could be reduced. Writing down personal reflections in the form of remarks, questions, and observations gave individual participants a voice.
Transcripts and observation notes from the three sessions have been coded around the topics barriers, enablers, applied methods and tools, networks, collaboration between networks, and other themes emerging on networked design. Some chunks of transcript were assigned with more codes, particularly the codes enablers, methods and tools, and networks and collaboration emerged as combinations.

The following compiles a preliminary overview of barriers, enablers, and themes in networked design from topics participants repeatedly brought forward in one or more session. Further analysis aims at validation of the list of barriers, enablers, and relevant themes. Therefore, the raw data from Study 1 are brought into Study 2.

Barriers and enablers

A main barrier for the design team is that they do not know whom to involve in implementing a human-centred approach in an organisation network. It is hard for the design team to prepare communication of their approach and concepts when they do not know their audience. When the audience was

known, and face-to-face contact was possible, designers' communication methods and tools did support engaging stakeholders in the human-centred approach. These designers' methods and tools were identified as main enabler. Examples of these methods and tools are:

- Immersing people in design research activities enables engagement in a human-centred approach. Immersing methods include visualisation, co-creation, and methods to teach design research skills (e.g., learning by doing). This approach was applied in the exploration phases of the discussed PSS design projects.
- Communicate results of design research in a way that a broad co-ownership of the results is created. Examples of approaches found in the study are providing reports, doing (video) presentations, and co-interpreting of results with company stakeholders. These approaches were applied in the exploration and vision phases. It is concluded that only delivering reports, even when quantification and validation of the results are included, does not work.
- Facilitate small multidisciplinary teams (people from different networks and/or departments working together) for development and implementation. Providing a dedicated space with design research data communicated in an engaging way (e.g., video, personas, value maps, drawings) enables such teams to co-create.

Relevant themes of networked human-centred development

Observations coded as networks, collaborations, and methods repeatedly addressed three themes: implementation of a human-centred approach, forming and sustaining collaborations in and between networks, and process of PSS design. Implementation was a reoccurring topic in the three sessions, particularly concerns were shared about implementing a human-centred approach in a network of organisations. Remarks concerning implementation included: convincing organisations to invest in further development, change of organisations to provide new services, co-ownership, facilitating co-creation, and making UX insights actionable.

Forming and sustaining collaborations in and between networks is a topic emerging from what had been coded as a combination of networks and collaborations.

In the three sessions participants discussed how to make user networks and a network of organisations collaborate, and how to continue collaboration after a design project was finished. Practitioners shared experiences with people who had been changing roles and/or priorities during and after a design project, resulting in discontinuation of collaborations. Also, participants shared difficulties with collaborations with people who were not in one of the networks of organisation, experience, or design, but who influenced further development and implementation. E.g., people from municipalities responsible for providing infrastructure had been influencing implementation of new digital services, and people from universities responsible for providing

facilities had been influencing implementing new print services. In the preliminary description of networked collaboration (Figure 2.3) these people were not included. A secondary network is added to the primary networks of design, organisation, and experience to accommodate such people. People in this secondary network, have a relation with people in the primary network but are not (yet) directly involved in the development project. This expanded description is visualised in Figure 2.12.

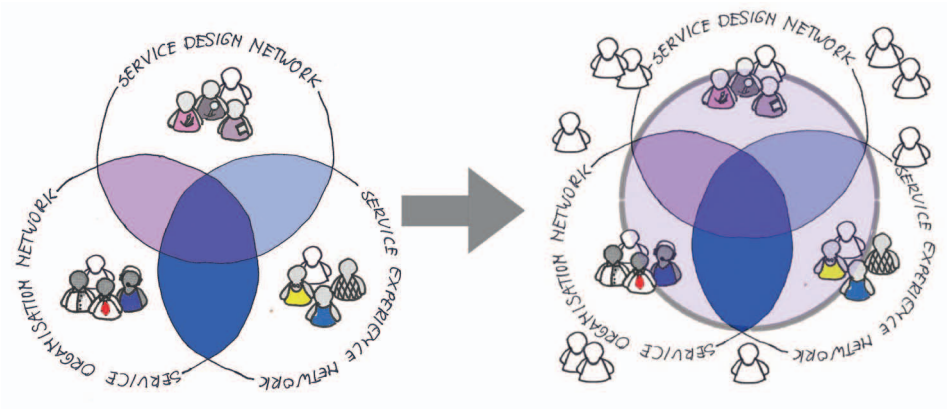


Figure 2.12: Visualisation of the preliminary description (left) is adapted (right) by making a distinction between a primary network and a secondary network (area outside the circle).

The shared experiences in PSS design projects show that in different phases in the process of PSS design different activities took place. In two of the cases a specific design process was presented with different activities in different phases. In the session on the print-services project a model of the design process was presented with a clear distinction between concept design and development of the concept, with distinct efforts in user involvement. In the session on the insurance-service innovation project a model was presented with an exploration, design, develop and commercialise phase. Each phase was in collaboration with users, respectively co-create a vision, co-design solutions, co-development concepts, and co-ownership. From what participants said and noted about these processes, it seems similar activities happen in a PSS design process: activities of exploring, creating a vision, creating solutions, developing concepts, and providing solutions. These activities preliminary describe phases in an iterative process of PSS design and implementation:

- Exploration phase: find and map what people are relevant, what their needs are, what makes people connect, and what values does the PSS add for them.
- Vision phase: develop a PSS plan based on future use and context of use.
- Creation phase: develop PSS concepts and methods to implement the human-centred approach.
- Developing phase: further create and test promising concepts and start

implementing new approaches.
- Doing phase: provide the PSS and continuously improve PSSs following a networked human-centred approach.

Findings in Study 1, and results of the clustering, were provided to participants in Study 2 to prepare them for further co-analysis of the data in study 2. The next section on Study 2 describes the workbook, with data and findings, created for this preparation.

2.5 Study 2: explore aspects for understanding networked design

Study 2 further explores the themes networked, barriers and enablers, and methods and tools, identified in Study 1. Study 2 aims to identify aspects relevant for a conceptual framework for understanding the mechanisms of keeping UX insights alive in networked design. This study has been embedded in a PSS101 session where participants interpret and review insights on specific methods and tools for PSS design they gained in earlier sessions. Participants prepared for Study 2 by individually reviewing results of previous PSS101 sessions, findings, and data of Study 1.

2.5.1 Method Study 2

This study, to further explore aspects of understanding networked design, has been set up in close collaboration with the host of the respective PSS101 session and an external moderator. The goal of this PSS101 session was to further develop the PSS101 framework of methods and tools for networked collaboration. For the study a set-up and materials have been prepared to support participants in further analysis of the raw data from Study 1. Set-up and materials evoke discussions on different aspects of networked design, elaborating on the topics touched in Study 1: the networked design process, barriers and enablers, and methods and tools. An external moderator moderated the study in order to get PSS101 project partners fully participating in the sharing of insights and allowing me to observe.

Participants in Study 2

In this study nine out of the ten PSS101 project team members participated, representing the variety in experience and expertise available in the team. Also, colleagues of the host participated, an expert in human-centred interface design and an expert in product management of business software.

Set up of Study 2

For Study 2 a workbook was prepared with findings and data of previous studies, and posters were prepared with visualisations of networks and process in PSS development, to guide clustering and review of remarks. The materials section below describes the contents of the workbook and posters in detail. Participants were invited to prepare the session with the help of this workbook that was sent in advance of the session. The workbook

supported participants to review preliminary coding and pre-select barriers and enablers, aspects of networked design, methods and tools, and additional remarks they wanted to review in the session. After the host together with colleagues presented their approach in PSS design, participants clustered their pre-selections of barriers, enablers, aspects, and further individual remarks on the prepared posters. After clustering, participants marked the items they felt where important to review elaborately during the study. The moderator presided over the discussions, guiding the participants to analyse and talk through relevant issues for networked design. After discussion, participants added their notes on methods & tools on the posters, without further talking the notes through due to time restraints. The session concluded with participants sharing their main insights gained in this session.

Materials in Study 2
The workbook consisted of summaries of the PSS101 sessions so far, the results of the sessions, and data and results of Study 1. Worksheets with preliminary coded data from the previous studies and stickers with data were available in the workbook to make this information actionable. Participants could agree with the coding, or could recode the data, by putting the stickers on different colours sticky-notes: orange for barriers, green for enablers, yellow for aspects, and pink for methods and tools.
The keywords ‘instrument’ and ‘objective’ were added to guide participants to note the methods & tools and the purpose or need for a specific method respectively. For additional remarks empty stickers were included.

Six posters were prepared to guide participants to associate their notes with specific collaborations and for specific phases of a PSS design process. The posters visualised the preliminary framework of networked design, providing a landscape of collaborations where participants could position their notes on. A rough timeline guided participants to associate notes with a specific phase of a PSS design process. As described in the discussion of Study 1, this timeline distinguished the phases explore, vision, create, develop, and do. The timeline has a messy front end in the exploration phase, and ends as a straighter line in the do phase, reminding participants of the fuzziness of a PSS design process. One poster was for general discussion on PSS design and included all phases, while the other five posters highlighted one of the phases. Figure 2.13 shows the poster with the phase explore highlighted.

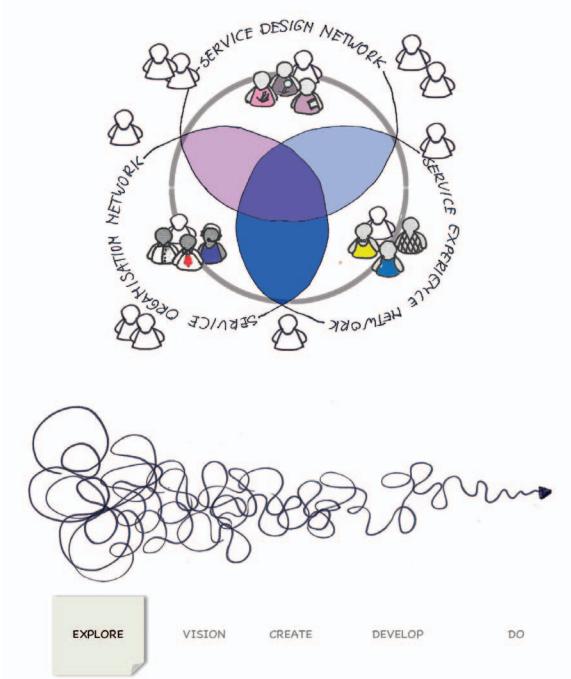


Figure 2.13: Poster of preliminary framework and development process guiding participants to cluster their notes. The preliminary framework visualises a landscape of collaborations in and between networks, a timeline indicates phases in the PSS design process. The timeline funnels from a fuzzy front end (explore phase) towards a straighter process at the back end (do-phase) and highlights the explore phase, inviting participants to add notes they associate with this phase.

Data gathering and analysis

Data gathering and analysis followed the general approach: observations documented by video registration, annotated materials, and field notes. Video transcripts, positioned notes, annotations on the posters, and field notes were combined in a simple excel worksheet and grouped in barriers, enablers, aspects, and objectives of methods and tools. Preliminary insights in Study 1 were compared with the groups found in Study 2 for validation of the results of Study 1. Further analyses of the notes marked for further review, and exchange of view of these remarks, was done with the aim to converge the themes into aspects of networked design that influence UX insights vanishing. For this purpose, I selected chunks of transcript of the exchange of views, and grouped these with annotations on posters, notes per phase (explore, vision, create, develop, do), and collaboration position on the poster.

The following overview of main observations during the host's presentation, followed by observations of the clustering and review of notes, illustrates what participants exchanged and together reviewed as relevant aspects in networked development.

2.5.2 Observations in Study 2: exploring aspects of networked design

The session host briefly introduced the experiences and interests in PSS design in business software development and software as a service. Together with the preparations of the participants for this study, this introduction has been leading to discussions between participants on differences and similarities between the specific approaches in software development and approaches in the other PSS design projects. Observations showed the exchange of views regarding to three new themes that were not touched in Study 1. These themes are: approaches in software development, complexity of networked development, and who takes control in networked development.

Approaches in software development

The introduction triggered a discussion on specific aspects of designing a PSS when software development is involved. The host described the specific issues of applying the scrum method in software development:

> *Every two weeks we deliver software that immediately is launched for use. We discuss the development goals for this two-weeks period in videoconferences with the development team in Kuala Lumpur, we try to meet about three times a year face to face. I also actually had twenty clients around the table* [to evaluate the launched software].

When asked if the human-centred approach was already embedded in the company the host answered: '*When we started to use a more human centred approach it was difficult to make clear what the benefits were.'* His colleague, who managed a new UX department that focuses on the user interface design, added: *'What we achieved is that we have an UX team and on the long term we will have changed our software development approach. It is now acknowledged that what we do influences the work of all departments.'* The UX department include a user researcher, an application designer who builds prototypes of new interfaces, and a graphic designer who designs the interfaces.

The UX team faced the barrier that software developers and their managers do not easily accept the solutions the UX team created, it seemed that the fit with user needs they accomplished in their design had less or no value, as their manager explains: '*It is not possible to make big changes; software development is traditionally developed in small incremental steps. Big changes can take two years to develop, and that makes it less clear if the changes will be worth the effort.'*

These specific aspects of software development (teams from different countries collaborating, difficult to make big changes) resounded in the remainder of the session, when participants collaboratively reviewed notes they positioned on the posters.

Participants positioned 124 coded notes on the posters, of which 41 coded as barrier, 35 coded as enabler, and 48 coded as aspect in PSS design. Of these notes they marked 24 notes for further review. Most notes, and marks for further review, were on the vision and create posters. This indicates that participants were seeking understanding of designing a PSS design, and less on further developing and implementation (develop and do phase). More than half of the marked notes on the vision and create posters concerned the process of networked design, e.g., communication during the design process, share knowledge, drawing up networks, and how these networks linked. An interesting observation was that notes associated with the networks also concerned communication in or between specific networks, and connections in and between networks. Figure 2.14 shows how the position of the notes on the posters, indicating if notes were associated with a specific collaboration in, or the process of, networked design.

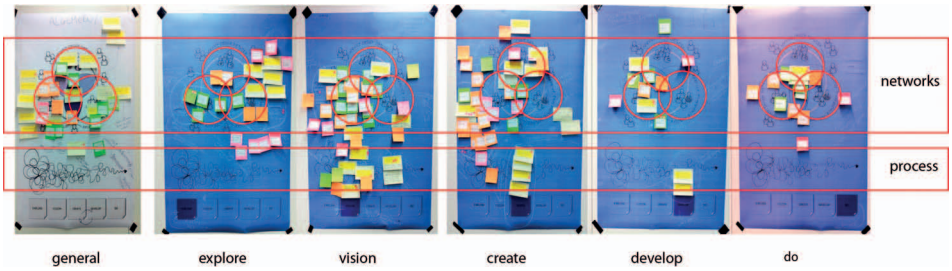


Figure 2.14: The six posters show what collaborations and what phases were triggering most notes. The vision and create posters clearly have more notes. On the general poster, most notes are on the left circles, in the overlap of design and organisation networks. On the explore poster most are on the right circles, in the overlap of design and experience networks. On the vision and create posters most remarks are on the left circles, in the design and organisation networks, and on the process.

Notes, both coded notes and annotations on the posters, that were marked with one to four red dots indicated the importance for participants to review the specific item. Only one note had four dots: the note coded as aspect saying 'values, make values understandable by their economic value or business benefit'. The other marked notes had one or two dots. Figure 2.15 shows the aspect marked with four red dots on the 'create' poster, positioned on the organisation network. The annotation on the process on this poster, with two red dots, concerned 'convince others'. When talking through this annotation, it became clear that participants seek for methods that support them in convincing higher management to take a human-centred approach and closely collaborate with design and experience networks during innovation projects. The barrier marked with one red dot, positioned in the process, was associated with convincing others: the risk of a change of vision as part of negotiating. The notes coded as aspects, positioned in the process, and marked with one red dot concerned communications and knowledge sharing between disciplines and phases. Seemingly, communication is an important aspect in PSS design aiming at both sharing knowledge and sharing

how to apply human-centred PSS design.

Figure 2.15: Detail of the 'create' poster, with marked (red dots) notes. The place of the notes indicates an association with a specific collaboration, or the overall process. The colour indicates the coding of the note as barriers (orange), enablers (green), or aspects (yellow). On this poster the only note marked with four red dots was found, indicating value is an important aspect associated with an organisation network. The two red dots indicate an important annotation on the process: convince others. One red dot indicates an important barrier (orange): possible change of vision, and three important aspects (yellow) on the process: communication between disciplines, knowledge sharing, and communication between phases.

When reviewing the marked notes, the complexity of networked development and the need for orchestration were mentioned for all phases in the PSS design process. The following summarises what has been said about complexity.

Complexity of networked development

When talking through the marked notes on the posters, the complexity of networked design was highlighted. A service designer commented that: '*You want to involve different people all the time, you need to update your network mapping continually, it is an iterative process.* The product manager added: 'Yes, *the group of stakeholders you want to involve grows and grows, that has as a consequence that sharing a vision becomes more and more difficult.'* During exchanging views on the necessity of sharing a vision, different opinions occurred on the need of having a shared vision. Some participants think there can be different visions in a project as long as people look for a good combination of these visions. A system developer warns for combining visions: '*You have to be conscious not to make too much compromises, you should try to keep faithful to your design vision.'*

The above quotes illustrate what participants experienced in what makes networked design complex: a continuous changing group of people involved makes it difficult to understand what and how to communicate with these groups in the PSS design process.

Making design decisions in the PSS design process also appears to be a concern, as the following conversations on leadership and control illustrate.

Who/what takes control in networked development?
At the end of the session, the conversation focused on orchestration in networked design:

> *You can have a superb design process but, in the end, you need someone who makes the final decision...it is a challenge to have someone to make final decisions when you have different groups of people who all have their own leader...in practice there are, from the beginning of a project on, always one or two people who become the product champions who act as boundary crossers to all groups.*

In summary, exchanging views between participants were about collaboration and knowledge sharing between different design teams, and between design teams and boards of directors. The filled in posters of the different phases of PSS design show differences in what networks collaborate, and aims of collaboration. Analysis of the data gathered in this study provide the following discussion on what aspects of networked development influence keeping UX insights alive.

2.5.3 Discussion Study 2

The specific aspects of software development of working in many groups (often with different timelines) and orchestration of the design process possibly triggered participants to share experiences on these aspects in product and service development. Also, presenting different phases of PSS design on the posters was guiding the focus in the session on the process of PSS design and less on the networks involved.

Analysis revealed main aspects of networked design that influence what happens with UX insights: phases of the PSS development process and levels of decision making. Although individual participants only posted the notes coded as methods on the different posters, and not reviewed the notes with the other participants during the study, an overview of the methods has been created. This overview of methods, and the noted need for the methods, indicate that different phases in PSS design seem to require different approaches for collaboration and communication. In the exploration phase the emphasis is on mapping networks (who are involved and/or need to be involved, what connections exist, and what connections are needed), sharing insights with stakeholders, and connecting new stakeholders. Participants indicated that the vision phase is not a clear specific phase in PSS design, but

is in concert with exploration. Methods for the construction, communication, and evaluation of the vision are important to enable agreement on a vision. Methods as prototyping and testing, and sharing methods are specifically relevant in the phase of creation.

Participants considered different levels of decision making in PSS design projects: strategic decisions on the PSS as a whole system, tactical decisions on the concepts of products and services to develop, and operational decisions on the detailed interfaces of the products and services. An understanding of whom in the end makes the final decisions, and how this decision making can be influenced, seems key to keep UX insights alive.

Study 2 did not distinguish other aspects of networked design that influence keeping UX insights alive, other than the general aspects: phases of a PSS design process and levels of decision making. Different methods, especially concerning collaboration and communication, could be associated with these aspects. This provided a first draft of a framework of methods and tools the PSS 101 team wanted to develop. The combination of participants' notes on methods and what participants said, resulted in a framework indicating a need for methods supporting activities in the phases explore, vision, and create of the PSS design process, and different levels of decision making. These levels concern: a strategic level of decisions on a system of products and services, a tactical level of decisions on concepts of products and services, and an operational level of decisions on touchpoints with products and services. Table 2.1 shows this framework. For the phase of exploration activities aim at gathering insights, while the phases vision and create aim at conceptualising. Similar activities can happen for the phases vision and create. Although the framework is still a draft, it guides the next Study 3.

Table 2.1: first draft of a framework of needs for methods and tools in the form of a matrix indicating needs for relevant methods for specific activities in phases (columns) and levels (rows) of decision making in PSS design

Levels of decision making	Methods that enable exploration	Methods that enable agreement on a vision	Methods that enable creating solutions
Strategic: Methods supporting making decisions on designing the system of products and services	Explore (networks) Mapping (networks) Sharing (insights on networks) Connecting & engaging (stakeholders)	Creation (vision) Recording (vision) Sharing (vision) Evaluating (vison)	Creation (solutions) Prototyping (solutions) Sharing (solutions) Evaluating (solutions)

Table 2.1 (continued)

Levels of decision making	Methods that enable exploration	Methods that enable agreement on a vision	Methods that enable creating solutions
Tactical: Methods supporting making decisions on concept services	Exploration Mapping Sharing Connecting & engaging	Creation Recording Sharing Evaluating	Creation Prototyping Sharing Evaluating
Operational: Methods supporting making decisions on touchpoints	Exploration Mapping Sharing Connecting & engaging	Creation Recording Sharing Evaluating	Creation Prototyping Sharing Evaluating

This framework of needs for methods and tools is brought into Study 3, enabling feedback on the relevance of the methods for PSS design.

2.6 Study 3: prioritise aspects for understanding networked design

The studies 1 and 2 led to an overview of general aspects and methods of networked design. Levels of decision making and phases in PSS design, have been distinguished that seem to address specific methods for collaboration and communication. These levels and phases have been used to make a preliminary framework of needs for methods and tools for networked HCD. This framework guides Study 3; it serves as a tool for evaluating insights from previous studies, and looking for prioritisation of aspects of networked design that influence what happens with UX insights. This study was embedded in the PSS101 thematic session where the PSS101 team discussed possible case studies in the next stage of the project.

Method Study 3
Study 3 aimed at distilling relevant aspects of networked design from what had been found in the previous studies. The method of Study 3 followed the general methods of the studies in this chapter. Participants reflect on the results of the studies so far, and together review aspects of networked design they want to focus on. The preliminary framework of needs for methods and tools guided the reflections and reviews.

Participants in Study 3
In this session the PSS101 project team participated, plus an academic researcher doing research in new ways of interactions at work at the UX department of the business software development company.

Set up of Study 3
The session was organised, prepared, and moderated by me. After a short

presentation of the analysis of what has been observed in previous studies so far, I presented the preliminary framework of needs for methods and tools. Participants were asked to use a canvas with this framework to select and consider initiation of projects that could serve as case studies in the remainder of the PSS101 project. Talking through selection happened in pairs of participants with expertise in similar PSS design projects. After working in pairs, participants presented the filled in canvasses to share what they had talked through and what the outcome was.

Materials in Study 3

For this study a canvas was prepared with an overview of activities in PSS design with associated needs for methods. The poster was designed to trigger participants to review the influence of levels of decision making, networks involved, and phases of PSS design on the methods they wanted to apply in specific cases. Figure 2.16 shows this canvas with the preliminary framework in the form of a matrix. The canvas provides room for annotations, and visualisation of the networks were added to allow participants to indicate specific collaborations.

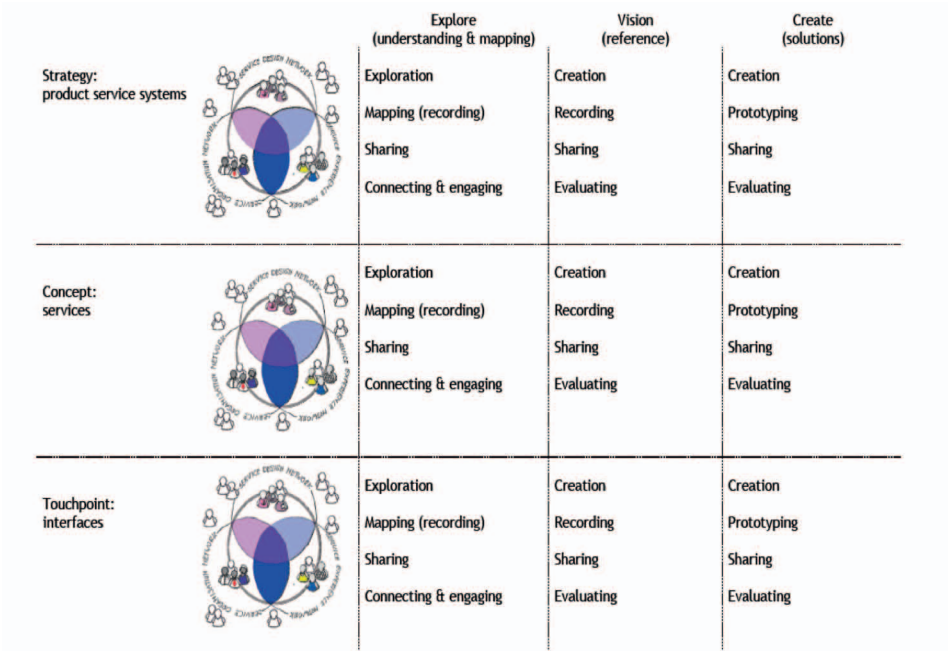


Figure 2.16: The canvas, for discussing selection and initiation of case studies, shows aspects that characterise methods and tools. The first column on the left describes the levels of decision making, the second column shows visualisation of the collaborating networks (for indicating what collaborations are associated with what levels), the other columns show the specific activities that are likely for the combination of phases of PSS design (explore, vision, create respectively) and level of decision making (exploration, creation, mapping, recording, sharing, connecting, and evaluating).

Data on what, and how, participants choose for applying specific methods in projected cases provided insights on the relevance and importance of specific aspects of networked design.

Data gathering and analysis
Following the general method, participants were videotaped when making inquiries during the researcher's presentation, and when using the posters to talk through what they wanted to learn with future case studies. The transcripts of the video, the filled in posters, and field notes were analysed by coding them around themes that emerged in the previous studies as aspects of networked HCD: phases of networked HCD, levels of networked HCD, and methods and tools for communication and implementation.

2.6.1 Observations in Study 3: prioritising aspects of networked design

During my presentation, project partners did not recognise the preliminary framework of needs for methods and tools in PSS design as a result of the earlier studies. They questioned why the phases develop and do were missing. Participants indicated that we possibly ignore the barrier of implementation of new products and services in an organisation when we do not consider the do-phase as relevant. Participants also questioned what exactly was meant with the different levels, and why it seemed that in all cells the same words were used. They could not recognise the design process, and were afraid that important insights they already had gained in the previous sessions would not be touched when using this matrix. As a system developer explained: '... *you have focused on building a framework and not so much on what we have learned already and can use in the next phase of the PSS101 project, it is about the low hanging fruit you leave in the tree now, we perhaps have to sit aside and focus on what we have learned already in the workshops instead of what we want to learn.'*

Although the participants found it a too abstract description, they used the preliminary framework for talking through what aspects they would like to explore in the next phase of the PSS101 project (see Figure 2.17).

The presentation and discussions on what the partners choose to do, provided observations that support prioritising of aspects for framing networked design. The following examples illustrate this.

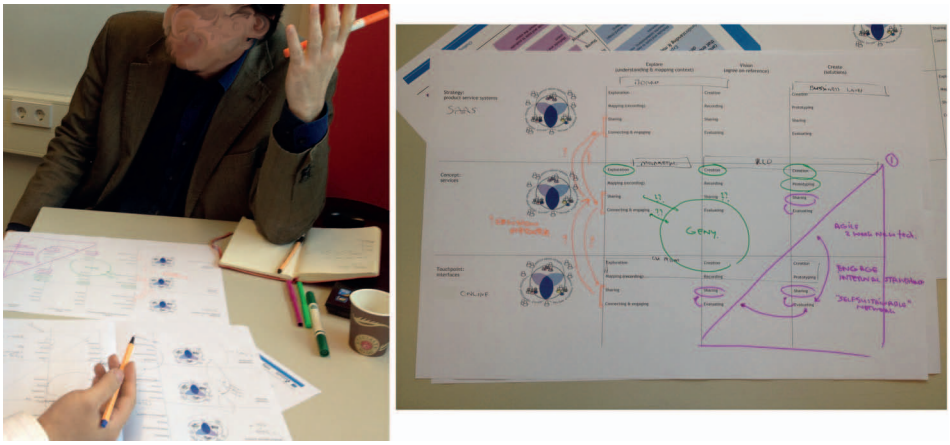


Figure 2.17: Canvas in use. On the left two participants discussing what they want to explore, on the right their notes: creating engagement from the operational (right bottom corner) to the tactical level (green circle in the middle).

When presenting his filled in canvas a service designer indicated that collaboration with different disciplines was envisioned: '*We are now exploring in the strategy level and come up with a vision* [pointing at the upper left corner of the canvas]. *The challenge is to work together in service-design with people from the building, architectural and project development field.'* He was looking for methods to engage and share insights with other disciplines. A solution architect indicated the importance of communication and implementation:

> *We are in this case working now in the right bottom corner, we want to develop an engagement of the stakeholders in a self-sustainable network of knowledge sharing, to start with internal stakeholders. This to keep all stakeholders up to date of all new features developed every 2 weeks in our agile process. Now we have documents and presentations but the network could provide a more engaging knowledge sharing.' 'It is all about how to share, how to bring my message across.' 'Ideas are bubbling up in the right bottom corner, but we have difficulties to bring it to the top because they at the top do not see the rational and potential for the business models.*

A system developer highlighted the importance of making insights actionable:

> *We want to focus on the gap that seems to exist between exploring and bringing the findings into vision, what we see now is that there is a nice presentation about the findings, everyone is interested but, in the end, nothing happens...we have to think of something to change the process or do the presentation differently to get the stakeholders involved.*

As in Study 2, the service designer indicated that implementation and engagement were important aspects: *'We want to involve more people to make the concept we developed into a success. This is what we find difficult in service-design, when we step out as designers it is not implemented, there seems to miss a drive to implement.' The s*olution architect added: *'You have to embed it as soon as possible into organisations, you have to engage with all stakeholders.'*

Further inquiries concerned how to understand which stakeholders to engage, and how to engage them. Mapping the stakeholders' values was mentioned as an example how to understand the stakeholders. Another aspect, mentioned several times, was the role of design. For example, a consultant on strategic collaboration stated: *'So somehow the expertise we have as designers is not understood'* and *'Why do organisations and government not bring design forward as a discipline that could help understanding the real problem to solve?'* Exchanging views between participants on what design could offer, led to the suggestion that some design methods would be supporting finding solutions for complex problems as connecting people and influencing behaviour.

2.6.2 Discussion Study 3

The framework presented was perceived as a too abstract landscape of methods, and did not provide a clear structure of methods and tools. Participants needed elaborate explanation before they could reflect on their own experiences, share knowledge, and indicate their future needs for methods in networked HCD with the framework. Participants missed a clear connection to the design process. However, annotations on the canvasses and transcript of discussions between participants provided data on aspects of networked design.

Bringing together chunks of transcripts of what had been said and annotations on the canvasses led to the insight that two important aspects in networked design are engagement and communication. As in the studies 1 and 2, it was emphasised that understanding and mapping networks is key for knowing whom to involve, and engage, during the process of networked human-centred design. Connecting people, creating networks and influence social behaviour was seen as a specific role for designers. Methods and tools designers use for engagement and communication, as for example visualising and immersing, were mentioned as appropriate to achieve this.

2.7 Study 4: prioritise methods and tools for networked design

The aim of this study was to identify aspects, relevant for construction of a framework of networked human-centred design, by understanding urgent needs for methods and tools of practitioners in PSS design. The study has been embedded in a PSS101 session where the industrial partners wanted to collect low hanging fruit from the PSS101 project so far for their design practices.

Reflections of the partners provided insights on the priority of aspects, and why these specific aspects influence using UX insights.

Method Study 4
Study 4 aimed at gathering data on what practitioners want to improve in their practice of doing PSS design. With this data aspects of networked design, identified in previous studies, can be prioritised. The study was embedded in a PSS101 session instigated and prepared by the industry partners in the PSS101 project. They organised this session with the aim to talk through how to bring into practice what they already learned on networked design in previous sessions.

Participants in Study 4
Participants in the sessions are industrial partners in the PSS101 project team with expertise in service design research, strategic collaboration in innovation, software system development in print industry, solution architecture in business software development, and innovation of homecare services.

Procedures of Study 4
The session was organised and moderated by a colleague of the consultant on strategic collaboration. Participants prepared the session by listing what they had learned from the other partners in the PSS101 project and what they would like to bring forward to the others. Participants presented these lists, and exchanged views on these lists with the other participants. Participants were invited to write down their personal reflections during presentations. After presenting and reviewing the lists, the participants jointly grouped their reflections in what they thought to be main aspects they wanted to focus on in their practices. With this clustering the industrial partners indicated and reviewed what methods they would like to bring in the practice of their own projects.

Materials in Study 4
No specific materials were provided for this study others than sticky-notes and pencils for making notes and flip charts for clustering these notes.

Data gathering and analysis
For this study I observed without intervening, other than now and then asking for clarification, to minimise influencing participants with my interpretations. I videotaped the session, and made field notes. By observing participants sharing insights on what they need in their practice, information was gathered on what, and why, practitioners prioritise methods and tools for networked design. Transcribed video of the session, annotated material, and field notes were coded around methods and the themes participants used to group their reflections. These themes were: communication of shared goal, understand networks, decision makers in the networks, visualise value chains in networks,

identify the value mechanisms, piloting, and understand the user.

2.7.1 Observations in Study 4: prioritise methods

In this study participants decided on what methods and tools they wanted to apply in their practices in the near future. The following observations summarise what participants shared on selected methods to use in their own practice.

The service designer and consultant shared their experience in doing innovation projects for organisations. They did these projects in an external process that was not part of internal processes in the organisations. They shared that a good method to try out new approaches and create new things had been doing pilots and prototyping. However, it had been difficult to bring results back into the organisation, and implement the new approach after it had been tested in a pilot. Others mentioned that using video to communicate the results of a pilot was an interesting tool, they expected that it even could be working as a tool for engagement when involving stakeholders in making the video.

As in the previous studies, the making of stakeholder maps and describing the stakeholders' values were mentioned as a method experienced to be supportive in networked design. Other participants seemed convinced about the value of these methods and said they considered to apply this method in their own practice.

Another method, several times mentioned, is the use of visualisations in combination with storytelling. A service designer: *'When you are sitting around the table with a group of stakeholders you need to develop a shared language. In our experience it had been helpful to visualise and involve stories, you could not have done this with only words.'*

At the end of the presentations, the system developer shared his hesitations in applying what he learned. He summarised the use of methods in PSS design as: *'OK if I understand it correctly, you have to communicate for 50%, making stakeholder maps for 20%, leaving only 30% of your time for actual design?'*

The participants mapped their reflections on methods they wanted to explore by grouping the methods in seven clusters: communication of shared goal, understand networks, decision makers in the networks, visualise value chains in networks, identify the value mechanisms, piloting, and understand the user. Figure 2.18 shows the clustered reflections on methods, and how participants linked some of the clusters through a road map. The road map starts with understanding the user, and links this to understand networks and decision makers in these networks. The link is in communicating user needs to decision makers. Then identify value mechanisms, visualise value chains, do pilots, and communicate the value chains and results of the pilots to decision makers.

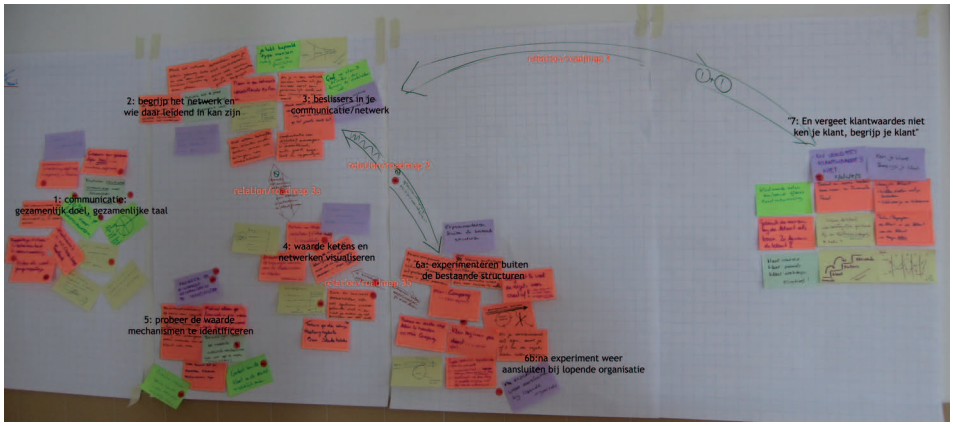


Figure 2.18: The overview of methods mapped by the participants in 7 clusters. The arrows show the roadmap linking the clusters: from understanding the user to communication insights to decision makers (roadmap 1) and piloting (roadmap 2) to understanding value chains (roadmap 3a) and communicate these to the decision makers by using results of piloting (roadmap 3b).

After clustering, participants selected methods they wanted to explore in the near future. These selected methods are: using video for communication and engagement, visualise networks and value chains, identify value mechanisms, piloting, and methods for understanding the user.

2.7.2 Discussion Study 4

Clustering individual reflections at the end of the session, and talking through the result of the clustering, provided an overview of what methods and tools participants wanted to apply in their future practice, and why they selected specific methods. Participants classified the selected methods as design methods and skills, reinforcing the result of Study 3 that a specific role for designers in networked design is in communication and engagement.

The methods and tools they selected were:

- Communication of UX insights: visualising UX insights, e.g., by video, in a way that it supports understanding of UX insights and engagement with using UX insights.
- Map networks: tools to map who is involved, and who to involve, in a networked design project that result in an understanding of communication requirements.
- Experimenting during design: methods for piloting and prototyping that support gaining and sharing UX insights.
- Understand the client (user) network: methods as context mapping that provide un understanding of user experiences and the social and physical environment of these experiences.

Analysis of the remarks of participants on the application of these design methods in the past, now, and in the future of doing human-centred design,

provides insights on what practitioners need for networked design. In general, these needs concern understanding UX insights, communication of UX insights, and make these UX insights actionable in a networked design process.

2.8 Discussion and conclusions of the exploration of practice

The studies in this chapter resulted in findings on what happens in networked design to make it a networked human-centred design. This section discusses what has been identified in the four studies as barriers and enablers in networked design, and what has been identified as aspects of networked design that seem to influence using UX insights in making design decisions. This discussion leads to a conclusion of what aspects of networked design could be identified for constructing a framework of networked human-centred design.

Barriers & Enablers

In the four studies, the experienced difficulty in understanding the networks in the design process was found a barrier in networked HCD. Participants discussed in each study how networks of designers, organisers, and experiencers could connect and stay connected in the design process. The studies 3 and 4 showed that without this understanding it would be difficult for designers to decide on appropriate methods and tools to get the three networks involved in the ecosystem of PSS design, and keep actors engaged in the networked process. In the four studies there were two questions that resounded: what criteria, or values, the different stakeholders use when making decisions on the design, and how should designers communicate concepts in the organisation network. Although these questions were not answered in the studies, the fact that participants frequently asked these questions, indicates a need for understanding how they could influence others in making design decisions. Participants' notes on convincing others also addressed this need for influencing in Study 3. Understanding how to influence decision making seems a key aspect to keep UX insight actionable in networked design. A key barrier found is that designers experience difficulties in communicating research and concepts in a way that the heterogeneous and dynamic networks get and keep engaged to the human-centred approach of taking user experiences as a main driver for development. Designers felt this engagement is necessary to get the resources as budget and time, facilities, and commitment to the human-centred design approach throughout the design process.

Design skills as visualising, prototyping, and creating scenarios enabled designers to engage the design teams and manager from the organisation network during the concept development. Immersing them in design (research) activities, and teaching them design skills, appeared to involve team members and managers in the concept development and made them co-owner of the concepts. However, participants only shared experiences of applying these design skills in the early phases of a human-centred

design process. It is still unclear if these skills could serve as an enabler of engagement in other, later, stages of the process.

What aspects influence using UX insights
Bringing the results of the four studies together, the following aspects that influence using UX insights emerge:

- In the studies practitioners indicate they have difficulties in identifying whom to engage in networked design in their current practice. For an understanding of UXs, designers include the context of the user experiences. Consequently, they include insights on what happens in the experience networks in the communication of UX insights. How, and to whom, these rich insights are communicated influences whether these insights will be used in making design decisions. In the studies participants suggested that direct collaboration between actors in design- and organisation-networks supports actionable communication of UX insights. However, the studies did not provide an answer on whom to involve in these collaborations, and what methods to use.
- It is still unclear how designers can motivate and support actors to use UX insights in making design decisions; a deeper understanding of the networks of actors in the design projects could provide clarity for this. Understanding who the actors are in organisation networks, and what they need when making design decisions seems required to communicate UX insights to those who make the decisions.
- The studies did not provide examples of support in using UX insights in decision making after the projects stopped. There were no signs that the methods and tools used, as involving some stakeholders in research, communicating results of research by reports and visualisations, and documenting UX by personas and stories led to the application of a human-centred approach in the stages of the design process where designers were not directly involved.

The initial description of networked design as three collaborating networks of design, organisation and experience guided the studies. Along the studies, it was assumed that making a differentiation in phases of a design process, and level of making design decisions, would support studying how designers could keep UX alive in PSS design. This resulted in a draft framework of needs for methods and tools in which different combinations of phases in the design process and levels of design decisions, indicated a need for specific methods and tools. Although this draft framework supported sharing experiences and needs between participants, the framework itself did not support participants to connect to their practicing networked human-centred design. Main reason for this poor connection to practice, was the abstractness of the described need for methods and tools. However, focusing on needs for methods and tool for networked design confirmed what was found in the first two studies: designers need different methods and tools to communicate actionable UX insights for different phases of a networked design process.

Conclusions
The studies aimed at finding aspects of networked design that provide an understanding of what designers need to address to prevent UX insights getting lost. The results of the studies provided understanding of designers' problems in networked design, however, only two key aspects of keeping UX insights alive in networked design could be identified, which are:

1. Engagement of actors in doing HCD is required to keep UX insights alive. Actors, in the networks, are engaged when they are motivated to actively apply a human-centred approach, and when they understand the necessity of taking user needs into account in their design decisions. There is a need for methods and tools that support getting and keeping actors in the networks engaged in a human-centred design approach.
2. Designers need methods and tools for understanding the process of networked design, and how they can influence actors to use UX insights in their design decision making. Who are these actors, what are their needs, and what opportunities can be identified for making UX insights actionable for these actors along a networked design process?

The studies in this chapter showed that in networked design these aspects are key for communicating insights. When practitioners reflected on communication and convincing others to adapt insights, they not only referred to UX insights, but also to new PSS concepts, visions, and design approaches. In regard to communication, it can be concluded that designers need to improve their communication of insights in two steps; communicate insights in a way that it motivates others to apply the insights, and make insights actionable through communication.

Reflection on the practice provided the main two insights on the previous page: networked design seems to happen through getting and keeping actors engaged, and designers need methods to influence using UX insights by other design decision makers. Also, participants in the studies did not already have a language or theory to frame aspects of networked design related to UX insights getting lost or staying alive. A deeper understanding of the rationale behind networked design is necessary, and provides new insights for constructing a framework of networked human-centred design that guides further studies on how designers can support keeping UX insights alive.

The next chapter explores literature on networked design, supporting a deeper understanding of the process of networked design relevant for keeping UX insights alive.

Exploring theory on networked design

3

3 Exploring theory on networked design

This chapter explores literature with the aim to ground the construction of a framework of networked human-centred design. For this construction concepts are sought that can assist in describing, understanding, and improving networked design. Previous chapters described how a practice of PSS design is organised, involving increasingly many actors from sides of design, product and service providers, and users. An important finding is that communication and interactions between these actors have become more complicated: PSS design has become working in networks of actors. It seems, connected networks of design, users, and product and service providers support human-centred design. However, the studies in the previous chapter have shown that it is difficult to build and maintain connections in and between different networks. The studies also have shown that it is difficult to bring insights, actionable for making design decisions, from a network of design to a network of organisation. Engagement with HCD, and understanding how to support networks in using UX insights in making design decisions, seem key aspects in networked HCD. This chapter seeks a deeper understanding of networked design in literature, to find a rationale how the insights of designers can also be actionable in other networks than the design network. This rationale aims to provide building blocks to construct a framework that serves as a lens to study practices of networked design in the remainder of the current research.

The motivations for the current research together with my prior knowledge in HCD[11] offered a point of departure for exploration of literature on networked human-centred design. In earlier research on HCD, theory on how designers think and work provided insights on what designers can do in an HCD process. In the current research, practitioners and academics have been sharing knowledge of innovation processes. This provided insights in what service design, understanding networks, and understanding values of actors contribute to understanding a networked innovation process. These insights lead to the expectations that literature in the field of design research and networked innovation would provide theory on networked human-centred design.

Method of exploring literature

The search for theory aimed to find building blocks to construct a framework of networked design. I explored the why behind mechanisms in networked design to find these building blocks by using a snowball method (e.g., Wohlin, 2014): references in a start set of papers were used to identify new papers to

11 I participated in 2009/2010 in a co-research project of Océ Technologies BV, P5 Consultants and the faculty of Industrial Design Engineering (Delft University of Technology): the 'Usability by Design' project. This project aimed at understanding and improving a User Centred Design approach in modern product development.

review. These start papers were sought in design and innovation literature, using the keywords emerging from the research question: PSS design, HCD, networks, and collaboration. The current research so far, and my involvement in earlier research on collaborations in HCD, already provided a small number of publications on HCD (e.g., Stompff et al., 2011), design thinking (e.g., Brown, 2008; Stickdorn & Schneider, 2010), networked innovation (e.g., Von Hippel, 2005) and a designerly[12] approach (e.g., Valkenburg & Dorst, 1998). With the start set of papers the explorations diverged into many directions; a large number of publications were identified as relevant for reading because the publications touched on a design process, HCD, collaboration, networks, and knowledge sharing. This preliminary identification of publications mainly aimed to include a wide range of concepts, and older and newer publications. Literature for detailed reading was selected on provided theoretical background and expected relevance of the theoretical concepts for the design practice in PSS design.

Finally, literature on the following theoretical concepts was further explored: social networks in innovation (e.g., Chesbrough, 2012), value networks in innovation (e.g., Vargo & Lusch, 2008), communities of practice (e.g., Wenger, 2010), action nets (e.g., Czarniawska, 2004), activity theory (e.g., Engeström, 2000), mediating artefacts (e.g., Ehn, 2008), sociology of translation (e.g., Callon, 1986), boundary spanners (e.g., Wenger, 2010), boundary objects (e.g, Star & Greizemer, 1989), participatory design (e.g., Ehn, 2008), and co-design (e.g., Eriksen, 2012). These concepts were, as expected, mainly found in the field of Design Research[13] and (networked) innovation. However, also another field of literature emerged: the field of Science, Technology and Society (STS) addressing theory on networked design. This field of STS, and the field of Design Research, seemed most relevant for understanding and articulate networked design from the perspective of design. In the field of innovation many publications were found that did not provide an understanding because theoretical concepts were only touched, without elaborating on the theory behind these concepts. Some of these concepts found in innovation literature were also, elaborately theoretical, discussed in literature in the fields of Design Research and STS.

As a next step, literature on network theory was consulted to develop a basic structure to describe networks. Introductory books on network theory (Newman, 2010; Barabási, 2016) provided a typology of networks used to classify the selected concepts as types of networks in a design process, and concepts of connections in and in between networks.

12 The term 'designerly' (postulated by Cross, 1982) was chosen to focus on literature on design as a discipline and practice in the broad field of literature on design.

13 Design Research is '*the study of and research into the process of designing in all its many fields*' (Cross, 2007). Most papers in the field of Design Research have been found in Design Studies, the interdisciplinary journal of Design Research published in cooperation with the Design Research Society.

Figure 3.1 shows the selected concepts of networks and concepts of connections in and in-between networks, and refer to their field of origin. Because some concepts have been found in the field of innovation and design research, or innovation and STS, and sometimes even in all three fields, the fields are depicted as overlapping. Concepts are depicted in those field they were found most frequent.

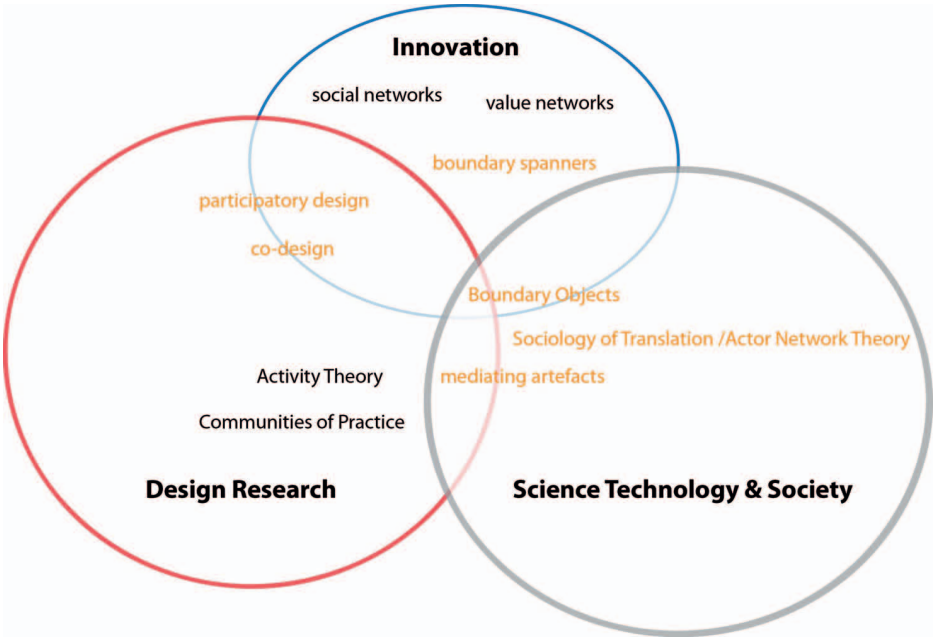


Figure 3.1: Concepts of networks (black print) in design and concepts of connections (orange print) in the (sometimes overlapping) fields of Design Research, Innovation, and STS. Some concepts were found in more fields, but more elaborate discussed in literature in one of these fields. E.g., the concept of boundary objects was found in all three fields but has been positioned in the field of STS because literature in this field provided a deeper understanding of the theory behind boundary objects.

In the following sections the selected concepts are reviewed on their relevance as building blocks to construct a theoretical framework of networked design. Concepts are relevant when they seem applicable to study a process of networked design and the role of designers in this process.

3.1 Concepts of networks in design

Newman (2010) and Barabási (2016) provide a typology of networks by differentiating specific nodes and connections between these nodes. They also provide examples of different types of networks, each type applied in related disciplines. Understanding the typology of a network offers methods for observing the phenomenon, and the description and analysis of the network concept, as applied in the related discipline. Basically, social networks represent groups of people with patterns of connections or

interactions between them. The discipline of social sciences provides methods to understand social networks. Social sciences have a long history of observing phenomena by inquiring about details of interactions (how often, with whom) between people to understand social networks. In networked design, a person collaborating in PSS development could be represented as a node and the connections between the nodes represent the collaborations between the persons. The description of networked design as the collaborations between networks of design, organisation, and experience (Chapter 2, Figure 2.12) resembles a group of people that is represented as a social network. The pattern, or network structure, of such a social network can be analysed to find which people are best connected (connectivity) or if and how people are connected to specific people (centrality). Such an analysis could help to explain what happens in the practice of PSS design and how to influence the practice (Brandes, Robins, McCranie, & Wasserman, 2013). The following discusses representations of networked design as social networks.

Social networks in innovation

The work on Open Innovation of Chesbrough (2006, 2012) and Von Hippel (2005) highlights concepts of social networks in innovation. Open Innovation is an approach where organisations collaborate with external resources (people and/or ideas) instead of relying on internal R&D, marketing, and sales departments. Chesbrough (2012) sketches the model of open innovation as '*designing and managing innovative communities*' and '*a process that makes more effective use of internal and external knowledge in every organisation.'* He proposes business models where technology is both in-sourced and out-licenced; when a company develops innovative technology but does not use it, this can be seen as a business opportunity instead of a spill over. Von Hippel (2005) uses a different business model of open innovation, representing a process where users as well as manufacturers are engaged in developing new products. In his model Von Hippel (2005) describes users who join in their innovation efforts as innovation communities. Both Von Hippel (2005) and Chesbrough (2012) identify aspects as exchanging intellectual property rights and knowledge sharing as the main influencers of collaboration in innovation. Concepts of open innovation, and the aspects identified, can be seen as social networks with nodes representing the (groups of) actors, and relations describing knowledge sharing. However, Von Hippel (2005) and Chesbrough (2012) do not provide a deeper understanding of how this knowledge sharing could be supported.

Another aspect of social networks found is a concept focusing on relations in social networks: the strength of weak ties (Granovetter, 1983). A weak tie is the less obvious connection between people who do not have much in common. Granovetter (1983) shows that a strong tie, mostly between people with a strong resemblance, predicts a better chance to get connected with people from different communities than a weak tie. However, the weak ties that are bridging heterogeneous communities lead to opportunities to provide

access to new information, knowledge, or skills. At first sight, this concept of the strengths of weak ties does not provide an understanding of networked design, other than it is a confirmation that collaboration between different disciplines could lead to more disruptive innovations. More significant for understanding networks, Granovetter (1983) concludes that the way ties are formed, is more important to analyse social life than a static observation of the network as it is at one point of time. The importance of how way networks develop and change indicates that networked design must be seen as an ongoing process.

Analysis of social networks could provide insights on, and for, networked design. For example, the research of Rowson, Broome, and Jones (2010) shows how complex service design projects might be understood with analysing a social network. As an example of how this works, Box 3.1 shows how mapping the connections in social networks and analysis of the map of connections provided patterns that helped understanding how social networks influence the design of health services (Parsfield, 2015).

Box 3.1: example how analysis of social networks could support service development

An example of social network analysis for service design can be found in the research project of the Royal Society for the encouragement of Arts, Manufacturers and Commerce (RSA). The research project is on how policy interventions can lead to the spreading of behaviours and values. In this project social connections in different (geographical) communities were mapped and analysed to understand how behaviours and values are spread through social networks (Rowson et al., 2010). Interviews provided information to describe a pattern in a network of a large quantity of names and the connections between these names. Relative connectedness and centrality of specific assets were explored and an understanding was gained how these assets were networked. For construction and analysis of the networks specific software was used. In-depth interviews were held to confirm the insights found by the network analysis and gain an understanding in the details of connections in real life. As a result, it was understood that the value of social relationships can be grown by connecting local people, and investing in interventions which build and strengthen networks of social relationships will generate social value shared by people in the community. This understanding supported the design of interventions (e.g., providing platforms for people to connect) to persuade specific behaviour in neighbourhoods that improved health and generated financial savings for health services (Parsfield, 2015).

The above-described concepts of social networks provide insights on how existing networks in design projects can be described and analysed. Concepts of social networks seem relevant for understanding networked design in general, however, to understand how designers can support networked HCD the concepts of social networks in innovation seem less relevant. The

empirical studies in the previous chapter, indicated that networked design can best be explained as a process. Granovetter's (1983) conclusion that understanding the ways networks develop and change is more relevant than understanding static networks, confirmed understanding networked design as a process.

The following describes concepts of value creation, communities of practice, and networks of actions and activities, and discuss how these concepts support understanding networked design as a process.

Value networks in innovation

The concept of value creation in social networks (e.g., Vargo & Lusch, 2008; Den Ouden & Valkenburg, 2011; Alle, 2008) describes networked design as a chain of actions. This chain of actions aims at increasing the worth of products and services. Value creation is creating better value for customers experiencing products and services, as well as creating economic value for the businesses involved and their shareholders. Vargo and Lusch (2008) put value creation at the core of PSS design with their concept of service-dominant logic (S-D logic). With S-D logic it is explained that in PSS design the emphasis should be on the services, it is the quality of the exchange of services that determines the created value for both customers and business. Networked design of PSSs is described as a social network with customers and business people collaborating in co-creating value (Vargo & Lusch, 2008). In a reaction on this model of value co-creation, Grönroos (2011) discusses the value co-creation process. With the argument that value for the customer is only created when a product or service is in use, Grönroos (2011) proposes a model where business value creation and customer value creation are separate processes that only coincide for a smaller part. Moreover, Grönroos (2011) confirms that this overlap where co-creation of value takes place in direct interactions between business and customers is the driving force in PSS design. Following Grönroos, networked design can be seen as a social network with two communities (customers and business) having strong connections in their interactions when co-creating value.

The previous chapter demonstrated that co-creation is an important phase in the practice of networked design. The publications on value co-creation, described above, confirm that the result of co-creation is a driving force in PSS innovation. However, a deeper understanding why and how the activity of co-creation contributes to networked design is still missing.

Den Ouden and Valkenburg (2011) address the complexity of creating added value in a networked setting: the values of many different stakeholders need to be addressed, different types of values are involved, and ensuring added value for all stakeholders is envisioned (Den Ouden & Valkenburg, 2011). In her Value Flow Model, Den Ouden (2011) distinguishes a core value proposition including end-customers, users, and those actors who directly exchange value

with customers or users. The Value Flow Model maps actors and transactions in nested fields, with at the centre the core value proposition surrounded by less important offerings. Actors have been described by their motivations, power concerning decision making, investments, and throughput time. This Value Flow Model describes transactions in a social network with actors connected through these transactions. These transactions are described as goods and services, money and credits, information and intangible values. By defining core offerings, complementary offerings, the supplying and enabling network, and other stakeholders in a PSS the network pattern is constructed. The construction of the model is used as an approach to design a PSS. Den Ouden (2011) advocates the use of the Value Flow Model in the PSS design team '*to help discussions and trigger the options for enrichment of the value proposition*' (p. 164).
The studies in Chapter 2 indicated that value mapping can be used to understand requirements and solution space of a new PSS, and communicate the insights that were used when making design decisions. The Value Flow Model serves as an example how to do value mapping and how the process of mapping supports to understand stakeholders and their connections in networked design. This understanding supports communication and collaboration, as the studies in the previous chapter indicated. The fact that the process, and result, of value mapping serves as an effective method for networked design triggers a curiosity about why this is an effective method and if this method would support making insights from one network actionable in another network.

Allee (2008) elaborated on the analysis of value networks with the focus on the conversion of intangible assets e.g., professional expertise. With the value network analysis Allee (2008) aims to support creating values from intangibles especially in knowledge economies. Allee (2008) describes a value network as: *'. . . any set of roles and interactions in which people engage in both tangible and intangible exchanges to achieve economic or social good.'* (p.6). This concept provides an understanding of relationships between actors in networks of organisation, design, and experience participating in a networked design process in different roles *'…in which they convert both tangible and intangible assets into negotiable offerings…'* (Allee, 2008, p.5). Following this description, experiences could be seen as an asset that can be negotiated to be used in making design decisions.

The above-described value network constructs can be seen as a social network with nodes representing roles in networked design and relations representing transactions through which deliverables travel through networks. The concepts of value-creation and the 'Value Flow Model' can be seen in a similar vein. Networks of nodes representing roles, and relations representing transactions or actions support an understanding of networked design. Thinking in roles and actions opens an opportunity to describe networked design as a process over time instead of a snapshot of characteristics of

people and their relations. Describing networked design as a process over time potentially supports understanding what can be done along that process to influence design decision making.

Communities of Practice, Action Nets, and Activity Theory are discussed in the following with an emphasis on their potential as concepts that support understanding how making design decisions can be influenced.

Communities of practice
A Community of Practice (CoP) is a network formed by practitioners who share an interest and together acquire expertise (Wenger, 2010). Wenger (2010) uses this concept to explain how one community can learn from another community. By crossing boundaries between practices, and sharing practices of different communities, people in a CoP are supported to acquire new expertise. Wenger (2010) proposes three ways to share a practice: people acting as brokers between communities, artefacts supporting connections between different practices, and interactions between people of different communities. The concept of collaborating CoPs suggests being a network of connected actions instead of a network of people as in social networks; Wenger's "sharing practices" are about connected interactions rather than connected people with specific characteristics. Sharing practices provides an interesting aspect to networked design: how brokers, artefacts, and interactions can support sharing ways of decision making in networked design.

Networks of actions and activities: Action Nets and Activity Theory
Czarniawska (2004) describes organisations as action nets; connected actions in an organisational process. She highlights action nets as a way of looking at organisations with the aim to understand what has been done, and how this is connected to other things being done in the same context. Czarniawska (2004) pleads for studying organising, instead of organisations. She understands '*actions as a movement or event, to which an intention can be attributed by relating the event to the social order in which it takes place*' (Czarniawska, 2004, p. 782). With this understanding of actions, a networked design project is a social order, system, or context in which design actions take place. In action nets, actions are connected to one and other, and because connected actions are often different, translations at connecting points are required (Czarniawska, 2004). The action net originates in the sociology of translation, a concept further described in section 3.2. Applying the concept of action nets in framing networked design supports the understanding of networked design as a process, with connected networks of designing, experiencing, and organising.

Miettinen (1999) studied technical innovations through the lens of a network of activity systems. He defines an activity as '*a hybrid composed of subjects, tools, the object of activity, division of labour, and rules*' (Miettinen, 1999, p. 175). Following Activity Theory (AT), Miettinen (1999) describes a local

activity system, or community of practitioners, as the basis node in an innovation network in order to describe innovation processes.

In a similar vein, Engeström (2000) used AT to analyse and redesign work. He describes an activity as the context of actions in a model of a human activity system (Engeström, 2000, p. 961). This model describes human activity as subjects performing actions with a specific outcome related to the object of the community of practitioners; available instruments (or tools, or mediating artefacts), the rules, colleagues in the community, and the division of labour between the colleagues influence the action of the subject. When problems occur in actions, because of disturbances or contradictions between action and elements of the activity, this can lead to changes in the activity: redesigning of work.

Kuutti (1995) used AT to frame Human Computer Interaction (HCI) with the aim to broaden the context of HCI in research. He stressed to take the context of interactions into account in doing HCI research and suggested to take an activity to describe this context. His model of an activity was based on the model of Engeström as described above. This model could be used to frame development as Kuutti (1995) described: *'Activity Theory is a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, both individual and social levels interlinked at the same time.'* (p.25). Following Kuutti, the PSS design process can be seen as two processes: PSS design and, at the same time, development of a human-centred approach in the practices involved. When seeing PSS design as two processes, designers have a role as PSS designer in a network of collaborating practices of designing, providing, and using a PSS, and designers could also take a role as developer of a human-centred approach in the practice of organising a PSS.

Figure 3.2 shows an adaption of the models applied by Engeström (2000) and Kuutti (1995). With the adaptions, I propose a model that specifically illustrates the practice of human-centred design. In human-centred design (HCD) the object is a human-centred design process, the subject is a designer who acts influenced by design tools (instruments), the team the designer works with (community) and how the roles are taken in the team (division of labour), the HCD approach and arrangements the team works accordingly (rules), and the outcome is a product fitting the user needs. Instead of a general context, now the importance of the context of design is emphasised. This model shows that influencing the context (e.g., bringing in new tools to keep UX insights actionable) opens an opportunity to influence how design decisions are made.

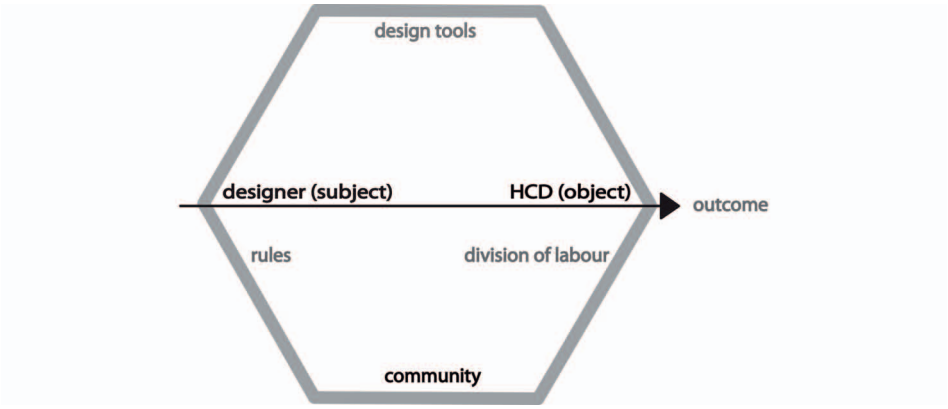


Figure 3.2: Model of human activity (adapted from Engeström, 2000; Kuuti, 1995) with a designer as subject doing actions with the specific object of HCD influenced by instruments or design tools, rules, community, and division of labour. The outcome is a product fitting the user needs.

The above discussion of concepts of social and action networks provided insights that support understanding the different networks in networked design. In summary: the concept of action nets provided understanding networked design as a process with connected actions, communities of practice provided the insight that sharing practices support sharing ways of doing actions (e.g., decision making), and activity theory provided the insight that activities form the context of actions. Activity theory also provided the insight that understanding the potential of changes in actions could lead to changing actions in an activity, or change the context of actions, and the insight that networked design concerns two processes: designing a PSS, and development of the PSS design process.

The following section discusses different concepts for understanding connections between networks: sociology of translation, crossing boundaries, boundary spanners, mediating artefacts, artefacts in participatory and co-design, and boundary objects.

3.2 Connections in networked design

One of the leading concepts to connect actors, actions and activities in innovation found is the concept of sociology of translation (e.g., Czarniaswka, 2004; Akrich, Callon, & Latour, 2002a, 2002b). Associated with sociology of translation are the concepts of crossing boundaries, boundary spanners, mediating artefacts, and boundary objects. This section discusses these concepts.

Sociology of Translation
Sociology of translation refers to the structure and functioning of translations that occur in a process of forming a network of humans and not-humans

who act towards a shared goal. The concept of sociology of translation was described by Michel Callon in his publication "Some elements of a sociology of translation: domestication of the scallops and the fisherman of St Brieux Bay" (Callon, 1986). He described the sociology of translation as an '. . . *analytical framework* [that] *is particularly well adapted to the study of the role played by science and technology in structuring power relationships'* (Callon, 1986, p.196).

Callon and Latour (1981) defined translations in their analysis of how sociologists describe society by classifying 'actors'. They stated that sociologists classify by taking the authority to combine characteristics of several actors in one 'typical' actor. They indicate that sociologists should do this in a more transparent way and make translations traceable following their definition of translations: *'Translations are all negotiations, intrigues, calculations, acts of persuasion and violence, thanks to which an actor or force takes, or causes to be conferred on itself, authority to speak or act on behalf of another actor or* force' (Callon & Latour, 1981, p. 279).

Actor-Network Theory (ANT)[14] explores networks in the mening of series of translations (Latour, 1999, p.15) as in the 'sociology of translation'. Latour (2005, p.132) uses the term network to designate flows of translations. This thesis uses both 'ANT'[15] and 'sociology of translation' to discuss translations as a concept to to make connections in HCD.

Translations aim at making connections in the form of establishing obligatory passage points (OPP) (Callon, 1986). At these points actors are forced to adapt their actions in order to make their actions connected to the other actions that suit the same specific goal. The use of the terms *obligatory* and *forced* may lead to understanding sociology of translation as a static predictable process. However, sociology of translation is a continuous process of making connections and adapting actions.The sociology of translation is a continuous process of making connections and adapting actions. New actors and actions will appear and require new translations and OPPs. Latour (2011) identified this as the essence of a network: '*the notion of a network is of* use *whenever action is to be redistributed'* (Latour, 2011, p. 797). Callon (1986) states that '*the notion of translation emphasizes the continuity of displacement and transformation….' (p. 18)*.

14 During literature review I noticed that some scholars interpret ANT as a Machiavellian approach where designers are involved in 'war and power struggles' (Steen, 2012, p. 74). In my opinion ANT refers to the ethics of design. Consequently, designers should consider how their design work influences the context of the projects they are working in.

15 Latour (1999) doubted on ANT as a clear name for the concept: *'…there are four things that do not work with actor-network theory; the word actor, the word network, the word theory, and the hyphen! Four nails in the coffin.'* (Latour, 1999, p.15). Later he stated: *'I was ready to drop this label for more elaborate ones like 'sociology of translation', 'actant-rhyzome ontology', and so on, until someone pointed out to me that the acronym A.N.T. was perfectly fit for a blind, myopic, workaholoc, trail-sniffing, and collective traveler.'* (Latour, 2005, p.9)

Building on ANT, Latour (2008) states that to design is to '*to draw together, to simulate, to materialize, to approximate, to fully model, to scale, what a thing in all of its complexity is*' (p. 9). Latour refers here to the aspect of ANT that an idea or object is always an assembly, the result of a flow of translations.

Dankert (2011) describes a translation as changing and moving of ideas, where Callon (1986) used the terms transformation and displacement. Figure 3.3 illustrates translation of using UX insights in making design decisions as an idea that is changed and moved from one action to another.

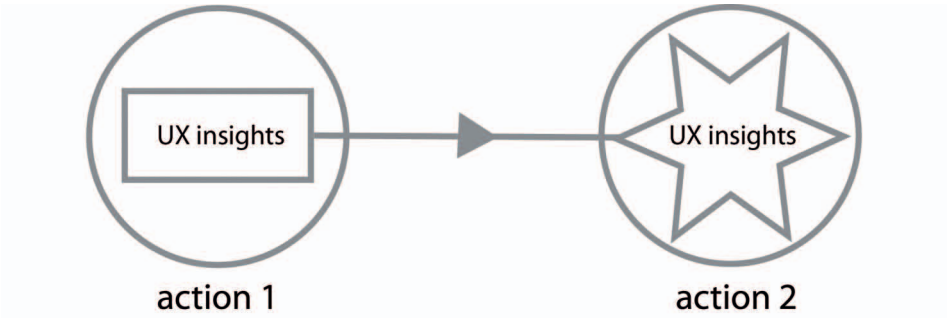


Figure 3.3: Moving and changing the form of the idea of using UX insights in making design decisions. E.g., in action 1 the UX insights have the form of video fragments to present results of user research, while in action 2 the UX insights have been transformed in test criteria for evaluating if user needs are met by specific solutions, the video fragments illustrate these criteria.

Both Callon (1986) and Latour (2005) perceive translations as a continuing process with different stages of connecting actants (human and non-human actors) to the network. Callon (1986) refers to stages of translation as the 'phases of translation', which are: problematisation, interessement, enrolment, and mobilisation. In his introduction to ANT, Latour (2005) uses the terms: perplexity, consultation, hierarchy, and institution. Latour (2005) describes the process of translation as a due process where both humans and non-humans could have a fair chance to influence the course of actions. In both described processes the stages include similar steps. With the example of scientists and fisherman Callon (1986) describes the stages as four 'moments' of translations as:

> *...(a) problematisation: the researchers sought to become indispensable to other actors in the drama by defining the nature and the problems of the latter and then suggesting that these would be resolved if the actors negotiated the 'obligatory passage point' of the researchers' programme of investigation; (b) interessement: a series of processes by which the researchers sought to lock the other actors into the roles that had been proposed for them in that programme; (c) enrolment: a set of strategies in which the researchers sought to define and interrelate the various roles they had allocated to others;*

> *(d) mobilisation: a set of methods used by the researchers to ensure that supposed spokesmen for various relevant collectivities were properly able to represent those collectivities and not betrayed by the latter* (Callon, 1986, p. 196).

When applying the process of translation to convince other actors to adapt a human-centred approach, problematisation can be described as the stage when actors (e.g., designers) define the nature and problems of other actors in order to suggest how these problems could be resolved by accepting using UX insights in design-decision -making. The stage of interessement is when actors search to convince other actors to accept their new role of applying a human-centred approach in their actions. Enrolment is the stage when actors endeavour to make that the proposed roles are taken, and roles and actions together support the process of making others apply a human-centred approach. When actors support other actors in representing user needs properly, and sustainably, they reached the stage of mobilisation; it is ensured that UX insights will be used in making design decisions.

The concept of translation focuses on '*a due process of collective action with a fair treatment of all actors, objects and interactions as potential mediators in translations that lead to reach a specific goal'* (Dankert, 2011). In innovation research this focus is mainly used to explain the role of technology in influencing development and implementation processes. Translation is used as a research method in this innovation research. For example, Akrich et al. (2002a) used translation as a method to reflect on innovation processes. Akrich et al. (2002a, 2002b) used sociology of translation through 'socio-technical analysis' as an approach to understand innovation processes. In this approach, they show how the active participation of many human and non-human actors is necessary for innovation, and how innovation concepts are adopted and adapted through multiple socio-technical negotiations. By 'just following the actors' they traced back the trajectory of an innovation (a new method, product, or idea) from the viewpoint of different actors and objects, and analysed what actors and objects were involved in translation and how translations took place without looking for explanations why things happened. The results of the case studies of Akrich et al. (2002a) were narratives describing translations in innovation processes in detail, emphasising that 'the inventor' does not exist other than as a network of humans and non-humans.

In another example, Dankert (2011) used the concept as a research method to understand how translations influence the implementation of policy in housing associations. In order to gather data that involve as many actors as possible, Dankert did elaborate document research (e.g., searching through archives of a housing association) followed by interviews with actors that were selected based on the document research. For analysis, he had put his findings in a chronological order. Not only did the chronology support comparison of cases, it also provided the basis for the narratives describing the role of translations

in implementation of policy and how these translations can be supported. These applications of the concept of translations indicate a potential of this concept as a method for understanding how UX insights can be made actionable in networked design.

In an attempt to describe translations in graphs instead off narratives, Latour (1992) uses the term 'program of action' to described how translations could change the intended action of an actor and the 'script' of artefacts. Latour (1992) makes a distinction between narratives and programs of action, because he feels that in narratives too much detail misses on what translations happened. Latour indicates that by precisely giving an account of actions, and what and how artefacts are involved, the mediating role of artefacts is better understood. In his example of a hotel key, Latour describes how a hotel manager has a program of action he wishes his customers would adapt: leaving a hotel key at the front desk of the hotel instead of taking the key with them when leaving the hotel. The hotel manager added different scripts to the key: from asking the customers for their key, to hanging signs on the wall with 'leave your key', up to attaching weights to the key. Ultimately, with attaching a large metal weight to the key the hotel manager succeeded in adding a fitting script to the hotel key: this key is inconvenient when you want to carry it with you. The new script leads to a new program of actions for the customer: leaving the key at the front desk. Changing programs of actions seem to be possible through actors and artefacts.

The examples of using translation as a research method show how networked design can be studied by precisely describing programs of actions, involved actors, and artefacts. Networked design has been described as a network of actions earlier in this chapter. The concepts of CoP and AT describe how networks of designing, experiencing, and organising can be conceived as networks with their own specific programs of actions. It also describes how crossing the boundaries of these networks seems necessary to change programs of actions in order to ensure a human-centred approach in a development project.

Crossing boundaries

Akkerman and Bakker (2011) endorse crossing boundaries of practices or activities as a way of learning. In their extended literature research for their review of educational research, they found that: '*A boundary can be seen as a sociocultural difference leading to discontinuity in action or interaction. Boundary crossing must not be seen as a process of moving from initial diversity and multiplicity to homogeneity and unity but rather as a process of establishing continuity in a situation of sociocultural difference' (p.133).* This rationale of boundary crossing supports understanding how different networks can learn from each other, more specifically how organisation networks can learn from design networks how to make design decisions. Actors in the networks could continuously improve their practices by learning how to do

this through crossing the boundaries of their activities.

Akkerman and Bakker (2011) also identified how boundaries can be crossed by people, artefacts, and by interactions between actors of different practices. Crossing can happen respectively by boundary spanners, mediating artefacts, and boundary objects. The following discusses these concepts.

Boundary spanners
Wenger (2010) proposes boundary spanners as one of the three ways to share a practice: people acting as brokers between communities. In the practice of PSS development boundary spanners are for example the product champions who manage a development process and closely collaborate with, among others, designers and suppliers of new technologies and different departments in the own organisation. The concept of boundary spanners supports understanding how the action of making design decisions in an organisation network can be changed: a boundary spanner learns how to use UX insights in decision making, and implements this in his own network.

Mediating artefacts
Different forms of mediating artefacts, with different mediating aims, have been described in literature. In AT, tools are seen as artefacts mediating actions (Engeström, 2000). Bodker (1998) designates representations in design as mediating artefacts in a design process aiming at supporting designers in communicating their ideas. Ehn (2008) describes mediating artefacts as 'things' with the aim to support participatory design; involving others then designers in the development process by designing things and interacting with these things together with other disciplines and end-users. Another, more general, description of mediating artefacts is used by Verbeek (2015) in his research on how technology influences society; for example, how a microwave oven could be seen as a mediating artefact that changed eating habits.
The concept of mediating artefacts supports understanding how artefacts in networked design can support influencing decision making through interaction with these artefacts.

Artefacts in participatory design and co-design
Chapter 2 provided the insight that co-designing happened in the practice of doing networked design. Similarly, Eriksen (2012) researched the role of artefacts in co-designing practices, and found that artefacts are not just a tool for participation but 'participating materials' acting in co-design networks. Through her research she established her view of '*materiality as an integral part of co-designing practice and situations*' (Erikson, 2012, p.255). As a result of her research, Eriksen (2012) formulated challenges for designers to adapt their practice of doing co-design. Some of these challenges are: to (co) design formats for staging co-designing (Eriksen, 2012, p. 391) instead of designing forms and proposals for others, to use tangible materials for collaboratively exploring and capturing issues, focuses,

questions and concerns of a co-design project (Eriksen, 2012, p. 397), and to format collaborative materialising of shared materialised insights (Eriksen, 2012, p. 405). These challenges form an addition to mediating artefacts: using artefacts as part of carefully prepared interactions, and assuring that co-created artefacts share insights in following interactions. This provides a possibility to keep UX insights alive through artefacts and interactions.

Related to this role of artefacts in sharing insights, is the concept of boundary objects.

Boundary objects
Boundary objects were introduced by Star and Griesemer (1989) as:

> *...objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site use. These objects may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognisable, a means of translation* (p.393).

The concept has been described within the context of translations. Star and Griesemer (1989) explain the role of (boundary) objects in translations as making the sets of translations coherent:

> *The coherence of sets of translations depends on the extent to which entrepreneurial efforts from multiple worlds can coexist, whatever the nature of processes which produce them. Translation here is indeterminate . . . there is an indefinite number of ways entrepreneurs from each cooperating social world may make their own work an obligatory point of passage for the whole network of participants (p.390).*

Applying this description to networked human-centred design leads to the understanding that criteria used in making design decisions can be made obligatory. This opens an opportunity to force actors to use UX insights when making design decisions.

Often boundary objects are mentioned as a knowledge-sharing-tool in design and innovation processes (e.g., Stompff, 2012; Carlile, 2002). Wenger (2010) mentioned boundary objects as mediating artefacts specifically aiming at connecting actions.
Star (2010) was concerned in how the concept of boundary objects has been interpreted: the aspect of interpretive flexibility is isolated from the dynamics and the entire system of boundary objects. In Star's interpretation

a boundary object can be ill structured when it resides between communities, some communities will work on the boundary object as a common object with a vaguer identity while other communities will make the identity more specific fitting the use in the specific (often not interdisciplinary) community. Communities working together without consensus, tack back-and-forth between the vague and specific identity of the object.

The different interpretations of boundary objects, as an artefact or as a system of artefacts, both describe boundary objects aiming at connecting actions. This underpins that for designing objects that could serve as boundary objects an understanding of the context of use of the object in actions is needed. Also, designing a boundary object does not solve communication problems without extra efforts. Akkerman and Bakker (2011) found that boundary objects can play an essential role in crossing boundaries, however, cannot provoke actions without supportive communication and procedures: *'Despite design intentions, it is stressed that boundary objects are only partially communicative and, therefore, can never fully displace communication and collaboration'* (p. 141). This indicates that when designing boundary objects, also communication and collaboration tools and methods are needed. Eriksen (2012) endorsed that boundary objects, or materials, have a connecting role in concert with people as boundary spanners and procedures of co-designing. She endorses that objects, people, and procedures are needed for establishing new shared practices when doing participatory design projects.

Some are convinced that boundary objects cannot be designed, e.g., Fujimura (1992) argues that boundary objects emerge and could not be engineered by a specific person or group; they are not designed but existing boundary objects are managed. As an example, Fujimura described how boundary objects emerged through describing the process of work of building a museum by Star & Greisemer (1998). Reflecting on past processes, as in other publications on translations (e.g., Akrich et al.,2002a; Dankert, 2011), seem to support that boundary objects emerge instead of someone proactively designing them. Although reflection on projects seems to provide clear descriptions of boundary objects, no examples have been found of objects created for future projects based on these descriptions. No literature has been found that describe the construction of boundary objects. However, Henderson (1991) argues that it is possible to design objects to serve as a boundary object, e.g., sketches can serve as boundary objects because they provoke interactive communication. Despite the discussion whether boundary objects can be designed or not, the concepts of mediating artefacts and boundary objects could be interesting as a building block for a framework of networked human-centred development. In the vein of AT, these concepts could support adapting actions of making design decisions and the context of these actions. The concept of sociology of translation can serve in this as an umbrella concept, with the concepts of boundary spanners, mediating artefacts, and boundary

objects as related concepts.

Other umbrella concepts, covering the discussed concepts, are social networks and networks of actions and activities. Social networks have networks of people in common, and cover the concepts of open innovation and value networks. Networks of actions and activities have in common that the focus is on interactions. These networks cover the concepts of communities of practice, action nets, activity theory, and boundary spanning.

From these umbrella concepts, networks of actions and activities, and sociology of translation seem more relevant for constructing a framework of networked human-centred design than others. However, clear selection criteria are still missing. Since the current research focuses on what designers can do, and the framework is used as a lens when inquiring designers on what they do and can do in the remainder of the current research, the framework should address the way designers work. Literature has been sought addressing designerly ways of working to understand how designers work. The following section discusses these designerly ways with the aim to find criteria for selecting concepts.

3.3 Designerly ways to support networked design

Literature in the field of design research addresses the designer's perspective in networked projects. Research was focused on the designerly ways of knowing (e.g., Cross, 2001), research on the practice and processes of design (e.g., Dorst, 2015), and the research on artefacts as a form of knowledge (e.g., Buchenau & Fulton Suri, 2000). These researches provide an understanding of how designers think and work and what a designerly way of networked design could be.

Designerly ways of knowing
In several publications Cross (e.g., Cross, 1982; Cross, 2001) provides arguments what makes design a distinctive discipline from e.g., humanities and sciences. Specific to the design discipline are '*the things to know, ways of knowing them, and ways of finding out about them.*' (Cross, 1982, p.221). Cross (1982) identifies five aspects of designerly ways of knowing: '*designers tackle "ill-defined" problems, their mode of problem solving is "solution focused", their mode of thinking is "constructive", they use "codes" that translate abstract requirements into concrete objects, they use these codes to both "read" and "write" in "object languages" (Cross, 1982, p.* 226*)*. Some 20 years later Cross (2001) concludes that these aspects are still relevant to describe design as a discipline. However, there is sometimes a need to borrow from other disciplines as sciences or the arts '*while building our own intellectual culture* [of design]*, acceptable and defensible in the world on its own terms'* (Cross, 2001, p. 55*)*.
This understanding of design as a distinct discipline with a specific culture,

confirms that a framework of networked design should address designerly ways of working.

The following describes one specific characteristic of a designerly way of working: reflection.

Reflective practice in design

Design scholars agree on the main characteristic of design as the ability to frame problems and find solutions at the same time in an iterative reflective way is (e.g., Dorst, 2015; Cross, 2004; Dorst & Cross, 2001; Buchanan 1992). The role of designer can be seen as that of a creative problem solver, simultaneously developing the problem and solution space when tackling a design problem (Dorst & Cross, 2001). As an example: Verbrugge (2012) characterises his approach as an experienced designer as 'creative reflection'. He builds on the methods of Roozenburg and Eekels (1995) in product design, developed and taught at the faculty of Industrial Design Engineering at Delft University of Technology. Designing is, in Verbrugge's (2012) view, a creative process within clear boundaries of the design problem. He uses the parameters technology, business, user, and semantics (the meaning the product or service radiates) to frame the design problem. In his view the designer interprets the information on these parameters and constitutes the essence of the design-problem. The designer creates solutions in an intuitive and holistic way, using the solution space bounded by the constituted design-problem. In an iterative process the designer reflects on his ideas for solutions using essential requirements defined by the frame and refines the requirements at the same time. When reflecting on ideas, the design skill of envisioning the ideas by sketches, models, and prototypes are crucial to review ideas. In his 'creative reflection' approach, Verbrugge (2012) emphasises the 'semantics' as an essential feature of design with a focus on usability aspects and the emotional or experience aspects.

In his research on the role of designers in a multi-disciplinary development team Stompff (2012) distinguishes designers from other members of the development team (e.g., software, electrical, and mechanical engineers) by the way designers frame the problem to be solved: holistically and from a user perspective. Designers interpret the work (information, knowledge, solutions) of others, and they create an image of how the user will interact with solutions and experience these. Stompff (2012) uses Schön's theory on the reflective practice to develop theory on his role as an industrial designer in a design team.

Both Stompff and Verbrugge ground their view on how designers work in their own practices as designers. This convinces that their view is relevant as a lens to study networked design. They characterise the role of design by interpreting knowledge and information in an intuitive way, defining the solution space by creating a series of solutions and reflecting on these. A

designer takes the user perspective as a main point of departure in iteratively defining the problem and solution space.

Another example of this iterative human-centred approach is "experience prototyping" where use of prototypes by researchers and designers support understanding user experiences, exploring ideas, and communicating concepts (Buchenau & Fulton Suri, 2000; Stompff, Smulders, & Henze, 2016).

Understanding the reflective practice as a main designerly way of working, provides two selection criteria for the concept: the concept should address a reflective approach and the use of artefacts for this reflection.

A designerly way of working is often seen as an example of how to solve complex problems. The following describes such examples and what selection criteria could be extracted from designerly ways of solving complex problems.

Designerly ways to solve complex problems
The way of working in designing is more and more applied to address complex (societal) problems (Friedman et al., 2014; Brown, 2008). The increasing complexity of designing due to the complexity of the problems and solution space is clearly described by the Design Council (Burns et al., 2006) in their concept of Transformation Design:

> *Transformation design asks designers to shape behaviour – of people, systems and organisations – as well as form. Because of this, its practice demands a high level of 'systems thinking': an ability to consider an issue holistically rather than reductively, understand relationships as well as components, and to synthesize complex sets of information and constraints in order to frame the problem (p.21).*

Dorst (2015) introduced Frame Creation as a possible approach to address *'...open, complex, dynamic and networked problems by creating a new broader context for the problem, and then concentrating on the emergence of underlying "Themes" that lead to the creation of "Frames" for action.' (p.26).* Without going into details of the 9-step frame creation process a lesson can be learned on how designers frame problems by involving various fields of practice: *'... design practitioners broaden the "system border" and then concentrate on understanding what is at play in this broader problem area. They use the richness of the artificially broadened context to understand context to understand the deeper issues and needs that are at play in the problem situation.' (p.26)*

The descriptions above indicate that a designerly way to solve complex problems is to apply a situated approach taking a broad context into account. This insight provides a third selection criterium: a situated approach.

Designerly ways of doing networked projects
From the exploration of "designerly", three characteristics of a designer's approach have been extracted that seem relevant for networked projects: a situated approach taking a broad context into account, the reflective practice of iteratively framing of the problem and solution space, and the creation and use of artefacts for reflection.

1. The situated approach of designers in networked design leads to gathering understanding of a broad context in which the networked process takes place. With this knowledge designers can support a networked human-centred process.
2. The reflective approach of designers in networked design can support designers in framing of problems and possible solutions for collaboration to sustain a human-centred approach.
3. The fact that designers create and use artefacts for reflection highlights the role of mediating artefacts in networked design.

These three characteristics are used as criteria to select relevant building blocks for a framework of networked design.

Designers' skills
Another aspect that could support constructing a framework of networked design is the skills of designers, the expertise they have in applying specific design methods and tools. Designers' skills influence how they gather knowledge about the broad context of the networked process, and how they create solutions for making connections to make networked design human-centred. I did a brief search for existing methods for human-centred design, in addition to the exploration of theory, to get an understanding of what these design skills include, and if existing design skills address networked design. For this search, platforms on HCD as the User Experience Professionals Association (uxpa.org) and publications at the faculty of Industrial Design Engineering have been consulted. With this small review of existing design methods, a preliminary overview of designerly skills that could be relevant in networked design is created.

Existing methods for human-centred design
Most methods are described in 'guidelines' for designers. In Table 3-1 an overview of found 'guidelines' is given. For each guideline, the aim and included methods/tools indicate specific design skills. Since only a small sample of available guidelines has been consulted, the examples only serve as an indication of what HCD methods and tools designers use. The overview illustrates the availability of a number of methods and tools for (user) research and designing.
Methods and tools for inspiring actors with user insights are available, but focus on people involved in the design teams. Examples are Personas (Pruitt & Adlin, 2006) where insights on user experiences are documented in the

form of representations of target users, and generative research (Sanders & Stappers, 2012) were user insights are brought by design researchers into the design process by actively involving stakeholders in the creation of solutions. Guidelines in the table address methods and tools that aim to support a designer in creating tools for collaboration and communication with users and the people directly involved in the design teams.

Table 3.1: Examples of 'guidelines' for (human-centred) design with methods and tools for designers (in random order).

'Guideline':	Aims at:	Includes methods/tools as:
The Field Guide to Human-Centered Design (IDEO, 2015)	Embracing human centred design: to design with communities, deeply understand the people (users) to dream up ideas and to create innovative new solutions rooted in people's actual needs. Introduce designing as the balancing act to what is desirable (human needs), feasible (technically possible to actually implement), and viable (business, financially).	Methods for Inspiration (e.g., framing, interviews, card sort, guided tour), Methods for Ideation (e.g., brainstorm, co-creation, role play), and Methods for Implementation (e.g., live prototyping, pitching).
Delft Design Guide (Van Boeijen et al.,, 2013)	Providing an overview of methods and tools to tackle design problems effectively and efficiently (learn by experience, reflect critically on chosen path and methods, adapt to specific situation).	Approaches to design (e.g., creative problem solving, vision in product design, brand driven innovation), and methods for discovering insights, evaluating design proposals, and simulation of use.
Inclusive Design (Clarkson, Keates, Coleman, & Lebbon, 2003)	Informing on principles, perspectives and methods and tools for inclusive design (designing for the whole population, including older and disabled people).	Observational research, assessment methods, empathic design, critical user participation.
Laurel, Design Research (Laurel, 2003)	Introducing design research methods and tools, how and when to deploy them effectively.	Traditional qualitative research (e.g., focus groups, ethnography), play as research, personas, and movie making.
Convivial Toolbox (Sanders & Stappers, 2012)	Introducing tools and techniques to bring people (users) into the design process to inspire and inform other stakeholders in the development process.	Planning, executing, documenting and analysing generative design research
This is Service Design Thinking (Stickdorn & Schneider, 2010)	Providing methods and tools for designing services.	Tools for exploration (e.g., stakeholder maps, service safaris, contextual interviews), tools for creation and reflection (e.g., what if, design scenarios), tools for implementation (e.g., storytelling, service blueprints)
The persona lifecycle (Pruitt & Adlin, 2006)	Providing methods and tools to keep user needs alive.	Creating effective personas, using personas to design products in every stage of the product development, and persona reuse in new projects.
Advanced Design Methods for successful innovation (De Bont et al., 2013)	Helping organisations adopt advanced design methods.	Participatory design, scenario- based design, brand driven innovation, and value framework.

In networked design, also supportive methods are needed for collaboration and communication with others than those participating in design teams.

HCD methods providing this support have not been found in the guidelines in the table. The methods and tools in the guidelines operationalise the three found characteristics of situated approach, reflective approach, and use of artefacts. Accordingly, the overview does not provide new characteristics of a designerly approach relevant for constructing a framework of networked design, other than the three already found.

However, by using the methods and tools in table 3.1, designers use and develop skills for collaboration and communication that could be relevant in networked design as e.g., prototyping and storytelling. Next steps in the current research provide insights on relevance of skills and where, what, adapted and/or additional skills are needed. The first of these next steps is the construction of a framework of networked design. The following section selects concepts which are used to construct a basic framework of networked design.

3.4 Selection of concepts

The current research aims at constructing a framework of networked human-centred design from a design perspective. The research also aims at serving the design practice by applying the framework for the development of tools for designers. For constructing such a framework, a selection of the concepts discussed in this chapter serve as building blocks. The designer's perspective in networked design informs this selection of concepts. The previous section, on how designers work, provides an understanding of the reflective practice of designers and how designers solve complex problems. This understanding led to characteristics that describe a designer's perspective in networked design: reflective, contextual, and artefactual (p.75). These characteristics form criteria to select concepts by describing how the concept is compatible with how designers work. This leads to the following criteria:

- Contextual: does the concept support taking a broad context into account?
- Reflective: does the concept fit iteratively framing problem and solution space?
- Artefactual: does the concept provide a possibility for creating artefacts that could serve as mediating artefacts?

In the following the umbrella concepts of social networks, networks of actions and activities, and sociology of translation are discussed using these selection criteria.

Social networks

The concept of social networks, covering open innovation and value networks, seems to focus on knowledge exchange in development processes and characteristics of people already involved in the development process. The concept seems not to support to understand the broader context of new

and future development projects. This makes the concept less contextual. The concept of social networks seems to focus on developing knowledge of people's characteristics as values and knowledge they bring into innovation. A designer's role as facilitator of using this knowledge in networked design and designer's skills of iteratively framing a problem and solution space seem less relevant in the concept of social networks. Also, social networks focus on people; there seems no role for mediating artefacts in this concept. In summary, social networks do not meet the criterium artefactual, and only partly meet the criteria reflective and contextual.

Networks of actions and activities
In networks of actions and activities the focus is on interactions and how one action influences other actions in the network. These networks cover the concepts of communities of practice, action nets, activity theory (AT), and boundary spanning. The concept of AT provides a broad context for developing ways of working in networked design projects. AT looks at networked design as two concurring processes: designing a PSS and developing the PSS design process (Kuutti, 1995). Developing the PSS design process provides a role for designers in developing a human-centred approach in networked design. Networks of actors and activities provide iterative framing problem and solution space through its focus on learning by crossing boundaries. Also, the concept of networks of actions and activities include a role for mediating artefacts. In activity theory mediating artefacts have a role in describing contexts of actions, without going into creation of these artefacts. The artefactual criterium seems not fully met because of this more passive role of artefacts in the concept. In summary, networks of actions and activities meet the criteria reflective and contextual, and partly meet the criterium artefactual.

Sociology of translation
The concept of sociology of translation, covering boundary spanners, mediating artefacts and boundary objects, seems to pass all three criteria: there is a focus on building a network by influencing actions in a broad context of actions and activities, problems and solutions are framed iteratively in the process of translations, and artefacts have an active mediating role in building a network of actions that together form a networked design process.

Table 3.2 provides an overview of the selection of the concepts for constructing a framework of networked human-centred design, the three plusses indicate that the umbrella concept of sociology of translation fits the selection criteria best.

Table 3.2: Summary of the selection of concepts using the design criteria contextual, reflective, and artefactual. In the right column the cumulative score of the relevance, as designated in the middle columns for the three provide an indication what concepts to select. The umbrella concept of sociology of translation seems most relevant for constructing a framework of networked human-centred design.

Concept	Contextual	Reflective	Artefactual	Relevance* C R A
Social networks open innovation value networks	Focus on knowledge exchange and characteristics of people involved in the context of the development process: +/-	Focus on framing solutions to add value iterated with framing problems: +/-	No clear role for mediating artefacts: -	+/- +/- -
Networks of actions and activities communities of practice action nets activity theory boundary spanning	The context of actions where actors are involved in is taken into account in understanding collaboration: +	Focus on learning by crossing boundaries, iteratively recognising problems and find solutions: +	Artefacts part of describing contexts of actions and activities: +/-	+ + +/-
Sociology of translation boundary spanners mediating artefacts boundary objects	Focus on building a network by influencing actions in a broad context of actions: +	Framing problems and solutions iteratively: +	Artefacts have a mediating role in building the network: +	+ + +

*** Relevance indication: indicators in order of the criteria Contextual, Reflective, and Artefactual: + relevant, +/- some relevance, - not relevant**

Sociology of translation provides an understanding of how insights from one action can be made actionable in another action. Identification of boundaries of a specific network of actions (e.g., networks of designing, networks of organising, and networks of experiencing) provide an understanding when, and how, boundaries are crossed. Networks of actions and activities do provide this understanding. Activity theory (AT) provides an understanding of a networked design process as connected activities, with each activity covering a network of actions.

Considering the above arguments, sociology of translation and AT are selected as the building blocks to construct a basic framework of networked design in the next section.

3.5 Framing networked design as sociology of translation

Chapters 2 and 3 provide basics that can be used to frame networked design in such a way that the research question on the role of designers in networked design can be addressed. Exploration of practice provided the insight that engagement of actors in the collaborating networks is needed for adapting new ways of making design decisions. Designers need an understanding of

networked design to support this engagement, communicate insights, make insights actionable, and convince others to use specific insights in making design decisions. Exploration of theory provides AT and sociology of translation as a rationale behind the way designers communicate and convince.

With AT, a subject is doing actions to reach a specific activity's objective. The subject does these actions in collaboration with a community of people with activity specific roles and rules, and using activity specific tools. Subjects can change these specific roles, rules, and tools, with what they learn in actions outside the boundaries of an activity. Translation supports the learning outside the boundaries of an activity.

The concept of translations provides an explanation how designers make their approach (e.g., using a UX insights in decision making) a shared approach and implemented in different activities in networked design. Designers can support translations by creating mediating artefacts and boundary objects, and applying these artefacts in interactions aiming at supporting subjects from other activities to learn to apply and implement a specific design approach.

Connecting the building blocks AT and translations, constructs a concept of networked design. Figure 3.4 illustrates this concept: subjects in an activity learn by crossing the boundaries of the activity and participate in a boundary action.

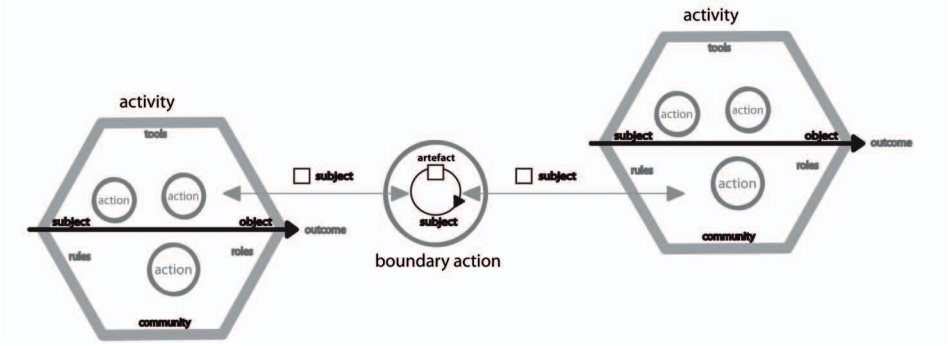


Figure 3.4: A concept of networked design: subjects of different activities cross the boundaries of their activities (hexagons) to interact in a boundary action. In the boundary action, subjects interact with artefacts (square). These artefacts support them in applying what they have learned in the actions, to change their actions in their activity. In networked design, designers are subjects in an activity of design, and bring in artefacts in boundary actions. Subjects of an other activity interact with these artefacts in the boundary action, and bring these artefacts into their activity. Through the artefacts and boundary interaction, designers support subjects from other activities to change their way of making design decisions.

In this boundary action they learn how they can change the way they do their actions in an activity, e.g., making design decisions. Designers can influence the learning by facilitating translations in boundary actions. In the boundary action designers can provide interactions with artefacts that support the subject of an activity to change the way of making design decisions in an activity. Subjects in an activity learn through their interactions with artefacts in boundary actions. These subjects bring the artefacts into the boundaries of their activity to apply what they have learned, and adapt actions in their activity.

Chapter 4 elaborates upon this concept to create a framework of networked design, particularly focusing on human-centredness in networked design and keeping UX insights alive through translations. The developed framework describes the forming of a network, and linking activities of design, organisation and experience, by supporting a process of keeping UX insights alive through tranlations. The framework defines networked human-centred design as: **A design process in which UX insights are translated in order to assemble designers, experiencers, and organisers in considering UX insights in design decisions.**

Chapter 4 also operationalises this detailed framework of networked human-centred design into a mapping method for observing how designers can support translations in the practice of networked design.

Framing networked human-centred design

4

4 Framing networked human-centred design [16]

This chapter elaborates upon the general concept of networked design constructed in the previous chapter, to develop a framework of networked design with a focus on human-centred design. The concept of networked design has been grounded in the practice and theory of networked design. Exploration of networked design projects and literature on networked design showed that networked design can best be understood as a process of connecting actions. In these actions actors and artefacts interact to reach the goal of the action. The exploration in the previous chapters also showed that designers can have a role in connecting actions by creating and using artefacts for collaboration and communication. The current chapter focuses on how to keep UX insights alive and supports further exploring designers' roles in networked human-centred design (NHCD).

The following sections describe the resulting framework of NHCD, using the elements of networked design described in the previous chapter: Activity Theory, Translations, and Mediating Artefacts. Activity Theory supports understanding the actions in an HCD project and how designers can influence these actions. Translations explain the rationale behind influencing actions and the role of mediating artefacts, in particular boundary objects in NHCD.

4.1 Keeping UX insights alive through translations

The previous chapter introduces the concept of translation that describes how designers can bring UX insights from one action into another in a networked design process. It forms the basis for framing a designers' role in networked human-centred design. Originators of the concept of translation, Callon and Latour (1981), describe translation as actors doing actions that make these actors representing another actor or force. In networked human-centred design (NHCD) the use of UX insights in making design decisions needs representation in actions where decisions on design are made. A designers' role in NHCD is then to make UX insights represented. Through such a representing action, other actors are stimulated and supported using UX insights in making design decisions.

Translations

Translations in an HCD project can be seen as a process of including humans and non-humans in a network of actions where UX insights are used in making design decisions. UX insights are translated step-by-step from the start of a design project when designers gain first UX insights to assemble such a network of actions. Callon (1986) described this step-by-step translation

16 This chapter is partly based on the conference paper: Henze, L., Mulder, I., Stappers, P.J. (2013) *Understanding networked collaboration: fields and patches of interactions*. Conference proceedings of the IEEE International Technology Management Conference & 19th ICE Conference, The Hague.

process as a continuous displacement and transformation. In a NHCD project this step-by-step process describes how UX insights continuously move from one action into another, transported by actors and artefacts, and transform design-decisions-making by the form UX insights appear in the actions they move into. Finally, different actors mobilise UX insights in those actions where design decisions are made and UX insights are enabled to be used in those actions. UX insights appear differently in different actions depending on the design phase and who are involved in the actions (Figure 4.1).

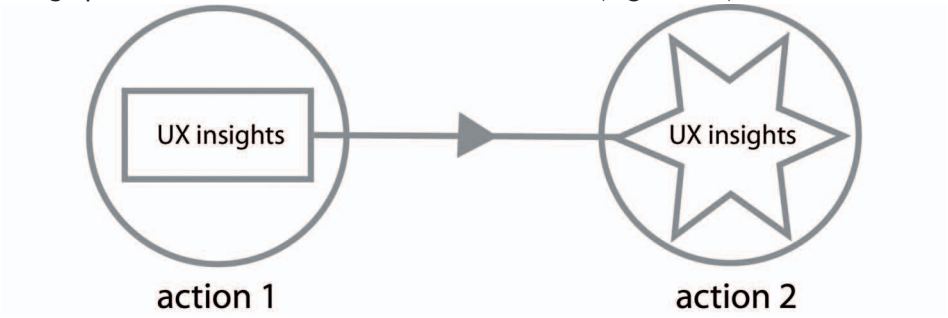


Figure 4.1 UX insights are translated by changing place, moving them from one action into another, and change the form fitting the action they are moved into. E.g., in action 1 the UX insights have the form of video fragments to present results of user research, while in action 2 the UX insights have been transformed in test criteria for evaluating if user needs are met by specific solutions, the video fragments illustrate these criteria.

Here is a role for designers in NHCD: supporting translations by creating artefacts and propose interactions that enable a better representation of UX insights in different actions. These interactions and artefacts stimulate the use of UX insights in actions where design decisions are taken. In other words, designers support assembling a network of actions by providing artefacts and interactions that make UX insights being used in these actions.

Process of translation

According to Callon (1986) translation is a process, never a completed accomplishment. The translation process can be seen as a continuing process where translations take place in different stages of connecting human and non-human actors to a network (Callon, 1986; Latour, 2005). In a translation process Callon (1986) distinguishes four moments he refers to as: '*problematisation, interessement, enrolment and mobilisation.*' These four moments are adapted to suit a process of translation in NHCD, resulting in the following four stages:

1. identify problems and solutions: designers define a problem and solution space for the creation of artefacts that could support translations.
2. trigger actors to use UX insights: actors are encouraged through interactions and artefacts to use UX insights
3. engage others in using UX insights: actors are supported to actually use UX insights
4. establish using UX insights in making design decisions: actors are supported to use UX insights as a routine when making design decisions

The left column of Table 4.1 shows Callon's description of moments of translation. In the right column the corresponding four stages applied in the process of translation in NHCD are shown.

Table 4.1: Stages of translation of UX insights following Callon's moments of translations

Moments of translation (Callon, 1986)	Stages of translation in NHCD
Problematisation: [researchers] defining the nature and problems of other actors in order to suggest how these problems could be resolved by accepting a specific 'obligatory passage point' [using researchers' programme of investigation]	Identify: [designers] understanding the actions where UX insights are moved into in order to propose or create a form that make UX insights obligatory to use [in making design decisions]
Interessement: [researchers] search to lock other actors in proposed roles	Trigger: [interactions and artefacts] encourage the actors involved in an action to use UX insights in their decision making
Enrolment: [researchers] search to define and interrelate various allocated roles	Engage: [interactions and artefacts] support actors to use UX insights in decision making
Mobilisation: [researchers] ensure representations	Establish: [interactions and artefacts] support actors to use UX insights as a routine in making design decisions

The next section constructs a map of actions in a NHCD project to get an overview of actions where these stages of translation happen.

4.2 Activities and actions in human-centred design

The literature review in Chapter 3 informed that networked design can best understood as connected actions. The perception of networked design, at the start of the current research, has been a collaboration between actors in three connected networks. These collaborating networks has been described as a network of designers, a network of experiencers, and a network of organisers. Activity Theory supports transformation of these networks of actors into connected actions of designing, experiencing, and organising. Activity theorists have been using the concept of activity to study human practices as development processes; processes where people develop their knowledge and skills through practice. Accordingly, Engeström (2000) applies Activity Theory to construct a model of human activity that forms the context of actions. With this model he explained how through learning in actions activities always are changing and developing (Engeström, 2000). Engeström's description of activity provides a basis for the construction of a map of relevant actions in a human-centred project. By drawing a landscape of activities in an HCD project the context of the actions in such a project can be described. In this landscape activities are visualised as designated

fields in a human-centred project, and actions can be positioned in and in between these fields. In the following the elements activities and actions in the landscape of an HCD project are described.

Activities in NHCD: context of actions

In Engeström's model, an activity concerns an objective oriented 'doing' by subjects (or actors) who are part of a community while available tools, rules and a division of labour, mediate the 'doing'. In an HCD project the goal of activities are related to PSS design. Transformation of the three original networks of actors in activities results in an activity of design, an activity of organisation and an activity of experience. In these activities the subjects are actors involved in creating, providing and experiencing products and services respectively. The object of an activity of design is creating a PSS solution providing a good user experience. An activity of organisation has the object to manage producing and providing a PSS, this provided PSS is experienced in an activity of experience. In an HCD project outcomes of the activities of design and organisation are products and services fitting the user needs. These outcomes are realised with the help of design and organisation tools (or artefacts) to support actions. The division of labour (or roles) of actors in an activity, and the rules applied in the activity, form an explicit and implicit standardisation of actions in an activity (see Figure 4.2). Both actors and artefacts influence a desired outcome of an action.

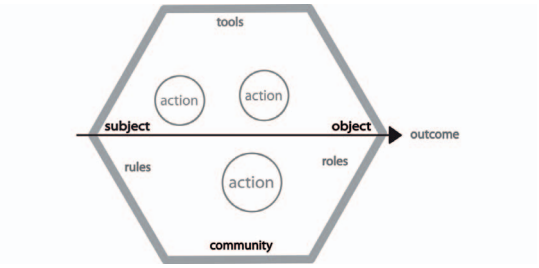


Figure 4.2: Basic structure of an activity (adapted from Engeström, 2000) as the context of actions (in the grey circles) with a subject of an activity (e.g., designers), an object and outcome of an activity (e.g., a product or service) and a community (e.g., other designers). In an activity tools, rules and roles mediate actions.

A learning process of actors in an activity to adapt their actions in an activity, as Mietinen (1999) described, involves actors identifying problems in achieving the object of an activity by reflecting on their actions and solve problems by adapting tools, rules, and roles in an activity. For example, when an actor cannot find tools the actor needs for a specific action, the actor can introduce new tools and change actions in the activity. Or actors learn about new roles in interactions that trigger these actors to introduce these roles in future actions in order to improve future actions' outcomes. The learning mechanism of identifying problems, and solving these problems by adapting tools, rules, and roles, opens an opportunity for translations. Translations support changing actions of making design decisions. When designers get an understanding of

actions in an activity and how mediators (e.g., in the form of tools) influence these actions, they can support actors to change activities and bring UX insights into making design decisions in these activities. A map of actions provides an overview of what actions occur where in a NHCD project, a first step in understanding actions.

Together the activities of design, organisation, and experience form the basic map or landscape of where actions in an HCD project take place (see Figure 4.3).

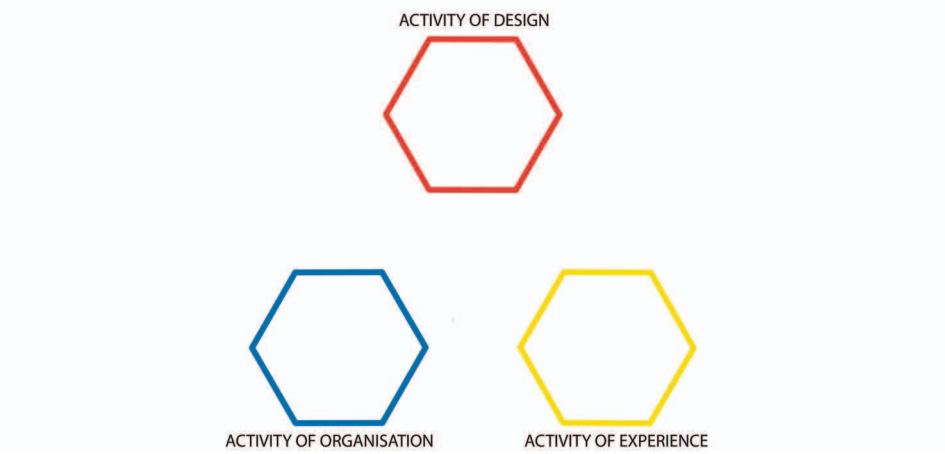


Figure 4.3: The activities of design, experience and organisation form the basic fields in the landscape of a human-centred development project.

Actions, actors and artefacts

The previous section described an HCD project as actions taking place in a landscape of activities. The activities form the context of actions, by the tools, rules, and roles in an activity that influence action's outcomes. The concept of Mediating Artefacts describes how artefacts can influence the outcomes of actions as much as the actors participating in that action can. Understanding the influence of actions, actors, and artefacts in NHCD projects provides guidance to study the role of a designer in NHCD.

In a design project a broad range of mediating artefacts can be found in actions, e.g., presentations in meetings, tools in workshops, and prototypes in tests. The actors (e.g., product manager, designer, user) and artefacts involved in actions influence the outcome of these actions. In a design project each action has a specific aim, with artefacts and actors playing an equally important role in achieving this aim. Thus, an action can be defined as actors interacting with other actors and artefacts, with a specific aim (see Figure 4.4).

Figure 4.4: The circle visualises an action with actors (the white silhouettes of people) interacting with each other and/or with artefacts (the coloured squares) in order to reach a specific aim. Actors and artefacts play an equally important role in achieving the aim

In a design project the aim of an action could be single or multiple. An example of such a single aim is to create a prototype. Deciding in one meeting on which concept to develop, what next steps to take in the project, and what target group to focus on is an example of multiple aims in one common action in a design project.

An actor or artefact can be involved in different actions, and can have different roles depending on the action involved in. Consequently, actor's and artefact's roles can be defined by what they do in actions they participate in. For example, any actor creating solutions in a co-creation workshop has a designing role independent of this actor's profession or education. The following overview provides roles and actions as found in human-centred design projects in the studies in Chapter 2.

Table 4.2: Roles and actors found in human-centred design projects

Role:	What the actor with this role does (tasks):
Designing	do research, define problem and solutions space, generate product and service solutions
Engineering	develop technical components of products
Software developing	develop software to support interactions
Marketing	research markets, and address potential consumers for products and services
Manufacturing	producing products
Sales	selling and delivering products and services
Product management	synchronise and connect design, engineering, software development, marketing, and sales
Using	experiences products and services in use

These roles were observed in the studies 1 - 4. New roles, or new tasks designated to specific roles, are expected to be found when studying networked design projects through the lens of translations.

A map of NHCD

With activities and actions, that take place in a NHCD project, a project's landscape can be mapped, Figure 4.5 shows such a landscape. The projects studied in Chapter 2 demonstrated that in a NHCD project designers have interactions with colleague designers, and with actors who are subjects in activities of experience or organisation. Designers have these interactions when they have meetings, workshops, or co-create with users and their clients. Meetings and workshops in an HCD project are actions that differ in aim, and take place in or outside the boundary of an activity. Inside the boundaries these actions are: actions of designing, actions of organising, or actions of experiencing. Actions outside the boundaries of an activity are referred to as boundary actions; these actions are not part of a specific activity but take place where actors of different activities participate.

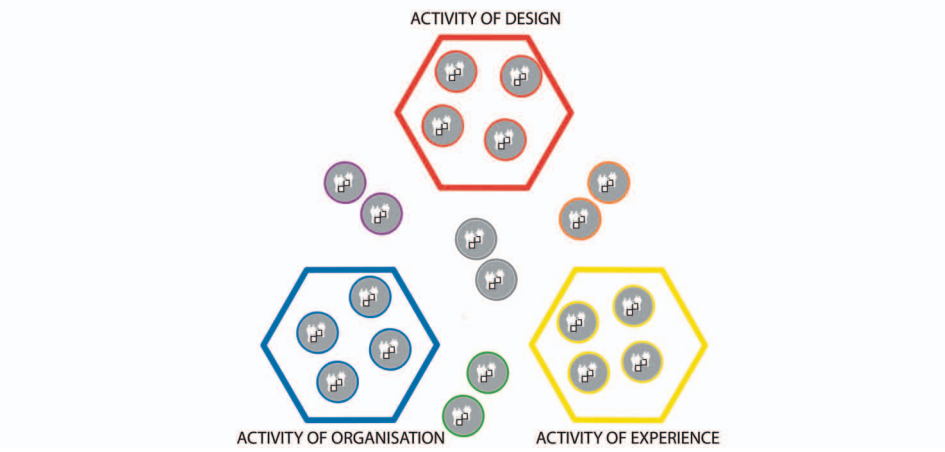


Figure 4.5: The landscape of a human-centred design project formed by the field activity of design with actions of designing, activity of experience with actions of experiencing, activity of organisation with actions of organising, and boundary actions in between these fields. The colours of the boundary actions are a mix of the colours of activities, e.g., a boundary action where experiencers and designers participate is orange (mix of yellow and red).

The elements in the landscape are described in detail in the following. An example from the case of the coffee-machine development from Chapter 1 illustrates each element of the map to make the descriptions less abstract (see boxes 4.1 – 4.8).

Box 4.1: Case of the coffee-machine

In the case of the coffee-machine, the user experience of a coffee-machine was improved through redesign of the user-interface of the coffee-machine. The redesign started after user research revealed problems with an existing machine, designed for professional use, used in the setting of a self-service restaurant. The problem to be solved was that the machine was not self-explanatory enough for the use in a self-service context. With the redesign the problem was solved and the product manager assured that UX insights were used in new developments and that concepts were tested with users. However, using UX insights in making design decisions seemed not to sustain in the coffee company. After the product manager retired, his colleagues have not been applying his human-centred approach. They returned to the company's traditional way of making design decisions informed by consumer insights, and testing concepts on people's buying intentions instead of user experiences in use.

Activity of design

In the context of networked human-centred design, the object of an activity of design is to create PSS solutions providing a good user experience. Accordingly, the outcome of the design activity is a product or a service. Designers are subject in an activity of design, using design tools and working in a team of designers with different specific design skills and roles. As Chapter 3 showed, the way of working in an activity of design is reflective (e.g., Buchanan, 1992), leading to specific actions of designing as interpreting of knowledge and information in an intuitive way to define problems and create solutions. Designers create a series of solutions and use these solutions to reflect on the problem definition and in that way iteratively design solutions. In a human-centred development project a designer gains, and uses, UX insights to define problems and solutions.

Box 4.2: Activity of design in the case of the coffee-machine

In the case of the coffee-machine the designer (subject) aimed at designing a self-explanatory user interface (outcome). The designer worked together with his colleagues to define solutions, and worked together with design researchers to gain UX insights and define problems (community). The designer and his colleagues used design tools to draw and prototype solutions. In the activity of design, actors who work on the coffee-machine aimed at designing a new interface. The designer used tools available in the design agency and worked in a team of other designers with specific research, product design, model making, drawing, and engineering skills (rules). The designer owned a small design agency, and was responsible for the outcomes of the activity of designing. He had the role of senior designer both doing design and coordinating the actions of his colleagues (roles).

Actions of designing

The tools the designers use, the way of working, or rules, in the design team, and the role of the designer in the team influences the actions of designing.

Examples of actions of designing are framing the problem and solution space, generating ideas, prototyping etc. Because designers bring UX insights in the activity of design, knowledge of actions of designing provides insights on what designers can do to support translations and bring UX insights in other actions.

Box 4.3: Actions of designing in the case of the coffee-machine

The user researchers shared the results of their user research with the designer, and provided (video) reports for the design team of the coffee-machine. With the UX insights the designer and design researchers framed the problem and solution space. The designer created solutions and made prototypes of these solutions with the help of colleague designers. The prototypes were provided as a look and feel model for discussing the specifications of the final design and for concept testing. In the case of the coffee machine the design researcher brings in UX insights in the activity of designing by sharing and discussing user research results and together with the designer frame a problem and solution space. The designer brings in the look and feel model for discussing and testing the UX.

Activity of organisation

An activity of organisation involves subjects (e.g., a product manager) with the objective to bring the products and services of a PSS into the market, and to manufacture, market, and maintain these PSS elements using management and production tools. The subjects are working in teams of managers and/or operators with specific management and operational skills, and ways of working specific for the industry involved. Understanding the activity of organisation in a specific design project provides knowledge of the context of the actions of organising where UX insights are to be used.

Box 4.4: Activity of organisation in the coffee-machine case.

The product-manager is subject in the activity of organisation in the coffee-machine case. This manager aims at manufacturing coffee-machines that increases the sales of a specific coffee-product. The object of the activity of organisation in the coffee-machine case is selling several coffee-products e.g., roasted coffee beans, ground coffee and liquid coffee concentrate. The outcome of the activity is the delivery of these coffee-products in the form of coffee solutions, e.g., a specific coffee-machine or a complete coffee corner. The product-manager works in a research and development team with colleagues with skills in marketing and sales of coffee and coffee-machines and skills in brewing coffee. The tools they use are digital tools for research and analysis, and analogue tools as white boards for team discussions. The role of the product-manager in the activity of organisation is to coordinate the design and manufacture of coffee-machines that dispense a specific coffee-product. In this role he is leading a project team with engineers and marketeers. He introduced the rule that new interfaces should be tested on usability; 90% of the users should be able to use the machine without problems.

A colleague in the role of marketing manager leads the team that is responsible for market research, and bringing a coffee-product, and different dispensers for that product, to the market. Another colleague is responsible for managing service and maintenance of the dispensers of all coffee-products. In regular meetings the different managers synchronise the actions of their teams in order to meet business targets and project planning.

Actions of organising

The actors involved, the tools the actors use, the way of working in the management or operational team, and the role of the manager or operator in the team determine the outcome of the action. For example, a product manager depends on available management tools as databases and software for analysis, and has to take international safety standards and available technological possibilities into account when making design decisions. With an understanding of these actions, it becomes clear how design decision making in these actions can be supported.

Box 4.5: Actions of organising in the case of the coffee-machine

The product manager in the coffee-machine case participated in actions of organising that were directly related to the redesign project, and in general actions in the activity of organisation. In the redesign project these actions were mainly meetings with other actors in the project to discuss requirements of the coffee-machine and to plan actions in the redesign project. The product-manager used the reports and presentations from the designers and his colleagues, and his own notes, to prepare these meetings.

Activity of experience

The field of activity of experience is framed as a user, looking for good user experiences when using products and/or services.

Box 4.6: Activity of experience in the coffee-machine case

The users of the coffee-machine are subjects in the activity of experience with the object to enjoy a good cup of coffee. For experiencing coffee, the tools available in the activity are the coffee-machine, cups and other supplies as e.g., coffee-spoons. Other actors in the activity of (coffee) experience are people in the environment where the coffee-machine is placed (e.g., restaurant, coffee-corner at work etc.). Rules in this activity are e.g., that the users have to pay for their cup of coffee or are allowed to use other cups than provided at the counter.

Actions of experiencing

The products and services the user uses, and the context of use (other products and services, community, rules, and roles) determines the actions of the user. With an understanding of these actions of experiencing, designers can gain UX insights they bring in in actions of designing and boundary actions

Box 4.7: Actions of experiencing in the case of the coffee-machine

Experiencing the coffee-machine involves all interactions with the coffee-machine, from the moment the user recognises the machine as delivering coffee, to the moment the user understands what to do in order to get a cup of coffee up to the moment the user taking the filled cup from the drip-tray.

Boundary actions

These actions differ from the previous actions that take place within a specific field of activity providing the context of the actions. Boundary actions take place in a combination of contexts from different activities. In a NHCD project a boundary action is where subjects from different activities exchange experience, knowledge, and skills. These exchanges support actors to learn about UX insights, and using UX insights in making design decisions. Therefore, boundary actions can be seen as intermediary actions between different activities. Boundary actions aim at an outcome that supports continuation of the design project in following actions. Following actions could be actions in a specific activity or other boundary actions.

Box 4.8: Boundary actions in the coffee-machine case

An example of a boundary action in the coffee-machine case is the user research of the design researcher. The design researcher observes and interviews users in a lab-situation to gain UX insights. The user supports the designer by sharing preferences, experiences and needs. Tools used in this action are e.g., a prototype of the coffee-machine and coffee cups. The design researcher uses tools from the activity of design and the activity of experience.

The elements actions and activities of design, of organising, experiencing, and boundary actions together form the landscape of an HCD project. This landscape enables customisation of the basic framework of networked design into a framework of NHCD.

4.3 Framework of networked human-centred design

The previous sections applied the concept of networked design (Chapter 3) to frame networked human-centred design: designers are subjects in an activity of design, and bring in artefacts in boundary actions. Subjects of other activities interact with these artefacts in the boundary action, and bring these artefacts and what they learned in the interactions into their activity. Through the artefacts and boundary interaction, designers support design decision makers from other activities to use UX insights when making design decisions. The concept of networked design focuses on the process of translation.
In combination with the landscape of an HCD project, the framework of networked human-centred design provides a map of how UX insights move from one action into another in a design project. Mapping the path of UX insights in design projects aims at providing an understanding of when, and in

what context, translations could occur, and how these translations could be supported to build a network of actions where UX insights are used in decision making.

In a design project, different insights (e.g., UX, technological, and economical insights) are translated concurrently through the project and are brought into decision making. In a human-centred project, designers make UX insights visible and applicable in actions where design decisions are made. Interactions with the designers' representation of the UX insights support actors to apply the UX insights by taking them in consideration in concert with technological and economical insights when making design decisions. In these actions they balance UX insights with other insights. By mapping actions in a design project, an understanding of how UX insights travel through these actions, and how this is supported, can be gained.

Boundary actions connecting activities
The main concern found in practice and theory (Chapter 2 and 3 respectively) is how to bring UX insights from the activity of design to the activity of organisation. Boundary actions potentially form the bridge between these activities, enabling UX insights to travel from one activity into another. In boundary actions designers could take the role of boundary spanner, and create interventions that support translations: boundary interventions. The term intervention is used in this thesis to refer to an action that supports actors in changing behaviour in making design decisions. Boundary interventions could mobilise using UX insights to decision making in the activity of organisation. Also, designers can create and introduce mediating artefacts, e.g., boundary objects, in boundary actions. These mediating artefacts could travel into the activity of organisation and take the form of a tool. An example of how boundary actions make UX insights successful traveling between activities is user research. User research can be seen as a boundary action between the activity of experience and the activity of design. Designers do interventions that enable experiencers to bringing in their user experiences in an action where experiencers and designers, or design researchers, interact. The action's outcome triggers, and supports, the designers in framing a problem and solution space. The designers use these UX insights, together with technological and economic insights, to make design decisions in their activity of design.

The following section describes how the framework of NHCD is made operational. The section describes a method to identify how designers can support translations, this method enables the application of the framework in studying networked human-centred design practices.

4.4 Application of the framework

With the framework translations during development of PSSs are studied in the remainder of the research with the aim to get a better understanding of what designers can do to keep UX insights alive. The NHCD framework provides detailed research questions for the studies and also defines the research method to be used to study PSS design practice.

4.4.1 Research questions

The current research serves to create understanding of NHCD and also aims at serving the design practice by developing a tool for designers. Studies on translations in PSS development addresses research questions that concern knowledge goals and a design goal:

Knowledge goals:

1. **How are UX insights translated between actions during design projects?**
   The framework suggests that translations take place in between activities through boundary actions. By studying HCD projects an understanding of translations in the practice of doing PSS design projects are gained. With this understanding the framework can be evaluated and improved.
2. **What methods and artefacts support translations of the UX insights?**
   The framework suggests that designers could create tools in the form of mediating artefacts and interactions that support translations. By studying development projects, methods and artefacts are identified that can help to understand how designers create artefacts that support translation.

Design goal:

3. **How can one 'design' these artefacts?**
   The studies aim at developing a tool for design practice to frame the problem and solution space for designing the artefacts that support translation. Through the development of such a tool, conversion of theory on mediating artefacts into design practice takes place. With this conversion guidelines for design practice can be formulated.

4.4.1 Research method

The general approach of the studies in the remainder of the current research follows the process Stappers et al. (2014) described as a research through design approach: a constructed framework guides a coherent series of studies by conducting design action and at the same time providing practical application. The studies in the next chapter are covering the aspects of the framework and are forming a coherent series of individual studies, each study with a focus on specific aspects of the framework. In these studies designers reflect on their design actions, and the studies inform the creation of a tool for designers. The practical application of the framework is in the mapping;

participants in the studies develop their knowledge and skills through reflecting on their practices. Other practical applications are in a tool and guidelines for designers supporting design practice to facilitate networked human-centred development. For operationalisation of the framework of NHCD, a mapping method is developed that draws on applications of the concept of translations by scholars in studying innovation processes.

Mapping as a method

The framework of NHCD provides a landscape where translations of UX insights can be mapped in. Figure 4.6 visualises the framework of NHCD by a map of actions in a specific design project with actions connected through translations. The path of UX insights starts at the moment UX insights are gained from experiencing, through the boundary action of design research, towards being used in designing and in organising through boundary actions. UX insights are translated from inspiration for designers into criteria for organisers in design decisions. Through translations UX insights are kept alive and are used by organisers in the activity of organisation in the routine of making design decisions.

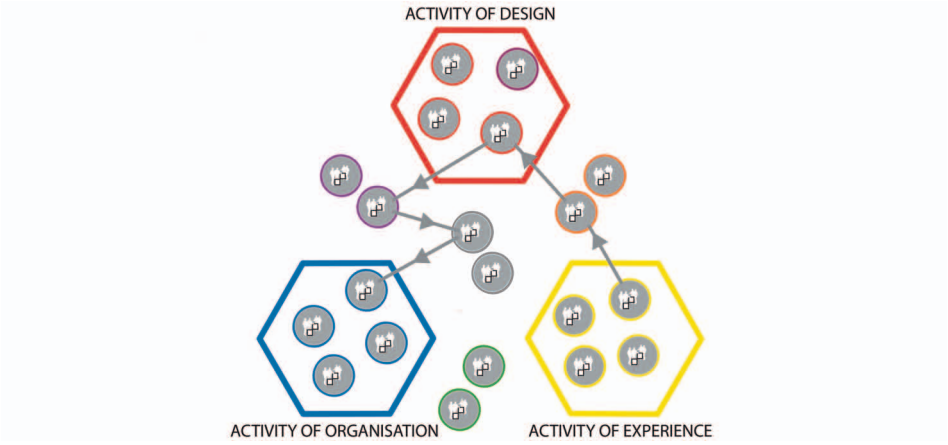


Figure 4.6: The map of NHCD shows the path (arrows) how UX insights travel through the landscape of a NHCD project from actions of experiencing, through boundary actions and actions of designing to actions of organising.

By mapping the path of UX insights, and describing how the process of translation of UX insights happens, the knowledge goals of the studies are addressed: the mapping provides an understanding of how UX insights are translated and what methods and artefacts support the translations. This mapping is used in the studies on HCD projects in Chapter 5. Mapping as a method for the studies draws on how the concept of translation has been used as a research method in case studies of innovation processes (e.g., Akrich et al., 2002a; Dankert, 2011). In these case studies, document research and individual interviews provided information on what happened in the actions of the innovation process, and resulted in understanding of translations in

innovation projects. In the current research, it is expected that understanding of how designers enable a process of translations can be gained through mapping past and planned actions in a design project, and mapping these actions on the landscape of a NHCD project. The result of the mapping describes the path of UX insights through actions and activities. A narrative of how UX insights are traveling through a development project, describes what happened in and between actions. To give as much as possible translations a fair chance to be found, Latour (1992) advises to be careful with narratives and to avoid the pitfall of excluding possible translations by a narrative that can lead to subjective conclusions. Therefore, this narrative needs to be precise in what happened to prevent exclusion of roles of actors or artefacts in translation. The narrative should include the mediating role of artefacts and interactions between actors and artefacts in detail. In the mapping method the path of UX insights is referred to as a trajectory, the narratives as a travelogue[17]. Analysis of the trajectory and travelogue on when in the projects what happened in the actions, would provide insights on supporting translations and the soundness of the framework for describing practice.

Mapping tool: Networked Collaboration Canvas

In line with the current general research approach, the mapping method follows a generative approach in order to support designers to share their experiences in networked design projects. In a generative approach, as applied in design research (Sanders & Stappers, 2012), the focus is on collective exploration where participants, being the experts of their experience, express their ideas and needs for future experiences. The mapping method enables co-creation of a map of a project by actors involved in the project. The co-creation of a map of actions allows the participants to collectively reflect on actions in the project, even when they were not all involved in each specific action. The generative approach makes it possible to give a variety of actors in design projects a voice and provide a precise narrative of what happened, preventing exclusion of roles of actors or artefacts in translation.

In Chapter 5 a mapping tool is developed to support the mapping, and enable the researcher to co-create a map of a NHCD project with participants in the studies: Networked Collaboration Canvas (NCC). The NCC tool is used throughout the studies in Chapter 5 to address both the knowledge goals and design goal. Observing the use of the NCC tool has a double purpose, gaining knowledge of translations and informing development of a toolkit for designers[18]. The knowledge of translations includes what and how artefacts support translation. The NCC supports the researcher to study NHCD projects by mapping design projects, possibly mapping design projects could support

17 Definition travelogue (Oxford Dictionary of English): a film, book, or illustrated lecture about the places visited by or experiences of a traveller.

18 The name Networked Collaboration Canvas was the working title of the tool given in discussion with the co-authors of the paper this chapter partly is based on.

networked human-centred design practice. Observations of using the NCC informs development of a mapping tool for design practice. Development of a toolkit for designers addresses the design goal, premising a toolkit would support designers in designing mediating artefacts through mapping their design projects. The toolkit would enable designers to frame the problem and solution space for designing artefacts that support translation in their projects.

Quality of research

The introduction of a new research method, for mapping and analysing translations, makes it more difficult to assure the quality of research as with existing validated methods. Therefore, specific indicators for the quality of the current research have been identified. The current research approach is explorative, aiming at understanding the situations in which translations take place. The used new method can be seen as a qualitative inquiry. Malterud (2001) identified indicators relevant for qualitative inquiry and are as such applied in the work of academic design researchers (e.g., Sleeswijk Visser, 2009; De Lille, 2014). Therefore, the indicators identified by Malterud (2001) are used to indicate the quality of the qualitative inquiry in the remainder of the current research. These indicators for the quality of the research are relevance, validity, and reflexivity. For the upcoming studies, these indicators are used as follows:

- The **relevance,** has been applied by selecting studies that involve a variety of industries, practitioners, and development projects. With this variety it is likely that findings of the studies are useful for the general design practice.
- The **validity** has been supported by applying triangulation in the current research by using multiple data sources, reviewing the results of the studies with participants and co-researchers, involving co-researchers in the analysis of the studies, and have peer reviews on the method used in conference workshops.
- The **reflexivity,** taking account of the effect of the researcher on what is investigated, has been applied by keeping a record of my interpretations and roles in the different research actions. In that way the influence of the researcher's preferences and preoccupations on the set up, analysis, and communication of the studies can be taken into account.

Chapter 5 constructs the Networked Collaboration Canvas (NCC) and uses the NCC as a research tool to map translations of UX insights in a variety of PSS design projects.

Mapping travels of UX insights

5

5 Mapping travels of UX insights

The current chapter maps the practice of networked design through the lens of translations. The mapping aims at finding how UX insights keep alive by traveling from one action into another through the support of designers.

To get a deeper understanding of a potential role of designers in supporting keeping UX insights alive, the following questions guide the studies:

1. **How are UX insights translated between actions during design projects?**
2. What methods and artefacts support translations of UX insights?

The design goal of the studies is:

3. How can one 'design' these artefacts?

This chapter highlights eight exploratory studies conducted to answer these questions. Throughout the studies the design goal is addressed by developing a toolkit for designers.

For seven of these studies design projects are selected from the portfolios of PSS101 project team members (studies 5-9) and P5 consultants (10-11)[19]. The following selection criteria were formulated to guarantee a broad understanding of networked design:

- The project can be defined as a networked human-centred design project; designers, experiencers, and organisers collaborate in an assembly of development actions where possibly UX insights are translated in order to consider the UX insights in design decisions.
- There are a variety of industries, practitioners' roles, and developments in the studies to ensure relevance for a broad range of design applications.
- The project has recently come to an end, or is still in progress, at the moment of the study to ensure information on the project is fresh.
- Designers in the project follow a human-centred approach to ensure UX insights are used in (at least) the early phases of design.

The seven selected design projects vary in subject. They include design of products and/or services in home care, printing industry, business software, municipal services, ICT industry, and consumer goods. An additional eighth study is conducted to get peer feedback on the framework of networked human-centred design. For this study, two workshops have been organised at conferences to benefit from a discussion with other scholars interested in networked design. The selected conferences relate to networked design: a conference on networked collaboration and a conference on service design.

Table 5.1 gives an overview of the eight studies (Study 5-12) and details for

19 The research has been grounded in experiences in design projects in the PSS101 project and at P5 consultants. See appendix 1 for more details on PSS101 and P5.

each study its aim, where it fits in the framework, the topic of the design project that was reflected on, and the framework elements 'actions' and 'roles' that are likely to appear in the project. The information in the overview is based on the rough project descriptions that were available for selection of the studies. The PSS101 team contributed the projects for the studies 5-9, P5 consultants provided projects for the studies 10 and 11.
In the previous chapter the element 'action' has been defined as: actors interacting with other actors and/or artefacts with a specific aim. Roles have been defined by what actors (or artefacts) do in actions they participate in, e.g., a designer in an action of prototyping (Study 6), or a product manager in an action of releasing & testing (Study 8). The studies aim to identify actors and artefacts in these roles, and in what roles and actions new tasks as facilitators of translations occur.

Table 5.1: Overview of the studies in this chapter.

study nr.	name	aim of the study	focus framework	project reflected upon	actions included	roles included
5	taking a designer's role	explore the role of design in boundary actions	Actions and translations	home care service innovation (PSS101)	co-creation workshops, business meetings, concept tests	service designer, design researcher, project manager
6	negotiating human-centred design	explore translations	artefacts (in boundary) actions and translations	design of an application for print services (PSS101)	user research, prototyping, presenting concepts	UI designer, software developer, service designer, business manager
7	communicating user research	explore what design researchers do	supporting translations	improving municipal business services (PSS101)	user research, stakeholder workshops, reporting research	service designer, public servant, entrepreneur
8	supporting agile processes	improve tools supporting the mapping process	boundary actions	design of application for business software (PSS101)	planning/ road mapping, conceptualising, software design, releasing & testing	sales manager, software developer, product manager, UI designer, service operator
9	implementing same concept in different contexts	explore scattered translations	stages of translation	implementation of concepts for home care services (PSS101)	co-creation of vision, concept testing, making business cases, piloting	service designer, architect, municipal councillor, citizen, carer

Table 5.1 (continued)

study nr.	study name	aim of the study	focus framework	project reflected upon	actions included	roles included
10	supporting the product manager	explore translations between activities of design and organisation	actions of organising	design of support for DIY installation of ICT products (P5)	pitching, conceptualising, concept testing, making business cases, implementing	product manager, designer, business manager, software
11	supporting the design manager	explore coordination of translations	sets of translations	design of an ergonomic aerosol (P5)	exploring user needs, user tests, discussing UX insights / concepts, consumer tests, engineering	marketing manager, product designer, user researcher, engineer, design manager
12	what do scholars say	review the framework with scholars	conceptual framework	PSS design	n.a.	n.a.

The following section describes the general approach, used for studies 5-11. For Study 12 this approach has been adapted to fit the slightly different aim of scholars reflecting and context of a conference.

5.1 General approach of the studies

The studies aim for a deeper understanding of a potential role of designers in supporting keeping UX insights alive. In workshops, networked design projects are mapped through the lens of translations seeking. With this mapping, an understanding is sought on what designers could do to make UX insights actionable in other activities than the activity of design. The mapping method, introduced in Chapter 4, provides a method to understand actions in design practice through the lens of translations. The NCC tool has been developed to support the mapping process during the studies. The mapping process is described in the procedures in section 5.1.2, the materials section 5.1.3 includes the developed mapping tool. The studies both inform research on what designers can do to keep UX insights alive, and inform the design of a toolkit for design practice.

5.1.1 Participants

Participants have been recruited by the contact persons of the selected projects. The researcher provided selection criteria for recruitment ensuring that participants were actively involved in the project, and represented different roles in the project. Participants in the studies were (experienced) designers, design researchers, and other stakeholders (e.g., product managers, marketing managers) involved in the project discussed in the study.

For optimal involvement in co-creation of the map, and group discussion, a group size between 2 and 8 participants was chosen to allow for peer conversations[20].

5.1.2 Procedure

Before the workshop, the project's contact person was asked to invite and brief the participants. Participants were asked to bring information on the project, no matter in what form e.g., written or visual, to the workshop. The mapping workshops took place at a location chosen by the contact person, preferably related to the project (e.g., meeting room where project meetings took place). The moderator[21] facilitated the mapping of the actions and exploration of what happened in the project's actions in the approximately 3-hour mapping workshop. At the start of the workshop the moderator introduced the NCC and explained how a project can be seen as connected actions, with roles and artefacts in an action, and translations between actions. Before the actual mapping started the contact person shortly introduced the project to review. Mapping started with participants making an inventory of actions taking place in the project by naming and writing down all actions they recall, and put these actions in chronological order in a timeline. In the next step participants were asked to talk through the lined-out actions in detail making use of the NCC materials, information they brought in and their memory of what happened in the actions. During the participants talking through of the actions, the moderator stimulated participants to use the provided mapping materials and emphasised to think in roles instead of persons, explaining that one person could fulfil different roles. After the actions were mapped and talked through, the participants were asked what they would do the same and what they would do differently in new projects in order to keep UX insights alive.

5.1.3 Materials

The NCC has been used as research instrument to help participants in the studies to structure their insights on networked design. The NCC mapping materials included:

- The NCC on a poster for explaining the concept of connected actions. The NCC is also provided on A3 format to allow participants to make notes during explanation.
- Sticky notes and pens for making the time-line.
- Aspects that describe an action (different roles of the actors involved, input/output, artefacts involved) visualised on stickers.
- White boards to map the action in detail, using the provided stickers and markers to add comments. The whiteboards allow changes during mapping; participants can easily remove stickers and annotations. The

20 The set number of participants in a workshop/group session is based on my experience in user research where the minimum of 2 and maximum of 8 proved to be working best.

21 In the studies I act as moderator to guarantee quality of procedures and video recordings.

whiteboard provides enough space for stickers and notes, while size and form of the whiteboards allow combining the boards into series of actions. The hexagram form corresponds with the visualisation of connected actions in the NCC.

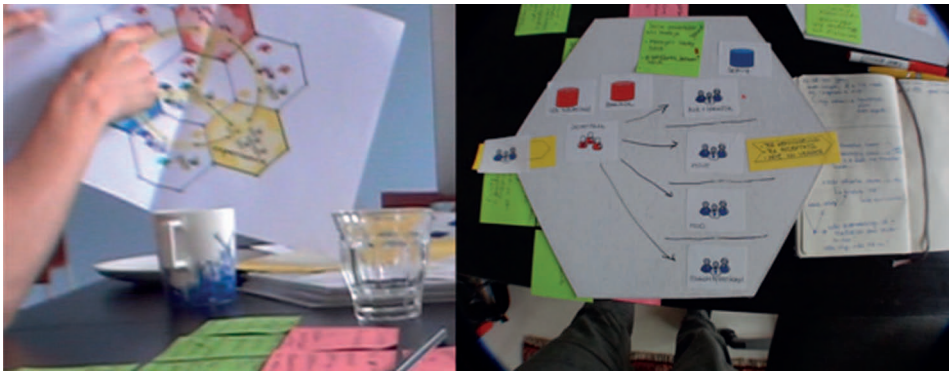


Figure 5.1: NCC mapping materials: poster of the NCC in use and mini whiteboard with stickers and comments used to map an action.

Optimising the NCC also informs the redesign of the NCC into a mapping tool for the design practice. It is expected that the redesigned tool supports in the design practice to map when, and what, opportunities for keeping UX insights alive occur [22].

Data collection and analysis

All workshops have been observed. For observation, field notes were made and the workshops were videotaped. Data collection includes transcripts of the video material as well as the resulting materials from the workshops, such as annotated materials timelines and maps created by the participants. For analysis quotes that concerned actions in the project were extracted from the transcripts. Quotes were translated into English when needed, and interpreted primarily following the framework elements: activity, action, boundary action and (tools for) translation. Interpretations that could not be identified as linked to one of the existing elements were laid aside for a separate reflection on improvement of the framework.

With the created timelines, maps per action, and quotes on the specific actions, the researcher created a trajectory; a visualisation of how UX insights move through actions in a project. Actions were identified as an action fitting in one of the specific activities of design, experience, and organisation, or as a boundary action. For this identification the definitions of the actions were loosely operationalised following the definitions in Chapter 4: when

22 Further developing the mapping tools into a toolkit for designers, addresses the design goal of the studies, premising a mapping toolkit would support designers in understanding what artefacts to design through mapping (potential) translations.

the goal of the action and the roles involved are likely to be typical for one of the activities the action is an action of designing, experiencing, or organising. When there is a mix of goals and/or roles from different activities in an action, this action is identified as a boundary action. Following this identification, actions have been coloured to mark it as an action of designing (red), organising (blue), or experiencing (yellow). Boundary actions are indicated with the mix of colours of the activities they are in between (red + blue = purple, blue + yellow = green, yellow + red = orange, red + blue + yellow = black). The timeline informed the trajectory; actions were positioned in chronological order to construct the trajectory of the UX insights on the canvas depicting the landscape of an HCD project. Figure 5.2 shows an empty canvas with the HCD project's landscape, and an example of a trajectory of UX insights moving through the project's landscape.

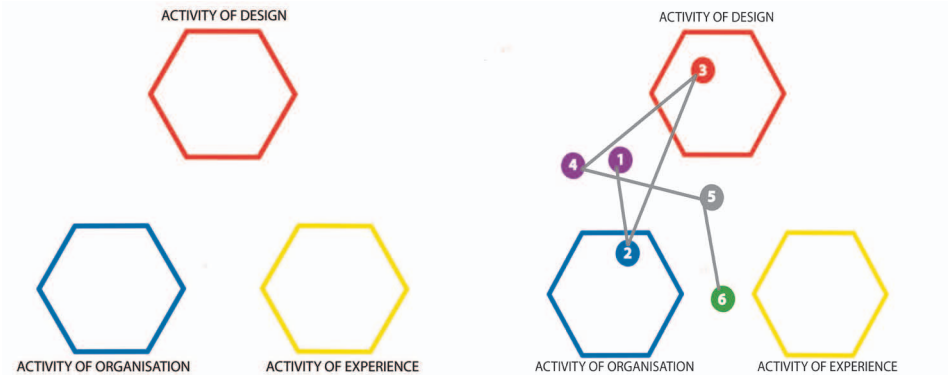


Figure 5.2 : An empty canvas depicting the landscape of a human-centred development project for creating a trajectory (left) and a filled in example showing UX insights moving from a boundary action (action 1) to an action of organising (action 2) to an action of designing (action 3), to boundary actions (4, 5 and 6).

With the trajectory and interpreted data of a project, the researcher constructed a narrative of what actions and translations happened. This narrative is labelled as a 'travelogue' referring to the travel of the UX insights through the different actions.
With constructing the travelogue insights on actions and translations (movement and changing form of UX insights) were identified and the soundness of the conceptual framework for describing practice is evaluated. In the travelogue the action number, and marking colour of actions relates to when and where in the trajectory the action happened, e.g., ***action 1*** is a boundary action in between the activities of design and organisation and starting point of the UX insights travel.

5.1.4 Studies 5-12

In the following sections, studies 5-12 are described in detail following the same structure. The description starts with the aim of the study, followed by a summary of the project selected for the study. In the methods section, for each study specific adaptions of the mapping procedures and/or materials

are described. These changes are due to inform optimisation of the mapping tool, and aim to evaluate how designers use the different materials. After the methods section, the project's mapping is described in the form of the trajectory and travelogue. In the results section the insights gained on translations, and the roles supporting these translations, are described. Finally, steps are suggested to further optimize the mapping tool.

5.2 Study 5: taking a designer's role

The aim of Study 5 is to explore the role of design in boundary actions that take place in the context of a home care service innovation project. This particular innovation project was also used in the previous Study 1 (Chapter 2), concluding that the project did not result in what the designers envisioned. Due to the researcher's familiarity with the project together with the project's modest complexity, the project seems suitable to gain first insights on what, and how, actions take place. Questions guiding this study are: what is the goal of an action, which roles of actors and artefacts are involved, what tools are used, and what translations occur?

Project in Study 5: Home care service innovation project
The project was one of the first projects of a recently founded department of a home care organisation. This department develops new e-health solutions. The project aimed at developing e-health solutions for home care services with the ulterior motive to bring service design into the home care organisation. The project focused on 'dementia patients and their carers' and developed a concept of a service that provided private communication through a multimedia application between professional carers and family/ carers of dementia patients. In the project external expert designers and design researchers supported project managers of the home care organisation to take a new role as service designer/researcher taking a human-centred approach. At some stage in the project the support of the expert designers was brought back to a minimum. Without this support the homecare managers experienced barriers in developing the concept and getting recources for testing and refining, possibly because of their inexperience. The project did not progress as expected and stopped without implementation of the concepts.

5.2.1 Method Study 5

The following additions to the general method, as described in section 5.1, have been made for Study 5.

Participants
In this study participants (n=3) have a background in management in home care projects. Two of them took the role of design researcher and service designer in the design project. During the project they were educated by expert design researchers to take these design roles. The third participant reviewed the project in her role as project manager.

Procedures
The set-up of Study 5 follows the general procedures as described in section 5.1.2. In the invitation, participants were told that the workshop was to understand what could have been improved in PSS design through the reflection on a project in which their expectations were not met. The workshop took place in a meeting room of the department of the healthcare organisation that was involved in the design project.

Materials
Next to the initial NCC materials (poster, whiteboards, stickers), participants brought an internal end report of the project and personal working notes.

5.2.2 Mapping the home care service innovation project

The three participants collaborated in laying a timeline of nineteen steps, mainly making use of their collective memory, and now and then using the documentation they brought in. Sometimes participants only mentioned the step without elaborating on what happened during this step: *'the first step was an inventory wasn't it?'* Or the step was just briefly talked through: *'here we did a workshop where we co-created a Business Model Canvas and a Service Blueprint and we decided to focus on the dementia patients as a target group.'* Only the last step in the timeline was reviewed in detail and mapped using the NCC materials. Figure 5.3 shows the mapping of this step.

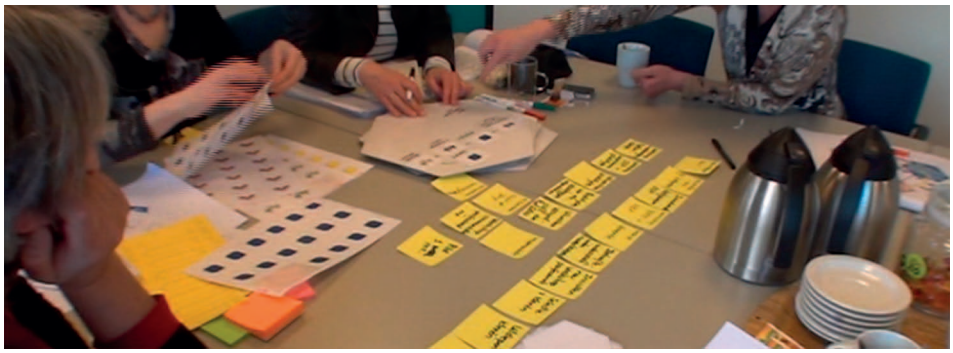


Figure 5.3 Participants in Study 5 mapping the last step in the timeline using the NCC materials.

The use of the provided materials for mapping was not straightforward. Participants had to be slightly stimulated to use the provided materials, as the following quote illustrates:

> *Moderator: You are talking about they and we; can you list and describe them by using the stickers? Participant: Obviously we are the red stakeholders, the designers, and they are the blue ones, organisers. We were in a different role and were as designers not able to propose a clear concept where the organisers could decide on with a yes or no.*

The visualisation of roles and artefacts triggered discussion between participants on defining specific roles and artefacts in order to decide on who had what roles, and what artefacts were used in the action reviewed.

Trajectory

When participants created the timeline that informed the trajectory, they described the steps using different aspects of an action, such as: the context (a meeting, a workshop), an outcome (a briefing, a service blue print), or an aim (decide on). The researcher used these descriptions to describe the steps in the timeline as a series of actions by combining or splitting up the steps into actions. Figure 5.4 shows this transformation of the timeline with steps into a timeline with actions. For example, the researcher split up the step participants labelled as 'discuss insights with professionals' in the four actions 5-7. These four succeeding actions had the same goal to discussing user insights, however with different roles involved.

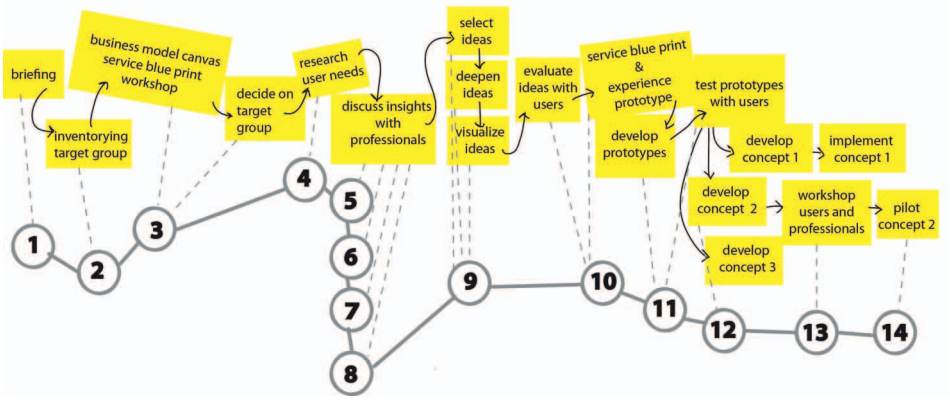


Figure 5.4: The timeline as constructed by the participants (yellow notes) is interpreted into a timeline of 14 successive actions. The dotted lines visualise the transformation of steps into actions.

The actions are mapped in chronological order on the canvas to form the trajectory of the home care design project. For constructing the trajectory each action has been identified as an action fitting in one of the activities or as a boundary action following the descriptions in Chapter 4. For some actions, identification is not as straightforward as expected due to sparse information on the aim, actors and artefacts involved and outcome. For example, for action 1, briefing, available information on this action is on the outcome of the meeting: *'The home care organisation wanted to increase their digital services and wanted us [design researchers and designers] to investigate new potential target groups for these services.'* Based on this information I interpreted that the aim of the action was to decide on the problem to focus on in the project, and that in this action actors with the role of designer and role of organising manager discussed the need for new target groups of existing digital services. This supports the identification of this action as a boundary action: roles from two activities are involved, and the

outcome influences future actions in the activity of design (investigate new target groups) and organisation (adapt and provide services to a new target group).

Action 2 concerns making an inventory of the possible user groups. No other information about this action was shared than that designers and organisers interacted in this action and different user groups have been chosen to discuss in action 3. Action 2 action seems similar to action 1 and is positioned closely near action 1 as a boundary action. Action 3 is positioned in between the three activities because the outcome directs the set-up of user research (action 4) and future actions in the activity of organisation and design.

Interpretations of actions resulted in the trajectory shown in Figure 5.5. All actions are positioned in or in-between activities on the canvas without a specific spacing indicating a relation between actions.

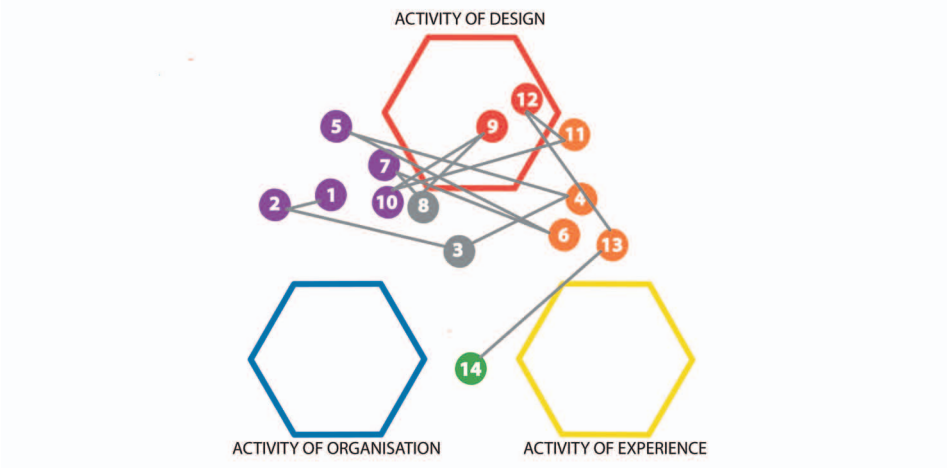


Figure 5.5: The constructed trajectory of UX insights in the home care service innovation project starting in a boundary action (action 1), and through boundary actions (actions 2-8, 10-11, 13-14) and actions of designing (actions 9, 12) end ending in a boundary action (action 14).

With data of what happened in actions, and what translations happened, the travelogue is created. In the travelogue the action number, and marking colour of actions, relates to when and where in the trajectory the action happened, e.g., ***action 1*** is the first action in the trajectory and is a boundary action between the activities of design and organisation.

Travelogue

The current project is one of the first development projects of the e-health developers in their role as design-researcher and designer; they are more experienced in their previous role as project managers doing actions of organising. They do take a designer's role in framing and negotiating a solution space, as described in the framework in Chapter 4. However, in

action 1 a clear objective of the development project is not mentioned. At this stage, it is not decided whether the project aims at designing a completely new service or minor adaptions to an existing service. Only decision in ***action 1*** is to find a new target group for existing e-health services to increase providing of this service. The next action aims to make an inventory of target groups in order to select groups to focus on.

In between ***action 2*** and ***action 3***, the designers prepare ***action 3***. The expert designers provide the tools and procedures, to be used in this action, in the form of a card set (developed by the expert designers as a reminder of the tools used in an earlier project). How actors in ***action 3*** decided which of the provided tools and procedures to use is not observed. In ***action 3*** users (carers), designers and managers of the organisation, co-create business-model-canvasses and service-blueprints[23] to discuss the feasibility of different user groups. The inexperienced designers/researchers moderate the co-creation. The outcome of the action is the decision to focus on people with dementia and their carers. It is not clear from the observations how the user groups discussed in ***action 2*** are brought into ***action 3***. Possibly the users participating in ***action 3*** are selected based on user groups from ***action 2***.

In ***action 4*** designers and researchers interview carers of people with dementia to understand user needs, and discuss their insights with the organisation in the succeeding action (***action 5***). The designers noticed the difference between using UX insights in decision making when bringing UX insights from ***action 4*** to ***action 5***: *'Management were seeking measurements they could use to make decisions for the organisation while we [designers] explored user needs for inspiration.'* UX insights, that serve inspiration in an action of designing, were used as a measurement of the feasibility of a new target group for an existing service in an action of organising. The observations do not provide information on how the insights from the user research are communicated in ***action 5***.

The data on the succeeding actions only revealed that the designers generated ideas in co-creation sessions with potential users (***action 6***), with potential providers (***action 7***), and with both providers and users (***action 8***). Presumably UX insights brought in by the designers (the insights that inspired them) and by the users (their experiences) are used to co-create solutions in ***action 6***. UX insights are contributed by designers and by providers in ***action 7 .*** In ***action 8*** designers, users, and providers brought in UXs. It is unclear how UX insights are communicated in these actions.

Designers generate, select, deepen, and visualise ideas in ***action 9.*** The

23 Business Model Canvas and service-blueprints are service design tools to respectively describe a business model and specify the different aspects of a service (Stickdorn & Schneider, 2010)

expert designers (design agency) are asked to visualise ideas and make prototypes. In this action expert and novice designers work together to complete missing skills of the novice designers. The UX insights are brought in the form of solutions created in *action 8* into *action 9*. There are no observations of other forms of (other) UX insights used in this action.

Designers discuss the selected ideas with managers from the health care organisation through the co-creation of service-blue-prints and prototypes (*action 10*) in order to choose concepts to be further developed. The visualisations of the ideas are available during these discussions, however, if and how they are used is not observed.

In *action 11*, designers develop and test prototypes with users. More details on what happened and the outcomes of the tests are missing in the data. Therefore, it is unclear in what form the results of the test are used by the designers when developing the concept of a new service providing video communication (*action 12*) and a new user interface.

In a workshop with users the developed concept was reviewed (*action 13*). How the concept is communicated, and in what form UX insights were available, is not observed.

In the final *action 14* of the project, a professional care provider conducts a pilot test. For the test the professional carer invited one of her clients to participate in the test. Afterwards it became clear the carer did not understand the concept PSS. The designers feel this is due to the fact they did not develop the service concept into enough detail to be tested. The communication of the concept was poor and a clear test protocol was missing. Another issue here is that the actors who had to decide on resources necessary for doing a full test, did not understand and/or accepted the goal of the pilot test. The designers did not succeed in negotiating resources for building a prototype for testing. In the end the concept service was tested with an existing user interface instead of the prototype of the interface envisioned in the concept PSS. Obviously, the description of the new service did not trigger and engage people in the role of organiser to take the UX insights into account in their decision to provide resources for the test.

After *action 14*, the project stopped. One of the participants concluded that what happened in *action 13* and *14* was a main problem they faced during the project: '*In my opinion the main problem was we failed to choose for a leading reference, we tried to satisfy both users/carers as well as the management in our organisation. Then you halt between two options, the organisation has a completely different objective than the carer. In the end it was the organisation deciding where we put our money.*'

5.2.3 Results Study 5

The insights found on actions and translations are brought together in addressing the questions guiding Study 5.

What is the goal of an action?

The trajectory created in this study (Figure 5.5) included fourteen actions, twelve of these actions were boundary actions. The general goal of these boundary actions was to inform and decide on the design of the PSS. Most of these actions concerned co-creation workshops. However, in most of these actions actors with a designers' role were not able to negotiate a human-centred approach with user needs as important criteria in decision making. Designers were not able to prevent that the goal of the boundary action became a goal of an action of organising, applying the rules and tools typical in an activity of organising with an emphasis on feasible and viable alternatives instead of user needs. This indicates that when designers not clearly define and communicate their goal of a boundary action they decrease their influence, and that of the artefacts and tools they use, in the action.

Which actors and artefacts are involved; what methods are used?

The travelogue describes five boundary actions with actors in the roles of designers and organisers involved. In these actions the artefacts and methods observed are mainly design artefacts (e.g., visualisations, prototypes) and service design tools (business canvas, service blue print). In the four boundary actions with designers and experiencers involved design artefacts as visualisations and prototypes are used, presumably service design research tools are used for understanding user needs and testing concepts. Service design tools were used in the two boundary actions with designers, organisers and experiencers involved. Here service designers took the role of facilitating the actions, providing tools and moderating the action. In boundary action 14, organisers and experiencers were involved. This action lacked design artefacts and tools; there was no prototype and clear test protocol. This lack prevented the professional carer from doing a proper concept test, leading to the failure of the test. After this action the development project was stopped.

What translations happened?

The trajectory shows only actions of designing and boundary actions, no actions were mapped in the activities of experience and organisation. However, these actions were inexplicitly mentioned during discussions. For example, managers deciding on business targets and what budget would be available were mentioned, but not mapped as actions in the activity of organisation. Consequently, no translation of UX insights from or to the activity of organisation was observed.

The travelogue hardly provides insights on what translations happened due to missing information on where and how UX insights are brought in. In the co-creation (actions 3, 6, 8) and interviewing (actions 4, 11, 13) it is clear

users bring in their own experiences, however, how these experiences were captured for further translations is not clear. When solutions in the form of visualisations and prototypes are used, the UX insights are obviously embedded. It is not clear if, and if so how, the embedded UX insights are communicated.

Next steps
Results of Study 5 show that, with the NCC materials and procedures, some translations could be identified in the mapped project. The detailed mapping of an action on a mini white board worked well and provided an understanding of the context of one of the actions. The detailed mapping resulted in a description that included roles, artefacts, tools, interactions, input, and (expected) output or goal of the action. For all actions this information is needed in order to identify translations. However, the resulting travelogue is not as rich with insights on actions and translations as expected. The limited data gathered in the study seems the main cause for this unsatisfactory result. The timeline only partly delivered the trajectory of actions in the project the participants were involved in; the accurateness of the mapping depends on what participants remember and the project information (facts) available. The fact that participants only reflected on actions they were directly involved in could explain why no actions of organising were added in the trajectory. In the next two studies the initial NCC materials and procedures are used to get additional feedback to improve the NCC for gaining more data on actions.

Mapping tool
Participants used the whiteboards to map an action, however, did not group the whiteboards in series of actions. As said, participants provided limited data on the actions in Study 5. The next two studies are used to additionally inform the development of the mapping tool.

5.3 Study 6: negotiating human-centred design

Study 6 focuses on exploring translations where user experiences are brought from the activity of design into the activity of organisation. Questions guiding this study are: how are UX insights negotiated, what artefacts support the translations?

Project in Study 6: design of a new application for print service operators
The project selected for this study is a follow up of the innovation of print-services project in Study 1 (see section 2.4 for details). The follow up project focused on the development of applications for the operators, meeting their specific needs as found in observing their daily practice in providing print services. The project started with the idea to develop applications based on new user/customer feedback on services, recently communicated by account managers to the designers. After field research, insights were gained on

what solutions could solve the problems service operators faced. One of the problems was that the service operators spend a lot of time bicycling around going back and forth to their desktop computer to get informed on services to be done. A new application was developed to solve this inconvenience by providing the service operator with relevant information on the mobile phone at hand when doing services. The experienced designers and researchers iteratively redesigned and tested concepts with end users during the project. At this stage the development of the new application was set on hold due to organisational changes in the company. An implication of the organisational changes is the expanded offering of printers and print services[24]. The designers and researchers wanted to continue the project and negotiate their human-centred approach in the current and future design projects. For this purpose they created envisions of applications for services that would fit the new portfolio of printers the company offers.

5.3.1 Method Study 6

The project's contact person invited participants and briefed them that the workshop was aimed at preparing a meeting where the continuation of an HCD project was discussed.

Participants

The participants (n=3) were involved in the project and experienced in HCD as respectively user interface designer, software developer, and service designer. When they accepted the invitation, participants indicated they would like to explore what they could do to consolidate their HCD approach.

Procedures

The workshop took place in a dedicated room used for exchanging user insights at the research and development department of the print company. The workshop followed the general procedures for the studies as described in section 5.1.2.

Materials

Posters, reports, and discussion tools on service design research were available in the room where the mapping workshop took place. The materials covered research that took place since the department's launch, including the materials used in the project to reflect on. The researcher provided the NCC materials as described in the general approach of the studies (section 5.1.3).

5.3.2 Mapping design of a new application for print service operators

The participants laid a timeline consisting of 21 steps based on their collective memory. Participants did not use documents, reports, or other reminders to

24 Next to large quantities of printers at one location (e.g., 100 printers at a university), often used in a network by many users, now also a small number of stand-alone printers at one location used by only a few users (e.g., 4 printers at a consultancy) are included in the company offerings.

recollect what had happened in the project. As in the previous study the steps could not all be transformed into an action. Figure 5.6 shows the thirteen actions in the timeline after interpretation of the steps.

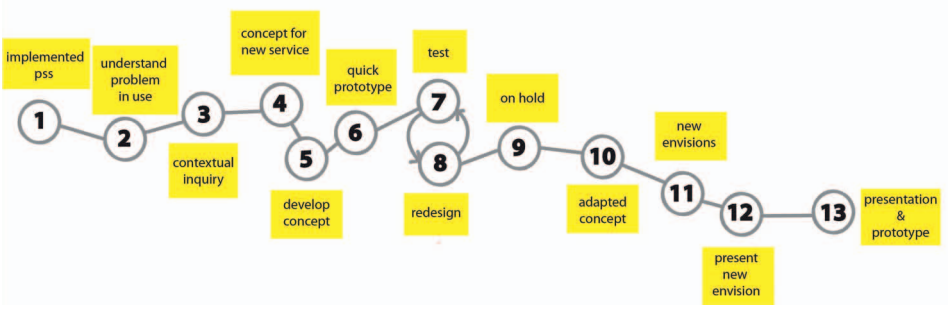


Figure 5.6 : The timeline with 13 successive actions. The names on the yellow notes are the names of the steps as participants used when creating the timeline of steps.

At the moment of the workshop action 11 was just finished, and action 12 was about to start. Action 12 was mapped in detail and concerned a future action: presenting concept solutions the designers envisioned.

Figure 5.7 shows a detail of mapping action 12, where participants talked through the need for understanding the values of the different stakeholders involved and added the 'values' *generate business*, and *save costs* to the map. While the previous values were still related to the development of new print services the participants also expected more personal values to play a role in the action:

> *UI Designer*: . ..*well we want to keep our jobs. Service designer: That is a different interest or value, any others? UI Designer: Make profit? Service designer: There is a sales organisation between production and the client. One will generate business, another wants to save costs, and another. . . don't know really. Designer: Wants to perform well to really grow in importance.*

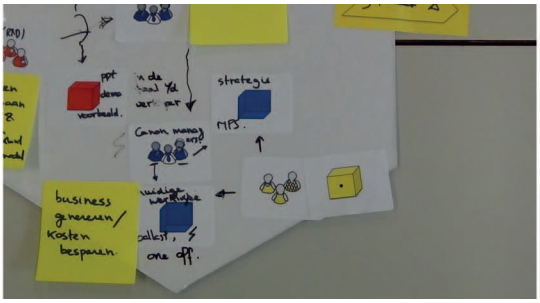


Figure 5.7: the participants added 'value' stickers (the yellow notes) with values as 'generate business/decrease costs'.

The participants concluded that it is difficult to serve so many different goals

in one action.

Trajectory
After interpretation, the actions are positioned on the canvas and show the trajectory of the UX insights in the design of applications for print services. The trajectory in Figure 5.8 shows actions that have taken place before the organisational change (actions 1 to 8), during the change (action 9 is putting the project on hold, changes in the activity of organisation take place), and the actions the designers foresee in the near future (11, 12 and 13).

With the data on what happened in the actions, and what participants expected to happen, a travelogue is constructed.

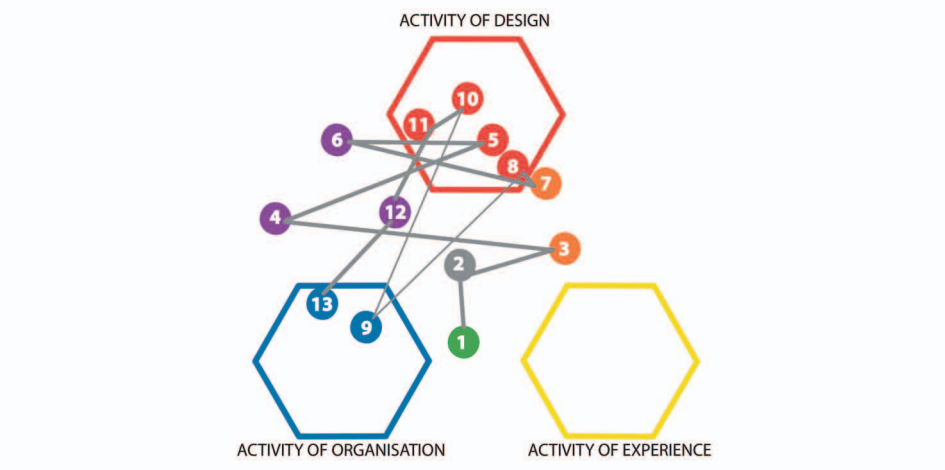


Figure 5.8: The trajectory of UX insights in the print services project. The thinner lines between actions 8, 9 and 10 visualise the break in the development project when the activity of organisation changed.

Travelogue
Managers, responsible for providing a print service, receive feedback during regular customer contacts when offering the service in *action 1*. This feedback triggers the managers to initiate the development of an extra service application. In *action 2* the managers discuss the feedback with designers and users and together get a deeper understanding of the problems to be solved. With the insights gained in this action the designers set up the field studies that take place in *action 3*.

In the field study designers, specialised in user research, observe and interview service operators and users experiencing existing print services. The UX insights gained in this action are visualised on large posters (photos and text) exhibited in a dedicated room where all user research results are assembled for further discussion in *action 4*.
In *action 4* a team of the service offering managers, service operators (users)

and designers discuss the UX insights to co-create solutions. The designers, who did the user observations, act as representatives of UX. Together with the posters they bring UX insights into this action.

The next action is an ***action of designing 5***, in which designers develop the idea selected in the previous action. In ***action 6*** designers build quick prototypes of user interfaces while collaborating with software developers who produce the software necessary to make the prototype of the interfaces function. During the close collaboration in this action between software designers and UI designers, the UI designers bring prototypes in of solutions they created based on UX insights. Which UX insights led to what solutions is unclear. After the prototypes are created they are tested on functionality (is the software bug free) without making a clear link to the UX problems to be solved.
In ***action 7*** the designers test the prototypes with experiencers in a pilot. Piloting was aimed at improving the design, however led to unexpected consequences:

> *Designer: An important learning was that we hoped for a proactive attitude and the operator would work more efficiently. In the end this has led to the conclusion that some people didn't work efficiently and even got dismissed. Service designer: It still remains unclear whether this was a result of the use of the prototype or our observations of the real practice.*

The result of testing a concept in a pilot test did benefit the designer who was able to improving the design but harmed one of the users. The designer iteratively improves the design based on the test results of ***action 7*** in ***action 8***. The UX insights represented in the form of a quick prototype (build in action 5) are reconsidered in the iterative actions of piloting (***7***) and redesigning (***8***).

The activity of organisation was changed in ***action 9*** leading to an on hold of the design project. What happened in this action is not relevant for the UX insights trajectory. However, the changed activity triggers the designers to negotiate their human-centred approach and continuation of the development project using the prototype of the application of print services as a proof of their approach. In ***action 10*** the designers adapt their concept to the changed organisation. In ***action 11*** the designers create presentations and reports on the development of the concept with the aim to support other stakeholders to negotiate the designers' approach. In the presentation the designers envision the concept and scenarios of experiencing the concept communication the UX insights. The designers will present their vision in ***action 12*** in a meeting with managers responsible of the future service offerings. The designers are convinced that prototypes and scenarios should be part of the presentation because prototypes support engagement of new stakeholders:

UI designer: we made some example how the concept would look like, a demo in PowerPoint, and a storyboard envisioning the use ... Service designer: A prototype works well; they wanted to have it and hold it... I still see that man holding the prototype like this, he wouldn't let go, he wanted to have it, that was the impression he gave.

In the next action (***13***) the designers will deliver the presentation and prototype to someone who will negotiate continuation of the development and designers' approach. The designers doubt if presentation and prototypes will work when they are no longer involved, and find it difficult to trust others to present their work, as the service designer stated: *'We hope that X will take the prototypes with him and uses them with critical stakeholders, who then will get excited. But the point is, we don't know who these stakeholders are.'*

5.3.3 Results Study 6

The mapping in this study provides the following insights on how UX insights are translated.

What translations take place and what artefacts support these?
Some actions were mentioned but not mapped. These concerned actions of organising as deciding on initiating innovation, and deciding on dismissing operators as a consequence of a user test. Also, actions of experiencing were mentioned: managers received feedback on specific experiences. Consequently, not all translations have been observed and miss in the following results.

The designers bring UX insights gained in the field study in action 3 into action 4 in the form of communicating their observations supported by posters with photos and text. In action 6 the UX insights are available in the form of prototypes; these prototypes do not lead to the software developers using the insights. In action 7 and 8 the designers use the prototypes to iterative test and design; here it is the designers who represent the UX insights using prototypes. For action 12 the designers develop a presentation with scenarios of the UXs. In this action the designers, the presentation and the prototype represent the UX insights. It is doubted if the artefacts (presentation and prototype) will represent UX insights visible enough to be considered in following actions.

In this study designers created posters, prototypes, or presentations, and applied these as mediating artefacts in boundary actions. However, interactions between designers and these artefacts seem not to trigger other actors to use these artefacts. In the NHCD framework, designers create artefacts that other actors could use to bring UX insights in actions where designers are not involved. This study shows that in practice this is not the case. Although the designers are aware of the need for identifying

the problems and roles of the actors in future actions, they have difficulties in doing so. Designers understand they need to identify in order to frame a problem and solution space for creating mediating artefacts, but find it difficult to anticipate on future actions due to a lack of understanding what problems and roles to consider. Translations found in the travelogue only concern the stages of triggering and engaging.

Next steps
The stage of identification, the first step in the process of translation, seems difficult. Identification has been described 'as defining the nature and problems of actors and then suggest that these problems could be resolved if actors take UX insights into account and negotiate others to do so'. In Study 6 it has become clear that gathering insights in order to define nature and problems of actors could be difficult when these actors are unknown. Possibly using the tool for mapping future actions supports designers in identifying nature and problem by thinking in roles and actions instead of stakeholders in the design practice. In the following studies additional insights on design practice are sought to make the NCC better fit practice.

Mapping tool
In the study, the participants used the mapping tools actively. They interpreted the provided stickers and added a new aspect: values. For the participants the value, or interest, of an actor in an action is important to be understood. However, the provided materials did not support participants in seeing the value/interest as part of the roles of the actors involved in an action. In the framework the aspect of value has been implicitly described in the input (the subject), the activity itself (rules, community, division of labour) and output (the artefact and outcome) of an activity. Extra space on the stickers with puppets (roles) could invite to describe the roles and tasks related to that role, and prevent adding personal characteristics.

5.4 Study 7: communicating user research

Study 7 aims to explore what artefacts and methods design researchers use to negotiate their findings, and how these artefacts and methods succeed in engaging new stakeholders. In order to have actions mapped that were successful, in the sense that they pushed research findings further in the development process, a project was selected that the contact person valued as successful.

Project in Study 7: Improving service offering from local government.
The project in Study 7 concerned services offered by a large municipality to support SMEs with business services (licenses, subsidies etc.). Also, the Chamber of Commerce supports the SMEs and guides the administration process. The Chamber commissioned a service design research agency to do a study among entrepreneurs about their experiences with the municipality's

services. The design researchers presented the results of the research to the service management team of the municipality, and shared and further explored the results with local council staff in a series of workshops. These workshops aimed to inform staff and employees on the results of the research, and together with the employees create suggestions for improvement. The project ended with report for the city council and municipality service managers to improve their service offerings.

5.4.1 Method Study 7

The contact person for this project invited one colleague at the design research agency for the study, with the brief the workshop could learn if, and how, they could improve the agency's practice.

Participants

For this study two participants were recruited, both experienced design researchers working for the service design research agency and involved in the project. Since the focus of the workshop was on their specific role as design researchers, no effort to recruit extra participants involved in the project was done.

Procedures

The workshop took place at the office of the design research company, and proceeded as the initial ones following the general description in section 5.1.2.

Materials

The participants brought in project documentation at hand, including the final report and examples of discussion material used in the project. The NCC materials, brought in by the researcher, were no different from the initial material described in section 5.1.3.

5.4.2 Mapping improving service offering from local government

The participants laid a timeline of 41 steps making use of their collective memory. As in the previous studies, the steps could not all be interpreted as an action; steps varied from just referring to one stakeholder up to referring to a series of reoccurring actions (e.g., a series of similar workshops). The researcher interpreted the steps into a timeline of eleven actions in the service improvements project as shown in Figure 5.9.

Figure 5.9: The timeline shows the 11 actions in the service improvements project.

After laying the timeline the participants selected steps they felt were exemplars of the success of the project. Figure 5.10 shows four of these exemplary actions mapped in detail: doing a workshop with the aim to discuss user insights (action 5), making a report of the user research (action 7), presenting the user research results (action 8) and doing a workshop with service providers to negotiate service improvements (action 10).

Figure 5.10: As a result of the workshop four actions have been mapped in detail, using the provided NCC materials (mini white boards and stickers).

The NCC materials, provided for mapping the actions, trigger questions on roles and artefacts. For example, the following discussion on the colour of the designer's tools used to communicate UX insights in action 5. One of the participants uses a yellow sticker for the tools 'video' and 'customer journey':

> *Moderator: why do you choose for yellow when you refer to a tool you use, why not red? Participant: It is all about the user experiences, it just doesn't feel right to make it red because although the users are not in this action, they are represented in the video and journey. Perhaps we should make it orange instead of red since it is used by both researcher (red) and user (yellow)?*

Trajectory

After the workshop the researcher interpreted the actions and positioned them on the canvas. Figure 5.11 shows the formed trajectory of the UX insights in the project on improving services. The trajectory starts when complaints are noticed in a boundary action with experiencers consulting organisers and ends with an action of designing when the designers create a report on the project.

The trajectory, together with observations of participants talking through the actions, leads to the following travelogue describing what happened in these actions.

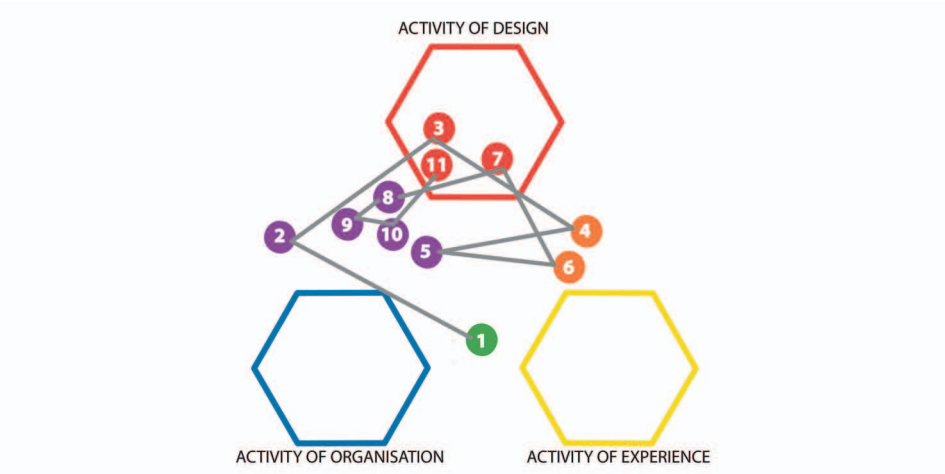


Figure 5.11: The trajectory of UX insights in the service design research project. The trajectory starts in a boundary action (consultancy) and ends in an action of designing (making reports) for this project.

Travelogue

A consultant of the Chamber of Commerce gets complaints from entrepreneurs about poor services of a municipality in ***action 1***. This triggered the consultant to contact a service design research agency to make a proposal for research. In ***action 2*** the researchers negotiate their service design research approach in a workshop with the consultant (who acts as their client) and someone of the municipality. For the design researchers it is important to have the 'right' participants in the workshops with people from the municipality. Already in this first workshop the municipality is informed on the added value of the workshops of involving participants in comparison with a presentation, and who should participate in these workshops.

In ***action 3*** the design researchers prepare interviews with (potential) users of municipality services. These interviews take place in ***action 4***. In this action the design researchers use video to document the interviews. After the interviews the design researchers prepare the communication of the UX insights gathered in the interviews by creating a customer journey, making posters and editing the video. The researcher takes the perspective of the client when editing the video:

> *You know, customer journeys . . . we looked at these customer journeys and said ok these are significant barriers and we want those shot again in order to have them clearly in the video. The client said we should elaborate on things that went wrong because he wanted to trigger stakeholders to improve the service providing.*

The design researchers discuss the found user insights in a workshop with their client and people responsible for the service offering in the municipality

in ***action 5***. For this discussion the researchers provide notecards for the participants to note insights during the presentation of video and customer journeys. The municipality representatives find the video too negative for using it to their colleagues because they miss examples of what UX to accomplish. This discussion leads to the conclusion to reframe the problem (not focusing on what goes wrong but what users want) and the need for extra interviews in order to expand the nationalities of the entrepreneurs.

In ***action 6*** these extra interviews take place. As a common practice[25] the service design researchers invite their client to observe some of the interviews. In one of the interviews the client is present in the room where the interview takes place without interfering. The service design researchers analyse all interviews in ***action 7***. After analysis they create booklets, cards, and posters to communicate UX insights found in the next actions.

In ***action 8***, the service design researchers present the UX insights in several sessions to different municipality stakeholders. In some sessions the design researchers only have 10 minutes to present their findings, in others there is time to do a more elaborate workshop as in action 5. They doubt if the audience will use the booklets, cards, and poster (provided during the presentation) after the presentation. One of the sessions triggers a manager working for the municipality to ask the service design research agency to communicate UX insights to the service operators of the municipal districts.

In ***action 9*** the service design researchers discuss with people from the municipality, responsible for educating service operators, the preparations of the workshops and negotiate a new offer for this extra work. Based on this discussion the design researchers prepare and deliver the workshops in ***action 10***. The goal of this action is to negotiate service improvements with municipality service operators. For the design researchers is a workshop approach an obvious choice, they experience the interactivity in workshops as a good way to communicate user research results and expect the artefacts they use (video, customer journey, cards with user stories) will support communication of UX insights and engagement of the municipality service operators. However, during some of workshops it is not clear if the showing and discussion of the artefacts lead to engagement and support the stakeholders to improve the service they provide. For example, showing the customer journey does not work: '. . . *they* [the service operators participating in the workshops] *said we should use this in a workshop with the controllers, not with them the operators.'* The service operators do not recognise their work in the touch-points shown in the journey.

25 In the mapping session it is not clear why the client was asked to observe an interview. In the practice of P5 the client observations support engagement with UX insights because the client gains trust (sees how UX insights were gathered) and makes preliminary interpretations that are discussed with the researchers.

The design researchers finish the project with ***action 11*** of writing and delivering an end report. With the aim of providing rich insights in the report, the design researchers find it difficult to anticipate on the different stakeholders who should read the report.
'We have sent the draft report with the request to carefully check the introduction. In that way there will be no words used that are sensitive or misinterpreted. It was not a crucial step, but you have to tune here to prevent doing it wrong resulting in non-use.'

5.4.3 Results Study 7

Study 7 resulted in new insights on what translations took place, how these translations were supported, and what artefacts were used. As in previous studies, actions in the activity of organisation were mentioned but not mapped, e.g., mentioning (in action 5) of educating staff considering use of the video the service designers produced.

What translations take place?
In action 2 the design researchers negotiate the 'right' participants in following (boundary) actions. This can be seen as the first stage of a translation, identification, if the design researchers are aware of the roles and problems of these 'right' participants and how they could engage these participants in using UX insights. In actions 4, 5, 7 and 8 the design researchers represent UX insights in artefacts as edited video and customer journeys to support triggering, the second stage of translation, the actors in following actions to use the UX insights. The third stage of translation, engagement, happens in the actions 9 and 10 that aim at engaging stakeholders in using UX insights. In most actions so far design researchers were actively involved and support translations as boundary spanners. In action 11 they make a report with little confidence that this artefact will be enough to support engaging stakeholders and establishing using the results of the design research, UX insights, in improving the services.

What methods and artefacts do service design researchers use to negotiate UX insights?
The methods and artefacts observed in this study are typically service design methods[26] and include contextual interviews, video, customer journey maps, posters, and cards with user stories. At the end of the NCC workshop the participants wondered if they could have had a better preparation for action 10 if they would have used representation of the various groups involved in a service (stakeholder maps) in action 9.

Artefacts for translation
The design researchers in this study, consciously created artefacts to

26 The managing directors of the service design research agency involved in this study co-authored a chapter on service design tools in the book 'This is service design thinking' (Stickdorn & Schneider, 2010)

engage new stakeholders in taking the design research results into account in decision- making. It can be said the artefacts are created to support translations, in particular to support the stages of triggering and engagement:

- For triggering, the design researchers used artefacts as video, note cards, and posters with customer journeys and user stories. However, these artefacts were in some actions not fitting the specific boundary action possibly because the design researchers were not aware of the role of the people involved in a boundary action and what triggers them.
- For engaging, the design researchers used video to represent user needs. The video shot and edited by the design researcher is a researcher's understanding of the user needs and shows the selection of the design researcher of what the service provider should learn about the problems occurring with the existing services. The design researcher translated UX insights into problems to solve when developing new services. It is not clear if the video engages in using UX insights in design decision making.
- An effort was done to bring user insights into actions of organising by delivering a report in the receiver's language. However, it was unclear how the report would support in implementing the improved services and establishing the use of the UX insights.

Boundary actions supporting translations
As expected, boundary actions seem indispensable to bring UX insights from one activity into another. The study shows that boundary actions could support the stages of triggering and engagement, if the form and procedures of bringing in UX insights fit the action's aim and actors involved. Actors involved in the boundary actions need to be seduced to actively participate in the action and use the tools for translation. More information is needed to understand how the last stage of translation, establishing, from a boundary action into actions of organising could be supported. The studies so far did not show any examples of successful establishing.

Mapping tool
As in the previous studies, describing the context of the actions using the NCC materials worked well. Again, the need for room on the stickers to more elaborately describing the roles of the actors was observed. A new observation was the doubt about the colours used in the NCC tools indicating the activity artefacts are referring to. The mapping tools provide white artefacts indicating an artefact that is specifically used in boundary actions. The suggestion of the participants to mix the colours is a possible solution to designate artefacts (to be) used in boundary actions with a new version of the NCC materials.

The actions in the current project were different from what was expected at the beginning of the project. During the project goals and actors changed,

and unexpected actions as gaining additional UX insights were included. Such unexpected changes in projects make it difficult to anticipate on the UX insights' trajectory. Moreover, gaining new insights is a continuous process and past, present, and future insights will travel through development projects concurrently. Adaptions of the NCC are needed to make it more interactive in order to make it possible to respond on changes in the trajectory.

5.5 Study 8: supporting agile processes

The previous studies showed that mapping and reflecting on actions in a development project could provide an understanding of occurring translations. The mapping in the previous studies provided limited information on what happened in the actions, resulting in a limited understanding of the translations. Study 8 mainly serves as a design opportunity with the aim to improve the NCC procedures and materials to support reflecting on actions in a project in more detail.

Project in Study 8: design of applications for business software as services
The project concerns a development project at a large company that develops business software. The company has a dedicated UX design department responsible for user research and the design of user interfaces. The project for this study was about the design of an application additional to an existing PSA[27] product of the company. The project aimed at adopting a more human-centred approach in the company and was just started at the time of the study. The project follows the agile approach using the scrum method (small development teams work in in short iterations of 1-2 weeks on specific problems). In the project a development team consisting of user interface designers, software developers and product managers collaborate. The project started with insights based on customer feedback and user research resulting in ideas for design. The project manager made a business case and planning/road map for the project on the most promising idea. Together software developers and user interface designers conceptualised solutions iteratively designing and testing the concepts. After a first prototype was available this was released to a small group of clients to get feedback on software bugs and interface problems (controlled release). The project would be ended when the application is released and available for the entire market.

5.5.1 Method Study 8

The aim of the workshop was to get a better understanding of the role of user research and UI design for an on-going development project of applications for software as services. In this project an agile process was applied. The aim was discussed between the researcher and the company contact and briefed to potential participants. Throughout this study NCC material was redesigned to support participants to create data on more actions, and to inform the

27 Professional Services Automation, project and resource management software.

design of the toolkit for designers.

Participants
The selection and recruitment of participants was done by the company contact. From the seven colleagues invited five participated in the workshop. The five participants were involved in the project and were experienced as respectively service operator (customer support), sales manager (presales), product manager (product development), consultant (customer services), and developer (software architecture). Unfortunately, none of the invited UI designers (responsible for user research) participated.

Procedures
The workshop was held at the company in a large meeting room providing connections to the company's intranet for retrieving information on the project. The study consisted of three parts, the first two parts followed the general procedures from section 5.1.2, and the third part was an addition to the procedures aiming at evaluating the redesigned NCC materials. In part one the participants were invited to make the timeline of the design of the product so far. In part two a timeline was created focusing on what recently happened in the selected project and alternative steps to make it an ideal development process. In the third part the map, created based on the timeline from part 2, was used to decide on the planning of the development project. In the first two parts of the workshop the researcher acted as moderator. In part three the company contact acted as moderator, while the researcher acted as an observer of the use of the redesigned NCC materials.

Materials
As a preparation for the third part of the workshop additional NCC material was created. This material was based on the findings in the previous studies and the first two parts in Study 8. The individual whiteboards to map one specific action were replaced by swim lanes for mapping connected actions on the timeline to trigger to map more actions in detail. Figure 5.12 shows a poster with swim lanes depicting the different activities instead of the mini whiteboards used in the previous studies.

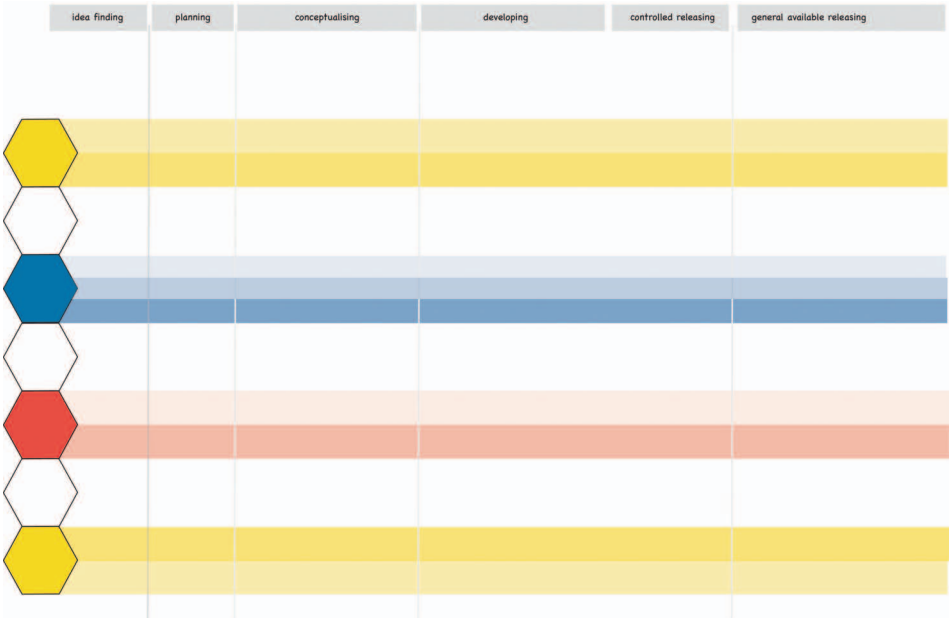


Figure 5.12: The poster with swim lanes to map the actions on the timeline replaces the individual mini white boards as used in the previous studies. The coloured swim lanes visualise one of the activities, while the white lanes give room for mapping boundary actions.

The remaining NCC material, the poster explaining the NCC, sticky notes and pens, and the stickers visualising aspects describing an action, are similar as the initial materials as described in section 5.1.3.

5.5.2 Mapping design of applications for business software as services

The participants lay out a general timeline, covering three years of development to retrieve memories on what happened in the PSA project before the application development started. For each action on the timeline, they write the release numbers, the number of the software version developed and released in the respective action, on a sticky note. The participants were surprised to see how many changes on the product (leading to new releases) were made without exactly knowing what triggered the design of new product features. In some cases, it was feedback from a limited number of clients, in other cases it was marketing asking for changes and/or new features. Only when they started to use the scrum method with small development teams that work in short iterations of one to two weeks on specific problems, user needs driving the development evolved as a routine. Figure 5.13 shows how the participants use the initial NCC materials to map the last two actions of the timeline in more detail. They have a lively discussion on what happened and all are spontaneously adding stickers and remarks on a long sheet of paper instead of the whiteboards offered with a clear link between the actions.

Figure 5.13: The PSA project actions on the timeline (right) described as release numbers on the sticky notes with the last two actions mapped in detail (left) making use of the initial NCC materials.

When shortly presenting what they want to include in an ideal project timeline, participants all mention improvements on the coordination and communication between those involved in development and release.

Trajectory

Based on their indicators for improvement on the usual development process the participants lay the timeline of the ideal application design project (Figure 5.14).

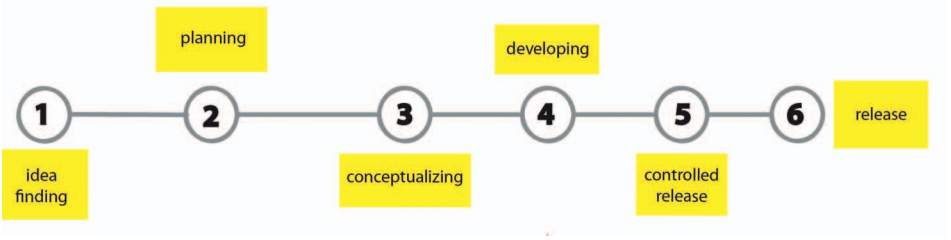


Figure 5.14: Timeline of the ideal application design project.

With this timeline, and the results of how the NCC mapping materials are used in the studies so far, I posted the actions in swim lanes in order to construct a timeline with actions mapped in detail. Each swim lane presents the action programs in a specific (experience, design, organisation) activity and the boundary actions in between the activities. Figure 5.15 shows the participants reviewing this poster and adding remarks on it in the third part of the workshop (two months after part one and two).

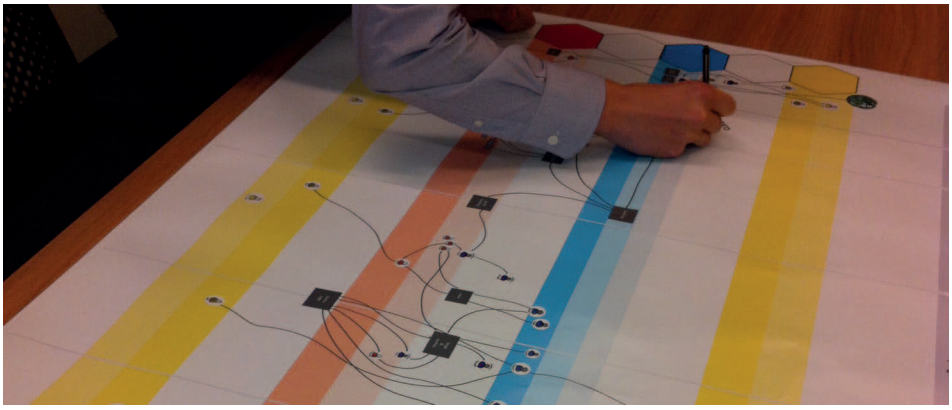


Figure 5.15: One of the participants adding remarks when reflecting on the actions mapped on the poster.

Although participants indicate that the swim lanes function very well to map and reflect on the project, and support to understand how to prepare for actions, they feel they need a more interactive solution with the possibility to make adaptions without the extra work of having to reprint the poster after each adaption.

Figure 5.16 shows the trajectory of the ideal design project, constructed based on the poster. What happens, or ideally will happen, along the trajectory is described in the travelogue.

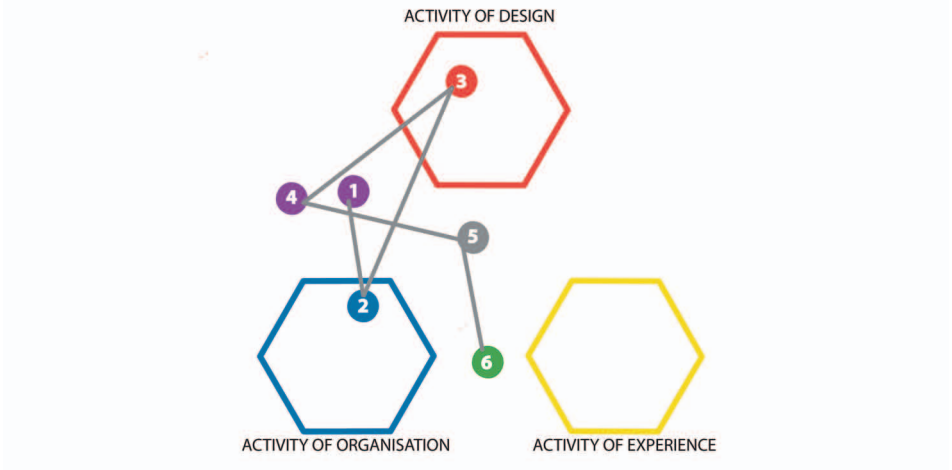


Figure 5.16: trajectory of the UX insights in the ideal business software application development project.

Travelogue

Idea finding, in *action 1*, happens in collaboration between the product manager and designers. While the UX designers gather insights on UX, the product manager gathers insights on target groups and technology. Together

they discuss ideas that have potential for further development. How the UX (and other) insights are represented in this discussion is not clear.

In ***action 2***, the product manager makes a business case and roadmap (planning) for the application design. There are doubts if the current way of working is fitting a more human centred approach:

> *Consultant: When you reflect on user needs the developers are not open for discussion but stick to what is in the requirements/ user stories. Contact: Yeah, that is also about understanding what is going on. Service operator: understanding the context. Contact: Some development teams do not see the whole picture and do not see the relation between elements in a concept. They are focused on one specific element and do not have the skills or means to look at the context. Product manager: I understand what you mean; it depends on the development teams involved and their experience and culture/nationality [the development teams are located at different countries].*

In an ideal planning procedure (roadmap) it is possible to incorporate evolving user insights and adapt the user stories used by the software developers. During conceptualising (action ***3*** and ***3a***) the UI designers iteratively gather user insights (***3a***) and use these to make a first concept of the user interface (***3***). User insights are gathered when evaluating prototypes with a small group of users. The product manager doubts the way of working of the UI designers:

Product manager: Often it takes a lot of time to build the UI concepts created, since there are UI designers involved a lot of problems occur. Contact: Is that because interaction between UI design and software development is missing? Consultant: Maybe not a mismatch between functionality and UI design, but a lack of understanding of user needs? Contact: The problem seems we do not put enough effort in user research .... Product manager: I do not agree, we have resources to do user research, but I doubt the quality of the research as it is now.

UI designers seem to have a different understanding of needed functionality than software development. A clear, consistent understanding of user needs is missing.

In the development action (***4***) the iterative design of the functionalities (software development) and UI design takes place using the scrum method. UX insights are brought in by both user stories, that describe a part of functionalities to develop, and the reviews in the regular sessions where the development teams present the solutions. If, and in what form, UX insights are brought into review sessions depends on who participates in the sessions. Communicating concepts is object of discussion. In the ideal situation the

iterative process of developing in sprints with feedback sessions would benefit keeping user insights alive. However, there is an enormous amount of information to share on changes in the concepts due to the short iterative development of the software. The communication of this information so far is not successful, people are not triggered to look for information and have to put much effort in finding the information needed:

> *Contact: a concept is a document of about thirty-five pages, my question is if that is the way to present the concept and give people an impression? Product manager: there is also a prototype, and the prototype is the 'showcase' in my opinion. You are proud to show it like we did this morning with potential users; they were so thrilled. It is UX that have to organise these feedback sessions, clients who see and use the prototype. Contact: ... yeah but what if the client would have seen more concepts? Who decide on what we want? Product manager: we also show the prototype to development, they have to build it you know. Sales: we haven't seen it at sales yet? Product Manager: no, but that is in the planning. In the earlier stages of concept development, we already showed it to some consultants but now we have a clearer idea what it will be we will show it to a broader audience [in the review sessions].*

Transferring the designed concept to the 'manufacturing' software development teams by presenting the context and delivering a document seems not sufficient because these do not support engagement of the development teams in the human centred design process. Participants agree that prototypes could serve to engage stakeholders, as long as you put effort in discussing the prototypes with them:

> *Product manager: ... absolutely, we use prototypes for presentation to the board and to (software) development; the document is a sort of container including the prototype. Developer: what I envision is that you involve all kinds of stakeholders with different core roles in the organisation (support, sales, presales, delivery, finance) by discussing in 15 minutes what the solutions are. Product manager: that is what we aim at, it has no sense to develop something you already say it will not work. Sales: But you have to make a planning for this, so I can inform my colleagues at regular meetings. Developer: you create so much support, you will have ambassadors within the organisation and when visiting clients, they spot opportunities and already prepare clients for new products.*

In ***action 5*** the software development team and UI designers hand over the concept to a 'business readiness team'. This readiness team is responsible for releasing a first version in order to test and iteratively improve the concept in real practice in what is called 'a controlled release'. A small group of

providers get the new application and provide this to a selected group of users who will use (and test) the application during a period of six months. During this action providers, users, service operators, developers, and managers closely collaborate in the ideal situation. The participants indicate that during this stage the communication needs improvement. Up to now communication takes place via 'release notes' (short notes explaining the new application), web-seminars, and blogs on the company intranet portal:

> *Sales: If I may say so I am rather engaged but I noticed that you have to put some effort in getting informed. It is not just getting info, you should also bring some feedback in. Development: yeah, and the web-seminars are during working-hours. Product manager: ... it costs a lot of time to prepare and in the end only 50 of the 1600 invited participate…. Sales: well I am not sure when the last seminar was, I might have missed it. Developer: Just too much messages posted on the portal, you do not have the time to read these every day. ... And the release notes are difficult to understand. Service operator: it also happens with testing; it is on the calendar of at least 25 colleagues and only the same 10 people do participate. Some say they do not need to be informed, others feel selling products is more important.'*

All participants feel that a new improved feedback procedure is much needed in order to take advantage of the controlled release action.

After improving the concept, the new app is ready for release on the market in ***action 6***.

5.5.3 Results Study 8

Mapping, and reflecting on the mapping, in this study provided potential solutions for supporting translation in boundary actions, e.g., collaboratively creating software and user interfaces. Software developers 'manufacturing' software was seen as an important action, although not mapped as an action. Translation to these software development actions were reviewed as important.

What translations take place?

Potential translations, found in the travelogue, take place between actions where UI designers gain UX insights (action 3) and software developers make user stories (action 4). The designers use the found UX insights to develop a user interface, while the software developers use the created user stories to plan development and test solutions. Collaboration in iteratively creating software and UI solutions, and testing these solutions, during review sessions (action 4) and controlled release (action 5) could be boundary actions supporting translations. The travelogue shows the specific problems occurring when bringing UX insights into an agile development project:

- UI designers gain new UX insights along the development process due

to the continuous user feedback. However, the user stories used in the software development process are not easily adapted to these new insights. Software developers seem to stick to initial user stories and requirements.
- The information load (e.g., extensive documents, hard to understand notes, load of messages on intranet portal) during development and controlled release makes it difficult to find a procedure and form for communicating UX insights.

Mapping tool
In Study 8 the NCC material was redesigned to improve the mapping. The main point of improvement found was the need to map actions more detailed when laying the timeline. Besides making materials that support mapping actions on one canvas, instead of on individual whiteboards for each action, also the mapping procedure and instruction needed to be improved in order to support participants in describing the specific role of actors and the artefacts used in an action. Study 8 shows that using swim lanes increase mapping and talking through actions. The use of the swim lanes also provided more information for understanding the translations happening. Still a point of improvement, observed in this study, is to make the NCC easier to adapt to where and when the mapping takes place. Based on these remarks the mapping process is improved for mapping in the remaining studies by:
- Making a prototype package to make the timeline with detailed actions independent from who participates and where the mapping takes place. The package consists of materials to draw the swim lanes and map the actions independent of the surface for mapping on (e.g., whiteboard or flipcharts).
- Adding a list of all people involved in the project at the start of the swim lanes in order to discuss what roles are involved in what actions instead of which people.

5.6 Study 9: implementing same concept in different contexts

This study concerned tracing of user experiences and exploring translations in a design project with many, very different, actors involved. The aim of the study was to understand the different stages of translation: what can a designer do when so many actions are involved with so many translations? The design goal with this workshop was to evaluate new NCC materials to inform the design of a toolkit for design practice.

Project in Study 9: Development and implementation of homecare and welfare products and services for independent living
The selected project was on human-centred design of products (e.g., architecture, ICT) and services to facilitate independent living for people who need extra care. A recently founded consultancy, that advises homecare organisations in the development of e-health services, managed the project

in which architects, service designers, health and care providers, and municipalities more or less collaborated. Initial development projects were rather scattered, with some partners (e.g., the architects) working without and others (e.g., service designers) with a human-centred approach. For this project an umbrella vision was co-created on the design of meeting points (e.g., buildings, internet platforms) and services for people who need care. With these meeting points people who need care and people who provide care could link and build a social network supporting independent living and keep this social network alive. For each municipality or neighbourhood, a customised solution was sought by doing research on user needs followed by co-creation of service offerings fitting the specific context. At the moment of the workshop the project had resulted in a meeting place where different activities are organised in order to build and sustain social networks, and a neighbourhood internet platform providing a 'video sitter' service that supports neighbours to keep an eye on vulnerable neighbours through a video connection. Architects, ICT developers, e-health service designers/consultants, and health and homecare providers who partnered in the project wanted to improve collaboration with each other and with municipalities in order to expand their approach to more municipalities and/or neighbourhoods.

5.6.1 Method Study 9

The company contact person for this selected project introduced the workshop in the invitation to all partners in the project as an occasion to discuss the state of the art of all subprojects invitees were involved in. The workshop provided the opportunity to discuss how to prolong and improve these subprojects and find opportunities to initiate new projects building on the human-centred approach.

Participants

From the broad invitation thirteen participants attended the workshop. For each subproject running at least one representative of the project participated. Their roles in the projects concerned service design, project management, architecture, homecare services, care, and welfare. Participants functioned as manager (n=7), service provider (n=3), and designer (service design n=2, architecture n=1) in the projects.

Procedures

An interview with the contact person before the workshop provided the researcher with information to prepare a timeline of the project. Participants discussed, and customised, the pre-filled in timeline in the workshop that took place in a course room at the facilities of the newly founded consultancy. The moderator started the workshop with an introduction of the pre-filled in timeline, allowing participants to add and/or change actions on the timeline. After the introduction, the participants were divided in two groups of six to seven participants to not exceed the maximum of eight participants as set in the general procedures. The groups continued reflection on the timeline,

adding annotations making use of the provided NCC materials. Meanwhile they reflected on the collaboration in their projects so far. After these reflections they presented their first results to the other participants, exchanging experiences in the project. In a second round, the groups discussed what they wanted to achieve with the project and then worked on the timeline mapping the remaining steps to take towards that goal. Again, they presented the results followed by a general discussion. Two days after the workshop, the contact person (who participated in the workshop) brought the two annotated timelines together in one new timeline using the toolkit. During the creation of the new timeline the researcher mainly observed. In addition, two participants used the NCC package as a toolkit in their consultancy practice two weeks after the workshop and shared their findings and reflections on that experience by email.

Materials

Pre-filled in timelines of the project were provided to support the reflection on the concurrent projects in two groups. On the pre-filled timeline hexagons are placed at the start of the swim lanes, including actors involved in the respective lane's activity. The timeline is divided in time slots named as the project's phases. Figure 5.17 shows the actions mapped in, and in between, the coloured swim lanes. There were several copies of the pre-filled in timeline available, covered with transparent film serving as a surface to add actions and notes. For discussing and adding actions sticky notes, pens and the same stickers as in the previous studies were available.

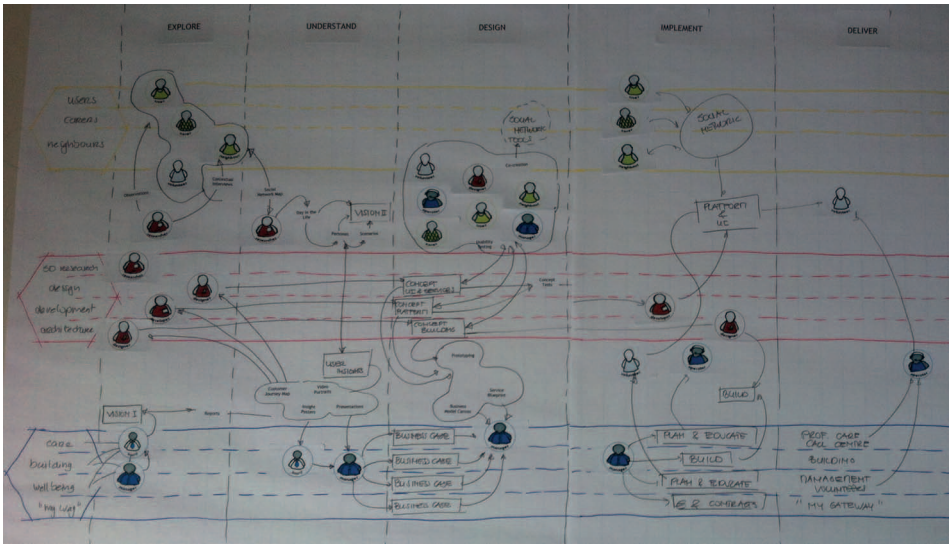


Figure 5.17: The pre-filled in timeline with actions discussed in the interview before the workshop. In the hexagons at the start of the swim lanes all actors involved in the lane's activity are noted. The timeline is divided in time slots named as the project's phases. The actions are mapped in, and in between, the coloured swim lanes.

For bringing the discussed actions together, a toolkit for making the timeline was created by the researcher consisting of flipcharts for drawing the swim lanes and time zones, coloured hexagons for naming actors involved, and the NCC stickers for mapping the actions. For the use of the NCC by two participants after the workshop in their consultancy practice, the researcher provided templates for making the tool.

5.6.2 Mapping development of homecare services for independent living

The pre-filled in timeline supports reflecting on the projects. Participants recognise situations and appreciate having an overview of the things happening, and will happen, in the projects. In both groups all participants make notes on sticky notes and add those on the timeline during discussions, one participant writes concluding remarks directly on the transparent film covering the poster. Figure 5.18 shows the annotated timelines on the wall and on the table, discussions take place on what happened and how to improve the process.

Figure 5.18: The pre-filled in timelines with notes support the discussions.

The contact person finds it difficult to create a new map. Using the toolkit is not straightforward, even after she gained some experience when using the filled in timelines in the workshop and after an introduction on the toolkit. She doubts how to combine the two annotated timelines of the projects in the different municipalities in one new overview of actions in the umbrella project. In the two projects reflected upon the aims of the actions are identical, however, the contexts are different due to differences in the developed product service systems. It seems confusing to generalise actions by identifying the roles instead of persons: *Contact: 'shall I use a new lane for each municipality or do I use different colours for the actors?' Moderator: 'what do you suggest, perhaps stakeholders from the municipalities all have an organising role and thus all live in the blue lanes?'* The puppets seem to be interpreted as a person instead of a role, the moderator needs to emphasise now and then that persons could have different roles before this is understood.

Trajectory

Figure 5.19 shows the end result of the workshop, a filled in timeline with eleven mapped actions reflected upon in the workshop.

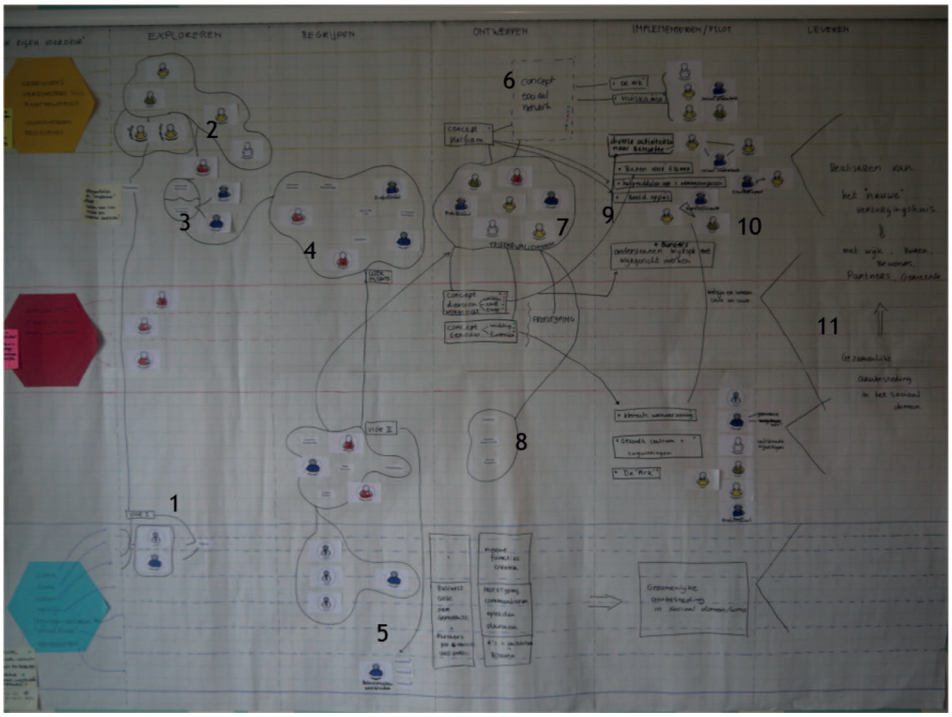


Figure 5.19: The new timeline of the umbrella project combining the actions of the annotated ones.

Figure 5.20 summarises the new timeline by just showing the actions of the umbrella project.

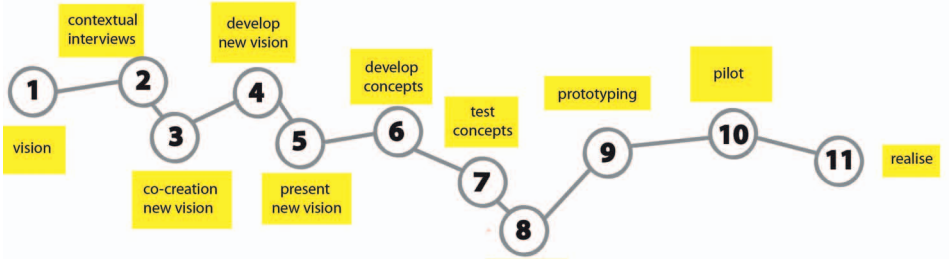


Figure 5.20: The summarized timeline showing the 11 actions reflected upon

Based on the new timeline the trajectory of the UX insights in the umbrella project of the development and implementation of products and services for independent living is constructed (Figure 5.21).

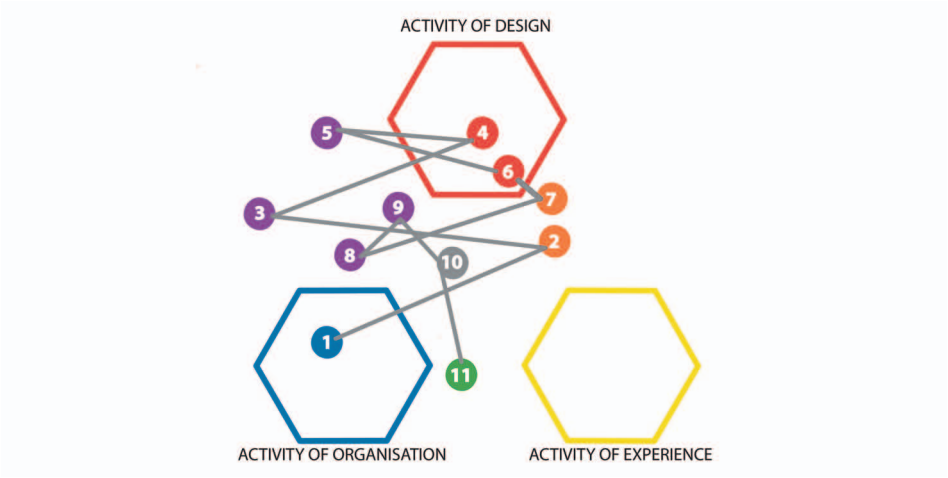


Figure 5.21: Trajectory of UX insights in the development and implementation of products and services for independent living.

Travelogue

The travelogue describes what participants said what happened and/or what they would prefer to happen in developing and implementation of products and services in municipalities based on their experiences in projects for several municipalities.

Some of the projects start (***action 1***) with a provider developing a vision of a PSS based on contacts with care professionals representing the users. Service design researchers do contextual interviews with (potential) users and their carers in ***action 2*** to increase an understanding of user needs, and engage providers in a human-centred approach. The service design researchers bring the results of these interviews in in a co-creation session (***action 3***) with providers aiming to create a new vision on housing and care provision, based on elaborate user insights. For the co-creation the service design researchers prepared social network maps, scenarios, and a day-in-life posters to represent UX insights while discussing a new vision. An important aspect of the new vision is the role of social networks in independent living. The developed solutions should include support for building and sustaining social networks apart from housing and care solutions.

In ***action 4***, service designers prepare visualisations (posters, video portraits, customer journeys) for presenting the new vision to municipalities/ neighbourhoods in ***action 5***.
Together with the care providers and architects the service designers present the new vision in order to engage municipalities/neighbourhoods in implementing the new PSS. Next to doing presentations the participants feel that getting the press publishing on the projects, with an emphasis on success

stories, is also a powerful tool to get people engaged at the start as well as along the project:

> *We feel the* [social] *network is very important... We also feel the press should be involved ... in order to use them to spread our vision. 'In new projects for other municipalities we want to show the small successes and trigger them to do some research on the specific needs for their context in order to customise the services.*

With the vision service designers develop and prototype concepts for social networking and a digital platform in ***action 6***. How UX insights are represented in these prototypes is unclear. In ***action 7*** the service designers test the prototypes with users and their carers. It is unclear where and how these tests take place. In the next ***action 8*** the service designers support municipalities, who are interested in further developing the concepts, in making business cases. It is unclear how the test results and prototypes are incorporated in this action.

In ***action 9*** service designers, in close collaboration with the providers of the service, adapt the prototypes to the specific situation in a municipality/ neighbourhood. With these prototypes the providers start small-scale pilots supported by the service designers in ***action 10***. These pilots provide feedback on what to take into account when implementing the service:

> *We found forces with a very particular dynamics we need to take into account. I do not know if these are blue roles: the local government. We failed to involve them at the right moment. . .there [*pointing at yellow lanes*] we encounter stakeholders we jokingly called 'neighbourhood mayors. These people have a lot of influence on the whole process, they are key stakeholders who can make or break our work.*

Obviously, these actors from local government and/or neighbourhoods do not engage in the human-centred approach but stick to their own vision if not involved before starting the pilots. After successful pilots the PSSs are realised in ***action 11***.

5.6.3 Results Study 9

The mapping resulted in insights on stages of translation.

What stages of translations take place?

In the travelogue all stages of potential translations can be found. By doing contextual interviews (action 2) designers identify roles and problems of actors to take into account when developing artefacts supporting translations. In action 3 the service designers trigger other stakeholders to use UX insights by presenting the results of interviews with users. By co-creating the new vision (also in action 3) the designers engage other stakeholders in

using UX insights. The service designers bring tools in action 3 that support stakeholders in understanding user needs (triggering, the second stage of translations) and use this understanding for envisioning solutions for independent living (engaging, the third stage of translations). By proposing to include social networks in the PSS implementation (in action 10 and 11), taking UX insights into account could be established in the activity of organisation, the final stage of translation. Study 9 shows how difficult it can be in practice to anticipate on how to support translations when so many actors and translations are involved.

Identifying
The main problem seems to be in identifying 'unexpected' actors. An example is the 'neighbourhood mayor' who is difficult to engage in using UX insights because he rather sticks to his own preferences and routines. Having examples as this is supportive in the stage of identifying. It helps using the experiences of people who worked in comparable situations. Reflecting on comparable projects helps to recognise these actors and their roles. Consequently, a guideline for designers is to prepare a mapping session on a specific project by making a list of possible roles based on experiences in comparable projects. Building a repository based on experiences, with examples of roles, artefacts and/or tools, actions, and translations, could provide support for to the mapping toolkit. However, a repository can lead to generalisation of projects and translations leading to 'standard' solutions for supporting translations. Each design project is different and needs customised support for translations as the mapped project in this study shows; although all subprojects shared a design vision the subprojects led to different solutions due to the differences in the contexts. Making one general project timeline, including subprojects that differ in context, led to too general solutions to support translations. By updating the trajectory and travelogue during a project and split in more detailed maps for some subprojects, avoids the pitfall of generalisation.

Designing boundary actions
Part of the design vision in the discussed project in this study is the building of social networks as part of the solution for the PSS. By designing a meeting point, e.g., a local activity centre or a website, people meet and are triggered to support each other in independent living by exchanging services. Meanwhile there is a possibility to consult professional care takers via this meeting point. Designing this meeting point can be seen as designing a boundary action that bridges the actions of experiencing home care and welfare services, and actions of organising the provision of these services. The meeting point triggers and engages professional care takers to recognise UX insights, identify changes in user needs and adapt services to these needs.

Mapping tool
Two participants used the toolkit in another project, and shared their experiences with the toolkit in an email to the researcher. A short evaluation

showed that the mapping does support them understanding actions of organising and how they could support these actions. A main complaint about the toolkit is the amount of work to prepare the mapping materials.

5.7 Study 10: supporting the product manager

The focus of this study was on what translations between activities of design and organisation would keep UX insights alive in the activity of organising. For this study a project was selected from the P5consultants portfolio. Being professionally involved in the selected project opened the opportunity to reflect on my own experiences, and to understand how to improve facilitating translations as a user researcher. The main question guiding this study was what opportunities the designers and user researchers had in supporting the final stage of translation: establishing. What did we do in this project to delegate and represent the user experiences in actions of organising?

Project in Study 10: Design of support for DIY installation of ICT products
The project was the design of packaging for ICT products that would support customers in DIY installation of the products. The project aimed at decreasing costs on support by a helpdesk or on-site technicians, improve logistics of providing ICT kits to the customer, and improve customer experience. The end result was a new packaging with the products to install in dedicated boxes, a clear quick reference card to get the installation done, and extra manuals in an information storing binder. An important user insight in this project is the need for consistency in the design of packaging, graphic design, and hardware elements. To get this consistency, close collaboration between designers and product manager, communication designers (from another agency), manufacturers of the hardware, packaging industry, and external user researchers was key during the three years lasting development project.

5.7.1 Method Study 10

For the study the emphasis was on the actors with an organising role, what do they do in actions of organisation to keep UX insights alive? Therefore, the senior designer involved in the project was asked to invite the product manager of the client (a large telecommunications company). Since the researcher was involved in the project, a second researcher was invited to observe during the workshop, and co-analyse, in order to prevent bias.

Participants
The three participants were involved in the project from beginning to the end. One of the two senior designers from the design agency participating in the workshop has done most of the designing, while the other designer was more involved in management of the design process. The third participant was product manager at the telecommunications company responsible for the logistics of the installation services. She was involved even before the project started when the first ideas to redesign the DIY installation service emerged.

Procedures
The workshop was held at the design agency in the room where most meetings between designers and product manager took place. The workshop followed the initial procedures as described in section 5.1.2.

Materials
For this study the NCC toolkit, created in study 9, was used. The product manager had project documentation at hand and used this to check steps in the process (when did this happen, who/what was involved, where did this lead to). The designers brought models and prototypes made during the project into the workshop (Figure 5.22).

Figure 5.22 Documentation and prototypes were at hand when creating the timeline and mapping the actions.

5.7.2 Mapping design of support for DIY installation of ICT products

From the beginning to the end of the workshop two of the participants (the product manager and the designer) actively talked through and reflected on the project, while the designer with the managing role was more passive. While mapping the participants hardly use the NCC material for mapping actions. They left the mapping to the moderator; however, the participants used the timeline to point out specific actions and asked the moderator regularly to add remarks.

Mapping the actions started with making an overview of actors involved by adding their roles in the hexagons visualising the activities of design, organising, and experience at the beginning of the swim lanes. When making this overview, the product manager realises her role during the project:

> *Designer: you accomplished to let us make models all the time to distribute and test, you really acted as a product champion convincing that the solutions we designed should be implemented. Product manager: but in the end I was less involved . . . but I kept informed and tried to influence whenever possible. Designer: yeah, but then you missed your manager who supported you all the time*

and gave you the freedom to act. Product Manager: ... I still miss that warm hand guiding me. . . the day he left the atmosphere definitely changed.

Obviously, the product manager is able to span boundaries between the design and organising actions because she gets the freedom to do so which doesn't seem a common practice.

At the end of the workshop a timeline is laid with fourteen actions covering the development phases: discover, design, and deliver. The participating designers differentiate their work in these phases. The details of the timeline in Figure 5.23 shows that in all of the three phases the artefact 'business case' is having a role.

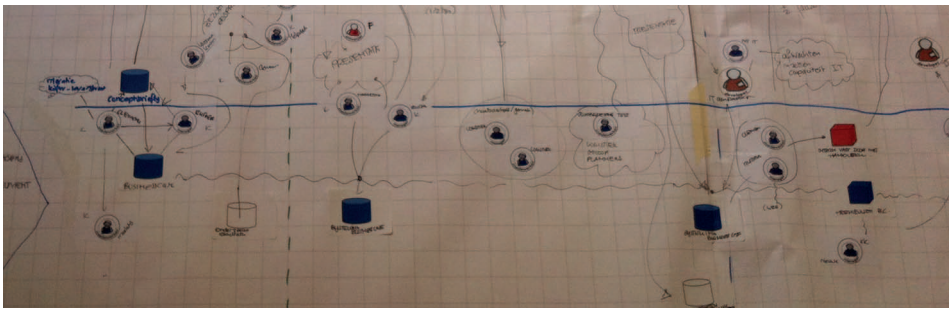


Figure 5.23 Part of the filled in timeline showing the trajectory of the business case (the four blue boxes below the blue line) with four times making adaptations of the business case in three phases of the project (dotted lines mark the phases).

Trajectory

Figure 5.24 shows actions mapped on the timeline in chronological order.

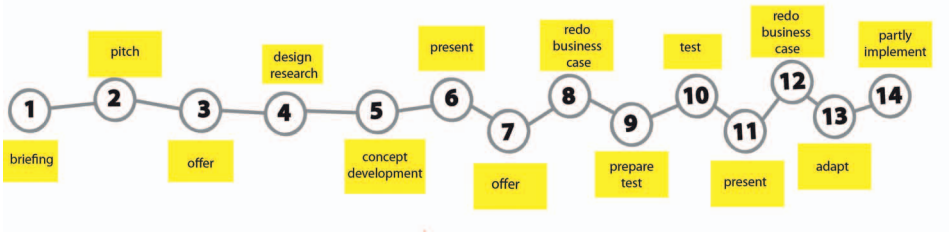


Figure 5.24: The 14 actions mapped on the timeline of the development support for DIY installation of ICT products.

With the order of actions on the timeline, and their position on the constructed timeline with swim lanes, the trajectory in Figure 5.25 is constructed.

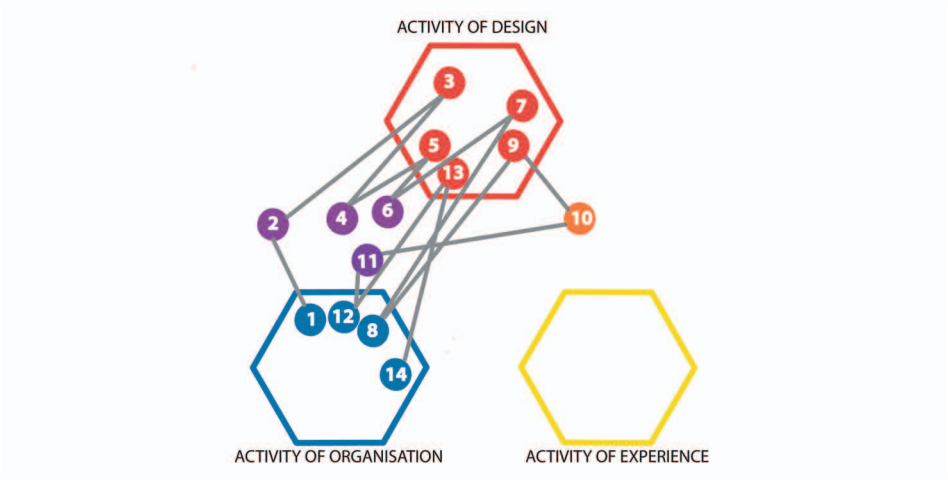


Figure 5.25: The trajectory of the UX insights during the development of packaging that supports DIY installation.

Travelogue

The trajectory starts in ***action 1*** when the product manager and her colleagues make the briefing of the project based on a business case, indicating how the development would benefit the organisation of delivering ICT products. The brief includes 5 aspects: environmental issues, customer satisfaction, cost reduction helpdesk and logistics, efficiency, and corporate identity. With this brief design agencies are invited to pitch for the project in ***action 2***. The large audiences, attending these designers' presentations, consist of the product manager, marketing managers, telecommunication engineers, logistic operators and more. Together they discuss the offerings and choose the one that showed tangible solutions. Showing solutions supports the understanding of the benefits of the designers' approach.

The designers make a detailed offer (***action 3***) and again include some potential solutions they created with the user insights they had gained in earlier projects for the same client. These UX insights involve use of comparable products by both the company's customers (available in user research reports), as well as the employees in the company responsible for assembling, packing, and sending the DIY package to the customers (not clear how these are documented).

In ***action 4*** the designers observe telecommunication engineers doing the installation of the ICT products, discussions between helpdesk and customers, and the interactions with the packaging when preparing for delivery, to get a renewed and better understanding of the solution space. With the observations on the use of the packaging of the ICT products and the installation of the products, the designers start creating solutions in ***action 5***. The designers frame the solution space by the aspects business,

technology, logistics, and user iteratively with creating solutions. They do not communicate the frame to the client but only show solutions when presenting the concept in ***action 6***. The UX insights are not brought into this action, instead the designers make an offer for user testing the concept in home based on the client's response on the presentation.

In ***action 8***, the product manager has to redo the business case on the new concept in order to get approval and budget to continue the development since every time something changes in the concept (and thus potential costs) the business case has to be adapted. She uses the solutions the designers presented to build scenarios in order to show the viability of the project. It takes almost 6 months before the project could continue due to the fact that the project does not get a formal approval. In the words of the product manager 'the project did not exist': *'...actually, the project was never formal approved when we started with as a consequence that the project did not exist and thus no responsible manager was there to approve continuation. If such a manager had been there he/she would have been on top of the project and had pulled it through.'* However, without formal approval the product manager finds resources and the project continues in ***action 9*** where designers (both the design agency and a graphic design agency) and design researchers together prepare the in home test by making prototypes of packaging and user manuals, making a test design and recruiting participants who in practice ordered the DIY package.

In ***action 10*** design researchers test the concepts with in-home user tests by means of naturalistic observations (video observations) of a sample of customers representing potential users. The design researchers analyse the test results and prepare the presentation of the UX insights gathered in the form of edited video.

The presentation takes place in ***action 11***. The design researchers together with the designers present the test results and UX insights to an audience of product manager, marketing managers, logistic managers and others. Based on this presentation and the discussions that took place the design researchers make a report including the presented video. The designers deliver prototypes and guidelines for implementation.

The product manager (together with a project manager) has to redo the business case again in ***action 12*** in order to include small changes in the design and to get the IT department commissioned to adapt the software for linking client data to logistics. In ***action 13*** the designers create these changes in the design (more efficient solutions for the packaging as making the measures better fitting storage capacity, less handling in folding boxes and less material use). The product manager gradually gets new solutions implemented in ***action 14***. In order to get things implemented she uses prototypes and the results of the concept testing in the form of the

presentations and video to negotiate resources for implementation. The product manager knows where this documentation/information can be found in the shared intranet documents, however, she misses a more systematic documentation to trace decisions and that is accessible for all stakeholders.

5.7.3 Results Study 10

Study 10 has been providing insights on the translations towards the activity of organisation and the use of the mapping tool in design practice.

What translations did occur?

Designers used the UX insights they gained to create solutions and triggered participants in action 6 to use UX insights by proposing to do a concept test with the prototypes of these solutions with users. The product manager wrote a business case showing the benefits of the solutions to engage actors in concept testing, and thus taking UX insights into account in decision making. This engagement did not succeed; the concept test took place without formal approval. The results of the test were presented to engage actors to use the UX insights supported by video reports and guidelines. Again, a business case was written to engage actors in implementing the new concept, and again engagement did not occur. The product manager then brings UX insights into the activity of organisation by showing scenarios build with the video reports. However, this did not lead to establishing using these UX insights by others than the product manager possibly because the insights were not accessible.

Translations towards the activity of organisation

In the translations, found in the travelogue, it is the product manager who takes the role of boundary spanner bringing UX into the activity of organisation. However, other actors in the activity of organisation seem not to use the UX insights when making design decisions when implementing the new packaging. The study shows two barriers that could explain why the product manager did not succeed in negotiating the implementation of the new concept. These barriers are:

1. The activity of organisation seems to include strict rules making it difficult to engage actors to adapt new routines, as using UX insights, and get these routines established. Negotiating the business case seems to be an obligatory passage point (OPP)[28] in terms of sociology of translation. Obviously, the product manager cannot make 'using UX insights' part of the system of OPPs with just the support of the video reports and prototypes she applies for negotiation. Additional boundary artefacts and boundary actions seem necessary.
2. UX insights were not accessible even if other actors would have wanted to use them. The project manager did not succeed in documenting the insights in a way that triggers others to look for, and use, the available

28 In chapter 4 an Obligatory Point of Passage (OPPs) is defined as a form that make an approach, e.g., using of UX insights in decision making, obligatory.

video reports, presentations, and a report with guidelines. Designers could support here in finding ways to 'store' UX insights. An example of a storage that seems to work is the dedicated room in Study 6 where posters (and other materials) are brought together for discussion of UX insights.

Mapping tool
The results of this study show the influence of who participates in the mapping workshop. The product manager largely influenced the mapping of the actions by sharing details on her experiences in the activity of organising, while the designers were a bit reluctant in doing so. Possibly the designers were too much aware of the product manager being an important client for them. For the purpose of the studies doing interviews before the mapping takes place as in Study 9 could have solved this.

5.8 Study 11: supporting the design manager

The aim of Study 11 was to gain insights on what happens when designers support different translations at the same time. In this study designers support a design manager. A task of the design manager is to coordinate design decisions and insights brought in by different roles, e.g., technical insights by engineers and market insights by marketing managers. Designers supported translation of UX insights, and at the same time technical and market insights.

Project in Study 11: Design of an ergonomic aerosol
In this design project the emphasis was on making an ergonomic aerosol with an international design team, working for a large international company operating on a global market. In the design team a Dutch based design agency collaborated with international actors e.g., a global design manager, UK based international marketing and sales managers, and UK based engineers. The project started with the request of a marketing manager to develop an ergonomic aerosol to compete with other user-friendly solutions on the market. The Dutch design team, consisting of two experienced designers, a novice designer, and a design engineer, put much effort in understanding why the customer would appreciate an ergonomic aerosol, what makes an aerosol ergonomic, and technical feasibility of new forms of aerosols. At the same time the company's design manager urged for a disruptive innovative aerosol very distinctive from what competitors offered. By iteratively prototyping and testing, an aerosol was developed that was ergonomic, distinctive, and design award winning.

5.8.1 Method Study 11
When inviting the design agency to participate in the workshop, the contacted designer indicated he wanted to learn about new design approaches by mapping the selected project. The design agency was, and is, eager to apply the state of the art of design and invests in collaboration with academic design researchers. The method, as applied in the previous studies, fits this

more holistic workshop aim of the participants and was not adapted for this study.

Participants
The two senior designers who participated in the workshop both have a long career at the design agency and are involved in several projects for the selected project's client. One of them was managing the development project, while the other was indirectly involved as an advisor for the design team during the project.

Procedures
The workshop was held at the design agency in a one of the meeting rooms. The workshop followed the general procedures as described in section 5.1.2.

Materials
For this study the NCC toolkit, has been used on a whiteboard in the meeting room. The designers had project documentation at hand, e.g., presentations used to communicate with the client, and brought models from different iterations including the final product to the workshop.

5.8.2 Mapping design of an ergonomic aerosol

The participants talk through the project alternating between project details and broad discussions on design methods. While the designer mainly focuses on the project details, the design team advisor brings in more general issues as experiences in working for the global company in the last five years in several projects. With laying a first timeline of the project the participants together create an overview of the project, now and then interrupted by leaving the room to get models and the final product. After drawing swim lanes on a whiteboard, and adding the sticky notes with the different timeline steps on top of the whiteboard, the participants indicated what and where to map actions leaving the actual mapping and adding notes to the moderator.

The designers split the timeline in the exploration, concept, engineering/CAD, pre-production, and production phases. Figure 5.26 shows the mapping result, a timeline with nine annotated actions mapped.

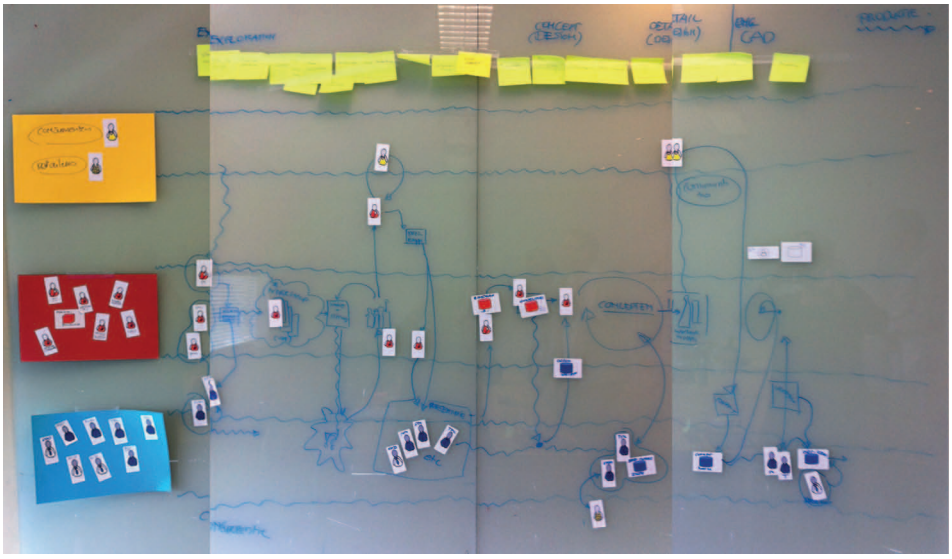


Figure 5.26: The filled in timeline of the design of an ergonomic aerosol, the yellow sticky notes form the preliminary time-line further detailed in the actions mapped on the swim lanes.

Most actions take place in the exploration phase: '. . . [compared to other projects] *this has been a very long process.'* The actions distinguished are shown in chronological order in Figure 5.27.

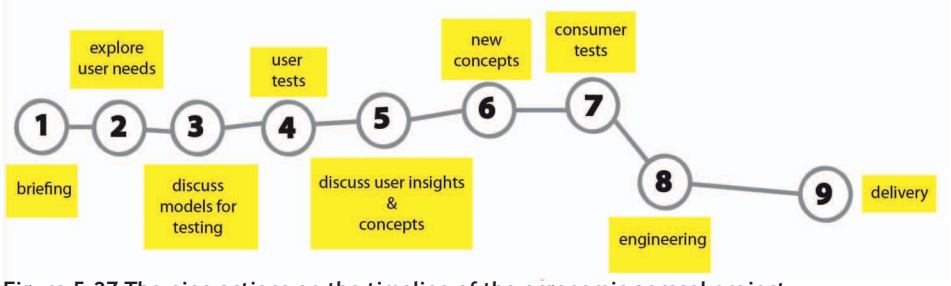


Figure 5.27 The nine actions on the timeline of the ergonomic aerosol project.

Trajectory

The trajectory (Figure 5.28) has been constructed using the timeline with annotated actions and the discussions on what happened in the project.

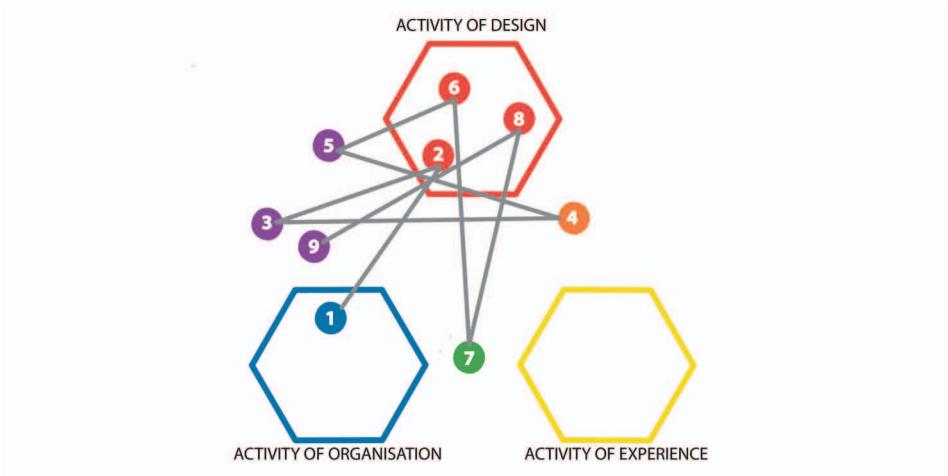


Figure 5.28: The trajectory of the UX insights in the design of an ergonomic aerosol.

Travelogue

The development project starts in ***action 1*** when a marketing manager decides to start the design of an ergonomic aerosol to be competitive on the market. He briefs the design agency, his company usually works with, to come with proposals. For understanding what makes an aerosol ergonomic the design manager advises the marketing manager and the designers to collaborate with a design researcher specialised in usability.

In ***action 2*** the designers and the usability specialist explore the use needs. The usability specialist uses her knowledge and experience to prepare a map with possible human aspects that could be relevant for aerosol use. The designers and usability specialist have a workshop using the map with human aspects with the aim to both create a solution space and frame 'what makes an aerosol ergonomic'. For this workshop the designers bring models of all kind of possible solutions for different aspects of interactions with an aerosol (e.g., holding, spraying etc.) available at the design agency from earlier projects. During this workshop the designers and the usability specialist go through all kinds of user scenarios in order to gather UX insights. The designers select, and in some cases remodel, models used in the workshop for further user research.

In a teleconference the design team (designers, user researcher, marketing manager, and product manager) discuss these models for testing (***action 3***). During this discussion it becomes clear that the marketing manager does not recognise the models as stimuli for user testing. He interprets the models as visualisations (look and feel) of how the aerosol will look like (for use as stimuli in market research) and is deeply disappointed with the result. Designers do extra sketching, and the usability specialist makes a test design for the user test with the models, to negotiate the next steps and explain the

purpose of the models in a user test.

The usability specialist gathers UX insights in the user test in ***action 4***, where users interact with the models and share their preferences for models in different scenarios. She prepares a presentation (including video) to share and discuss the test results in ***action 5***. The meeting takes place at the company in the UK with the global design manager, the design team, and engineers of the aerosol manufacturer. The designers and usability specialist present the test results and plan to co-interpret the test with the audience in order to share UX insights and engage the audience in the human-centred approach. However, the design manager interrupts and overrules the procedure because he thinks the conceptualisation will not lead to the disruptive innovation he has in mind. The planned workshop turns out to be a traditional meeting discussing the planning and technical feasibility of the solutions presented.

Soon after this meeting a new marketing manager comes into the design team and has to be convinced to continue the project. Nevertheless, the designers manage in following discussions to get resources to proceed with the development. They feel that one of the designers is very good in negotiating: *'Our designer has the ability to steer the decision process of the client by structuring the process and his presentation skills. He steers the client in the direction we [*designers*] prefer.'*

In ***action 6*** the designers create guidelines of what would make the aerosols ergonomic (an interpretation of the user test report) for the new marketing manager and the design team and create concepts based on these guidelines.

Marketing people use prototypes of these concepts for consumer testing in ***action 7*** in order to decide on the 'best' aerosol concept. The marketing department in the UK organises the consumer tests and report conclusions in the form of rankings of the concepts without adding the underlying test results. Iteratively several concept redesigns and consumer tests take place. The designers feel that in the end the choice of the final concept is done rather intuitively by one of the marketing directors. After this choice was made, the designers do the engineering in ***action 8*** and the designers deliver prototypes, CADCAM files, and the guidelines that would support further decision making in the next phases of development at the company in ***action 9***. In an ideal situation, the designers' deliverances would support establishing the use of the UX insights. However, the guidelines probably are now stored somewhere in a drawer at the engineering department: *'...especially marketing people come and go all the time....when there is a new marketing manager you get the same questions* [the answers on these questions are in the guidelines] ... *I just mail them the existing old presentation...the marketing people can store my emails for max 3 months and then it is just gone...'* Meanwhile the design manager is working on a solution for this by building a digital design management repository where design decisions and

reports, presentations and visualisations can be traced but the designers doubt if this will work:

> *We have to upload all our documents and presentations on that system, but we can only see what we uploaded ourselves...if no one knows what projects took place everything you uploaded will disappear in the end...luckily we have* [at the design agency] *the support* of *colleagues who remember things from earlier projects they worked in.*

5.8.3 Results Study 11

In Study 11 insights have been gained on designers, a design manager, marketing managers, and engineers doing sets of concurrent translations. Where the designers focused on bringing UX insights into the activity of organisation, the design manager coordinated insights brought in by designers, marketing managers, and engineers.

Translations occurring in the travelogue

The design manager stimulated the designers to involve a usability specialist to gain and use UX insights, after the marketing manager had briefed the designers. Together the design manager and the designers triggered the marketing manager to use UX insights. The designers send a presentation with the UX insights they gained prior to a teleconference with the marketing manager to discuss further user research and trigger. This presentation did not suffice to trigger and engagement of the marketing manager in user testing. Additional sketches together with a user-test-set-up did support to engage the marketing manager, and a user test took place. In order to engage other actors in the activity of organisation, the designers and usability specialist brought UX insights, gained with the test, into action 5 in the form of a presentation including video. The designers prepared interactions to support engagement, however, the design manager overruled the interactions and the workshop turned into a regular meeting. After this failing engagement, the designers did manage to negotiate the continuation of the project with one of the designers as a boundary spanner. The designers created guidelines and prototypes to support the use of the UX insights in decision making. Marketeers used the prototypes for consumer testing, but the designers doubted if they used the UX insights from the guidelines. Instead, the marketeers used the insights on consumer behaviour and shopping preferences they gained in market research. Engineers used the CADCAM files, the designers delivered, to prepare production and used their technical insights to make further decisions for implementation. Engagement to use the UX insights the designers gained seemed to fail. Finally, the designers delivered prototypes, CADCAM files, and the guidelines for implementation of the product. These deliveries seemed not to support the final stage of establishing where other actors as marketeers and engineers will use the UX insights in further developments.

Sets of translations
The project in this study is an example of how concurrent translations can take place during a design project. Designers, marketing managers, and engineers negotiate respectively UX insights, market insights, and technical insights as OPP in decision making. At the same time the design manager aims to be the OPP for all design decisions and wants to bring market, engineering, and UX insights together in a repository that provides the possibility to trace back design decisions. The role of the design manager, supported by the repository as a boundary artefact, could support establishing using UX insights in design decisions.

Mapping tool
Participants were reluctant in using the provided mapping toolkit (the same form as in studies 9 and 10). The moderator was doing the mapping with the participants indicating what to map. It is not clear whether the mapping tool or the moderator does not trigger participants doing the mapping. For the purpose of the studies the moderator could influence the results. When drawing conclusions on the studies (see section 5.10) a possible moderators bias should be taken into account. For the purpose of using the tool in practice the toolkit might not be straightforward enough. Clear instructions are needed and to be included in the toolkit.

5.9 Study 12: what do scholars say

The previous studies explored the practice of networked human-centred design and provided insights on how designers can support translations. Study 12 aims at reviewing the framework of networked human-centred design with scholars in networked engineering and service design. For this study conference workshops were selected where a mixture of people participated. Participants form a mix of practitioners and the academics with broad experiences and knowledge about collaborative PSS design, and with an open mind to learn from each other's experiences. Workshops on two conferences were held (Henze & Mulder, 2013; Henze & Mulder, 2014): a conference on networked collaboration and a conference on the futures of service design.

Conference workshop 'Beyond Boundaries: Networked Collaboration Canvas'
The workshop took place at the 19th ICE & IEEE-ITMC International Conference on 25 June 2013. This workshop was set up in collaboration with the co-researchers from the PSS101 project. In the workshop we aimed at increasing understanding of the networked nature of Product Service System design, the boundaries faced, and ways to cross these boundaries by applying the Networked Collaboration Canvas.

In the workshop three different projects were discussed, each project in an individual session of ninety minutes.

In the first session a presentation of a design project showed how to innovate organisations by looking beyond products and services and focusing on delivering values customers expect. The presenter emphasised the need of looking beyond products and services an organisation currently delivers. As an illustration he showed the case of an insurance company. Designers were brought together with customers and internal specialist to design solutions for specific customers' context. In a short film it was shown how design thinking helped to bridge the gap between a traditional insurer, the insurer's customers, and local stakeholders. Data were translated and strategically communicated to stakeholders through rich user insights, using several tools and techniques to make new connections.

In the second session insights gained during the design of new e-health services were presented. The presenters frankly showed what went right and what went wrong, in this way provoking the audience to share their experiences.

In the last session the innovation process of a new managed print service was presented. The complexity of transforming an organisation from 'product developers' into 'product service system developers' was illustrated by the case of print services for a university environment. As an example: only to bring bits of information together, necessary to make reports facilitating managed printing, you already had to collaborate with several different back office systems. The presenter ended his presentation saying: '*I have shown this story to different stakeholders and found it triggered emotion, they really saw there was a problem to be solved*!' This also happened with the audience, participants were eager to come up with print service solutions before the actual discussion on the networked collaboration and innovation process started.

Conference workshop 'Networked Collaboration Canvas: How can Service Design facilitate Networked Collaboration?'
This workshop took place at the ServDes 2014 conference, a bi-annual conference where service design practitioners and scholars exchange knowledge and experiences. The aim of this conference workshop was to review existing Service Design methods, techniques and tools, and challenges to develop new methods and tools for networked human-centred design. The workshop invited both practitioners and academics in the discussion on what Service Design can add to networked collaboration, and what directions are desirable for new Service Design methods and tools. Participants worked collaboratively to map boundaries using the NCC timeline (the pre filled timeline of the independent living project from Study 9 was provided as a case). The workshop continued discussing what (Service Design) methods and tools could support crossing the boundaries. A moderate palette of methods and tools was provided. Participants were invited to add on and remove from the palette, and discuss the need for new methods and tools.

5.9.1 Method Study 12

For Study 12 the method slightly differs from the earlier studies to fit the aim of scholars reviewing the framework of networked human-centred design.

Participants Study 12

Conference participants were invited to join the workshop. Twenty people participated in the workshop 'Beyond Boundaries'. About half of these participants were academics mainly coming from universities of technology, the other half were business managers or consultants from the ICT field. Some of the participants attended all three sessions where others participated in one or two of the sessions. In the 'Service Design' workshop twenty-eight participants attended, seventeen of the participants were academics and eleven were experienced service designers.

Procedures Study 12

For both workshops a similar procedure was followed. After a short presentation to introduce the framework of networked human-centred design and the Networked Collaboration Canvas, the project to be discussed is presented (Figure 5.29).

Figure 5.29: presentation of the NCC (left), and a project to be discussed using the canvas to highlight barriers and enablers in the networked design (right).

In small groups of four to six participants, cases were discussed using the canvas and the NCC materials to add their remarks (Figure 5.30). Now and then the researcher interfered by providing further explanation of the NCC and/or project triggered by observations and questions from participants. After the discussions in small groups each group plenary presented a summary of their findings.

Figure 5.30 Scholars and practitioners on networked collaboration (left photo) and service design (right photo) using the canvas and mapping tools to add remarks while discussing the presented case.

Materials used in Study 12
For the workshop 'beyond boundaries' posters with the landscape of an HCD project with the activities of design, organisation, and experience were provided. For the service design workshop the prefilled in timeline from Study 9 was provided, covered with transparent film serving as a surface to add actions and notes as in study. In both workshops a short description of the NCC was handed out as a reminder of what has been presented at the start of the workshops.

Data collection and analysis Study 12
Some of the discussions were videotaped, although the main parts of the data were gathered in the form of the annotated canvasses and the video recordings of the summary of the discussions as presented per group at the end of each block. Quotes were extracted from the video transcripts and, together with the annotations on the posters, interpreted primarily following the framework elements.

5.9.2 Discussing the framework with scholars and practitioners

Both workshops were well attended and appreciated, some participants in the workshop 'beyond boundaries' participated in all three sessions because they expected to gather new insights in each session.

Workshop 'Beyond Boundaries'
During the workshop twelve groups reflected on the framework and created annotated posters (Figure 5.31). At the end of each session one of the group members presented shortly what they had discussed. It turned out that many of the discussions were on offering specific solutions for the problems in the projects presented. In the following results related to the general framework are described.

Participants with a management and engineering perspective, find it difficult to understand the framework. They do not see the difference between the

framework of networked human-centred design and a concurrent engineering approach[29]. They see the Networked Collaboration Canvas as a project management tool visualising the different stages in a development project.

Figure 5.31: Twelve annotated canvasses are the result of discussions that took place in the workshop 'beyond boundaries'.

Activities and actions
Participants find it difficult to understand what the activity of experience is about: '*... are these only end user experiences or also other stakeholders as employees?'* It is doubted if the complexity of projects with companies involved with many locations, and many actions involved, can be mapped on the landscape. Also, a time horizon is missing; participants indicated they needed to see which roles are on board in which phase of development.

Boundary actions
Participants wonder where to place actions like education? In projects there is often a link with academia in the form of research collaboration. In one of the groups it was proposed to oblige specific actors to participate in boundary actions: '*…you need a sponsor who actively promote value propositions.'*

Translations
Participants suggest giving room for translation of values of stakeholders and not focus on user values too strictly. Also, technical and economic values should be included.

Methods and tools
Participants have experienced that video could serve to bridge boundaries between activities and support translations. In their experiences, video could bridge language and cultural boundaries, acts as a record, and keeps focus on the goals. Other methods and tools mentioned are role playing games and making ideas tangible through prototypes. A repository, to share best practices and embodied knowledge, is also mentioned as a possibility to select methods and tools for specific situations.

29 Concurrent engineering, or simultaneous engineering, is a method of designing and developing products, in which the different stages run simultaneously, rather than consecutively. (https://www.concurrent-engineering.co.uk/what-is-concurrent-engineering)

Workshop 'Service Design'
One of the five groups hesitated to use the provided materials; they reclined instead of actively bending over the table using the materials to discuss as the other groups did (see Figure 5.32). One of the participants in the hesitating group acts dominantly and convinces the other group members that more information on the independent living project is needed before discussion is possible. At the end of the workshop this group did not add any notes on the poster, however, they were able to present their conclusions at the end of the workshop.

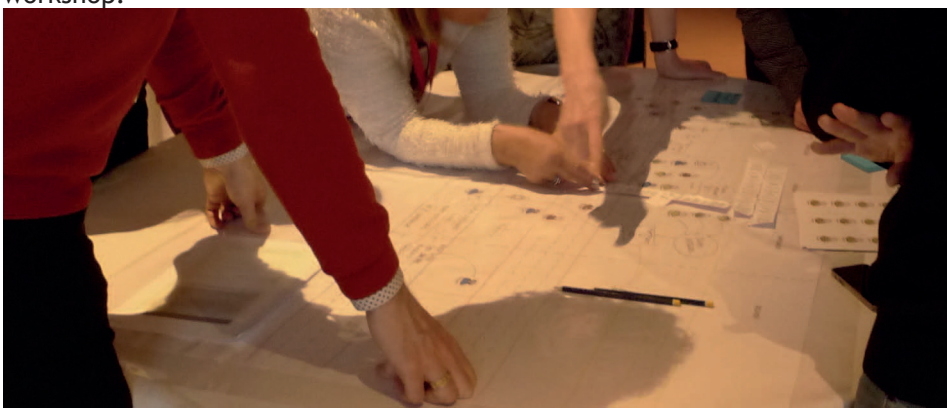


Figure 5.32 Scholars and practitioners in service design discussing the tools they would consider using the partly filled in canvas of the home care study.

The other groups actively participated during the full ninety minutes of the workshop and added numerous notes on the posters (Figure 5.33) by adding provided stickers, sticky notes and write text and make drawings directly on the posters.

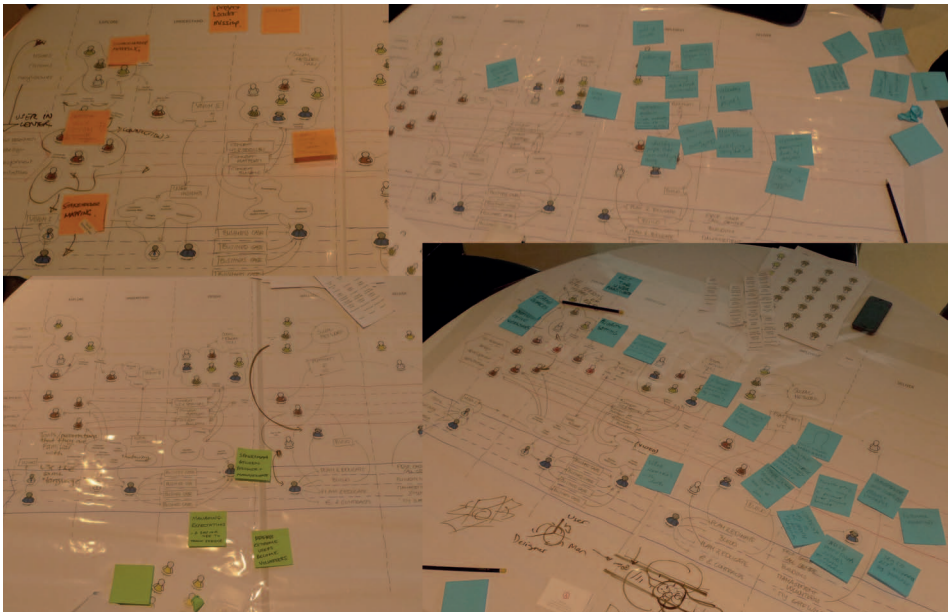


Figure 5.33: The service design workshop resulted in four annotated timelines.

Most discussions are on traditional service design methods and tools, and how these could be applied by designers in the independent living project. However, after the moderator indicates that the service designers step out of projects when 'their design work is done' there is still a need for keeping UX insights alive, the focus of discussions shifts to what to do when service designers are stepping back from projects.

The participants were still hesitant in discussing what methods and tools could support keeping the user insights alive when they have stepped out the design project. In 'This is Service Design Doing', Stickdorn, Hormess, Lawrence and Schneider (2018) claim that designers do have a role in implementation: *'a service design project does not end with a concept or a shiny presentation but with an implemented and operational service.'* For some it was an eye opener that projects could continue without their involvement, they were convinced, as Stickdorn et al. (2017) claims, that they were involved from the very beginning of the project until the services are in use.
Some turned it around; it is not the designer who steps out but the user who steps in and thus represents the user experiences in the remainder of the project and after implementation:

> *... we had the idea that the user should be involved in the whole process and continue to be involved possibly as volunteers or expert users supporting the ones they know in using the new system. What we really do as designers is managing expectations. We want the managers and user to do 'a day in the life' for each other so they*

continue to empathise and understand each other's part in the new solution. As a designer you have to step back incremental.

We talked about ambassadors but not as a person that goes through the 3 activities. The issue is that you have to create a project that is developed by the user since they have the stakeholders that manage the project forever possibly. The designer should not be there but disappear in the beginning and make sure that the user has a really strong ownership. The participants [in the service] *themselves are the ambassadors. They are among the community of users, the designers are only there in the beginning for facilitating, visualising.*

We talked about the project leader, who is taking it from the beginning to the end, who is the owner of the insights. But the insights need to be visualised as well; the users buy in and organisation buy in so that everybody has the same set of insights. So, if the spokesmen do change or disappear that vision still exists. The users should have a more important role and should be in the middle of this (canvas).

Others looked for new methods and proposed a boundary spanner:

We came up with a new person, we called him/her ambassador who is multilingual and speaks the languages yellow, blue and red. This ambassador has some evidence with him/her that is tangible, visual, experienceable, contextual, and narrative. The idea is to kill the document and to have the ambassador drive the experiences through this package, we talked a lot about theatre.

A main concern of the groups was to find adequate negotiators: '*Be sure the spokesmen is appropriate.'* Instead of using personas they advise to involve 'real people' and make use of gaming and role playing in boundary actions. This would also address the problem of user needs changing over time.

5.9.3 Results Study 12

The main result of Study 12 is that the NCC is hard to understand for others then the researcher. Participants in the workshops faced difficulties in describing projects in terms of actions and roles instead of milestones and stakeholders.

In the workshops, both scholars and practitioners seem to cling to the paradigm of creating a stable network of collaborating people through management instead of supporting a continuous changing assembly of actions. In both conferences, scholars did see a difference and/or added value of the framework compared to their approaches only after further explanation of the researcher throughout the workshops. A more operational description of the framework is needed for application in further research.

Issues concerning the framework of networked human-centred design
Some doubted if more activities, e.g., education, should be included in the landscape of an HCD project. It was suggested that in some projects the activity of organisation should be split up in different activities being 'organisation' a too general activity in complex projects with many companies in different locations involved.

Not only UX insights are translated during design projects, also technical and economic insights are translated throughout the projects. Participants suggested, as in Study 11, to give room for concurrent translations when mapping projects.

A clear statement on supporting translations was given by the quote '*…kill the documents….*' It was suggested to oblige actors to take the role of boundary spanner in actions or include more interactive boundary artefacts. Making ideas tangible by the use of video or role-playing and build repositories of ideas and/or insights was also suggested. However, all suggested methods and tools seem to support the stages of translation of triggering and engaging. Methods and tools that concern the translations stages of identifying and establishing were not suggested other than include 'spokesmen' who take the role of boundary spanner.

Issues concerning the mapping tool
Participants have been found identifying actions as boundary actions, or as part of a specific activity, difficult. The participants seemed to cling to the definition of organisation as an institution instead as an activity. Not understanding the basics of connecting actions in the landscape of an HCD project caused these difficulties. Instructions and definitions provided in the workshops were still poor, and extra explanation of the researcher along the workshops was needed. For a toolkit, that supports design practice in framing a problem and solution space for facilitating translations, a clear introduction and instruction is needed.

5.10 Discussion and conclusions of mapping UX travels

The previous sections reported on a series of connected studies (studies 5-12) where design projects have been mapped to find how designers can support translation. Each study addressed different aspects of translations in design projects. These aspects are: the actions where translation take place, the phases of translation that take place, and the artefacts that support translation. This section brings these aspects together by addressing the three questions that guided the studies, and concludes with insights on what designers can do to make UX insights actionable in design decision making in other actions than actions of designing.

5.10.1 How are UX insights translated between actions in design projects?

Cumulating actions and translations observed in the studies provides an indication of where, and what, translations take place in design practice. In each study participants used the NCC to map actions and translations happening in the landscape of a design project. Translations have been visualised in a trajectory by showing the path of UX insights, moving from action to action. The lines connecting actions in, and in between, activities of design, experience, and organisation illustrate the path of UX insights. The number of actions and translations in the trajectories in the individual studies add up to a total of 78 actions and 71 translations that have been mapped. Figure 5.34 brings these actions and translations together in one cumulative trajectory that shows how often actions are mapped by number, and how often translations have been observed by line width.

In what actions do translations take place in design projects?

The general observation in the projects mapped was that translations of UX insights mainly took place in actions where designers were involved. In the design projects studied, translation mostly happened between actions where designers meet with designers, organisers, or experiencers. Where translations happened supports the basic concept that translations take place through boundary actions with designers supporting translation.

The numbers in the red, purple, orange, and grey, actions on the map in Figure 5.34 show that designers were involved in most actions (n=63) of the actions mapped in the studies (n=78). These actions where designers were involved concerned actions in the activity of design (red actions, n=20) and boundary actions where designers meet with organisers and/or experiencers (n=43: 26 purple, 5 grey actions, and 12 orange actions). The map also shows that organisers were involved in actions in the activity of organisation (9 blue actions), boundary actions with designers (26 purple actions), boundary actions with designers and experiencers (5 grey actions), and boundary actions with experiencers (6 green actions). In total organisers were involved in less actions (n=46) than designers. Experiencers were involved in even less actions, they were only involved in boundary actions (n=23: 5 grey actions, 12 orange actions, and 6 green actions).

The cumulative trajectory provides an indication of where translations take place in PSS design projects, however, the used mapping method possibly biased the findings. In most studies the mapping focused on designers' experiences, actions where designers did not participate came out less.

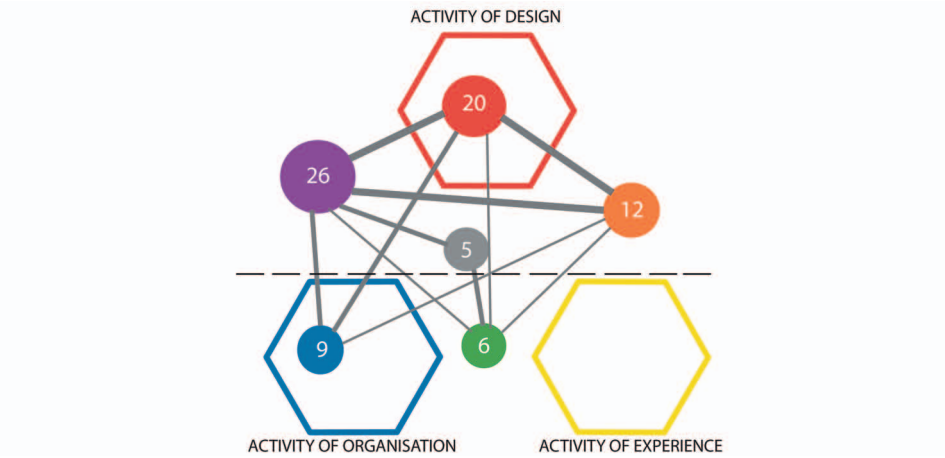


Figure 5.34: The cumulative trajectory of translations found in the studies 5-11. The numbers in the specific actions depict how often an action is found in the design projects. The thickness of the lines indicates the number of translations between the actions connected through the lines. The dashed line visualises the boundary between actions where designers are involved (above the line) and not involved (under the line). The cumulative trajectory shows that the projects studied covered most actions, excluding actions in the activity of experience, and translations happened mostly between actions of designing and boundary actions where designers were involved.

Above the dashed line in Figure 5.34 the actions are located where designers are involved. Under this line less actions have been mapped, participants in the studies even did not map actions in the activity of experience. Possibly participants found it difficult to review actions beyond their own experience. In the few studies with also organisers participating (e.g., a product manager), participants paid more attention to the activity of organisation and the organisers experiences. This demonstrates that involving actors from different activities than design, when mapping a networked design project, increases insights informing how to support translations. The mapping method seems not optimal to understand what happens in other actions than those where designers are involved. Along the study the mapping materials were adapted to improve co-creation, however, procedures and materials possibly still did not support a mapping process where all actors in a design project have a voice.

The studies show how UX insights move via boundary actions from activity to activity through PSS design projects; UX insights are translated from one activity into another. The connection between red and blue actions in Figure 5.34 visualises when designers translate UX insights directly from an activity of design into an activity of organisation. The studies revealed that organisers do not use these insights in design decision making. E.g., when designers provide reports or guidelines by sending them to organisers, organisers seem not to share and use the UX insights in the received reports or guidelines.

This observation supports the theory that translations happen if subjects in an activity learn when crossing the boundary of their activity. Observations of what happened in boundary actions in the studies 5-11 help to understand what interventions designers can do in these boundary actions to support this learning. The following addresses these designers' interventions.

What translations take place in design projects?
The travelogues of UX insights traveling through the design projects, described what happened in the actions mapped in the studies. Table 5.2 brings together what happened in the actions in an overview of what supported translations in design projects. The overview shows what specific actions occurred in the studies, and in what activity or boundary action these specific actions took place. The actions were found in studying a variety of product and service projects, providing a relevant overview of what happens in design projects. The right column of Table 5.2 describes the aim of interactions, in terms of stages of translation: identify, trigger, engage, and establish. The roles and artefacts occurring in actions, and the aim of the interactions, provide an indication in what actions what interactions support translation. The table shows that in many projects the stage *establish*, that support organisers to establish using UX insights in decision making, does not take place. The right column in the table shows that the stages of translation *identify* and *establish* only happen in actions of designing, the stages *trigger* and *engage* do happen in boundary actions, and *triggering* happens in actions of organising.

Combining the aim of the interactions (right column in Table 5.2) with the type of action where the interaction happens (left column in Table 5.2), indicates that *triggering* of, and *engaging* in, using UX insights mainly happened in actions of designing and in boundary actions. The studies showed that designers create interventions in boundary actions that support learning how to apply specific insights in making design decisions, as expected in the framework of NHCD (section 4.3). Table 5.2 also shows that some artefacts are used in different actions, e.g., prototypes are observed to be used in most actions. This indicates that designers create and use artefacts in one action, and these artefacts are used by others in other actions. This supports the theory that artefacts act as boundary objects, and could mediate the use of UX insights in design decision making in other activities than the activity of design. For example, designers create artefacts in the activity of design (red actions in Table 5.2) as prototypes, visualisations, and guidelines. Designers take a role of facilitator or moderator intervening in boundary actions by bringing these artefacts in boundary actions (orange, purple, and grey actions). For example, in a boundary action with designers and organisers (purple action) a designer takes the role of facilitator by creating interventions using note cards and video reports. The use of the note cards engages the organisers to use UX insights represented in the video report during the intervention.

The studies showed that when designers send artefacts from the activity of design (e.g., created guidelines with UX insights) and boundary actions (e.g., created video with UX insights) to organisers, without using these in boundary interventions, these artefacts were not used in actions of organising. The artefacts transferred knowledge, however, there were no interventions that supported organisers in how to use this knowledge.

It was only two times observed (of the 71 translations) that actors in the role of organisers translated UX insights. E.g., in Study 10, a product manager brought UX insights into the activity of organisation supported by video reports. Designers used these video reports to present design decisions and solutions in a meeting with the project manager. The designer's intervention in that meeting did support this organiser to learn using UX insights in making design decisions. When making design decisions the product manager used artefacts the designers provided: video reports, presentations, and prototypes. The product manager also used these artefacts to trigger colleagues to use UX insights during a meeting, however, failed to motivate and support them to keep using UX insights after the meeting. The artefacts did not equip organisers to transfer using UX insights to colleagues in the activity of organisation. Other translations by organisers did not concern UX insights. These translations concerned organisers exchanging products and services with experiencers, organisers consulting experiencers (green boundary actions), and organisers moving complaints on services to co-creation of problem definitions (purple boundary actions).

The overview in table 5.2 links the framework of NHCD with design practice. It summarises what the researcher has observed in design projects: what happened in design practice that informs on how translations can be supported. This provides insights on when and where in design projects opportunities for designers exist to intervene in project meetings to support the different stages of translation. E.g., the listing of specific actions, roles, artefacts used, and translation aims, in the purple boundary action show that UI designers can stimulate a product manager to use UX insights when they present solutions using user scenarios in project meetings.

Table 5.2: Overview of actions, and what happened in these actions, found in the studies. Each row represents a type of action (corresponding with the cumulative trajectory in Figure 5.34) and lists specific actions and roles involved, artefacts used, and translation aim of interactions in these actions. The overview shows a broad variety of specific actions, roles, and artefacts, that support some stages of translation.

Type Action	General roles	Specification action	Specific roles	Artefacts used	Translation aim of interactions
Designing	Designers	Make offer, Explore problem space, Create solution space, Redesign, Design UI, Create prototype, Create CadCam files, Make visualisation, Make report, Make presentation, Prepare user research, Analyse user needs, Create posters/ cards, Edit video, Create guidelines,	Engineer, UI designer, Service designer, Product designer, Design researcher, Design manager	Engineering software, Creative software, Models Sketches, User research report	Identify UX insights: designers define problem and solution space for designing a PSS. Establish using UX insights: designers support other designers in using UX insights as a routine to make design decisions.
Boundary Action	Designers Experiencers	User-research, Concept-test, Field study interviews, Pilot-test, Contextual interviews	Design researcher, Videographer, Moderator	Models, Prototype	
Boundary Action	Designers Organisers	Project meeting, Co-creation workshop, Workshop UX insights, UI/software development, Pitch design project, Present solutions	Facilitator workshop, Chair, Product manager, Software developer, UI designer, Communicator	Service Blue Print, Methods Card Set, BMC (business model canvas), Prototype, Note cards, User stories, scenarios, Video reports, Customer journey, Day-in-a-life poster, Presentation	Trigger using UX insights: designers stimulate organisers to use UX insights Engage in using UX insights: designers support organisers to use UX insights Trigger in using market insights: organisers stimulate designers to use market insights

Table 5.2 (continued)

Type Action	General roles	Specification action	Specific roles	Artefacts used	Translation aim of interactions
Boundary Action	Designers Organisers Experiencers	Co-creation workshop, Meeting Controlled software release, Small scale pilots, Release service	Design researcher, Facilitator workshop, Moderator,	Service Blue Print, Methods Card Set, BMC, Prototype	Trigger using UX insights: Designers and experiencers trigger organisers to use UX insights Engage in using UX insights: designers support organisers to use UX insights
Organising	Organisers	Vision development, Making design brief, Making business-case, Making road-maps, Implement new solution, Regular meeting, Organisational change	Product manager, Project manager, Business manager	Road map, Business-case, Prototype, Video report	Trigger using UX insights: Organisers stimulate other organisers to use UX insights
Boundary Action	Organisers Experiencers	Customer contacts, Customer service, Pilot-test, Consumer test, Software release	Sales manager, Business consultant, Professional carer, Help Desk operator, Product manager	Report, Prototype, Meeting place	

Although not mapped in the studies 5-11, the current research showed that actions of experiencing do happen in HCD projects. In studies 1 and 9, actions of experiencing have been identified where experiencers gain UX insights. In Study 9, designers created a meeting place as a solution that supported experiencers to reflect on their experiences and needs, and supported experiencers and carers to create a caring social network. In Study 1, toolkits were shown that were used by experiencers to gain UX's and share these with designers. In these studies, designers mentioned actions of experience, where experiencers develop UX insights, and actions of doing user research where experiencers bring in these UX insights. The fact that these actions happened, substantiate that designers do support experiencers to move UX insights from the activity of experience into boundary actions (orange, green and grey). Also, Study 9 provides an example of UX insights moving from a boundary action (green) into the activity of experience, when experiencers support each other in independent living as a result of meeting with carers and neighbours in the meeting place. These observations indicate that designers do interventions that support translation of UX insights from and to the activity of experience to boundary actions. The fact that these actions in the

activity of experience, and translations between the activity of experience and other activities, have not been mapped supports the earlier discussion on the limitations of the mapping method.

The overview in table 5.2 indicates that designers' interventions did not support organisers to facilitate their colleagues in the activity of organisation with what they had learned by these interventions. Instead, it shows opportunities for designers: what actions they can take that support organisers to engage their colleagues later on. For example, they can involve organisers in using UX insights when making design decisions in a project meeting by using video and note cards. Designers support organisers by providing experience in using UX insights in making design decisions and equip the organisers with tools as video and note cards. Insights on roles and artefacts, described in the following, provide a deeper understanding how boundary interventions could support organisers in stimulating and engaging colleagues in using UX insights.

5.10.2 What methods and artefacts support translations of UX insights

The second research question that guided the studies is addressed by discussing what roles and artefacts were found in the studies that supported translations, and what this means for the role of designers.

Roles and artefacts supporting translations of UX insights

A facilitator and moderator are roles found in boundary actions where designers were involved. These roles articulate the new role for designers in boundary interventions: actively supporting translations. Some boundary interventions using existing design tools as video, and approaches as co-creating insights, supported translation of UX insights. These interventions worked well for stimulating and supporting use of UX insights in boundary actions but fail to support organisers to make other organisers to use UX insights in making design decisions. The artefacts used in these interventions seemed to fail to make UX insights actionable for organisers in the activity of organisation. Designers failed to provide artefacts that organisers could use, and knowledge about how to use these, in actions of making design decisions. The main barrier occurring in the studied projects is that organisers stored UX insights in ways that make it difficult to notice them by others than those who brought the UX insights into actions of organising (such as the product manager in Study 10, saving presentations and video reports in intranet in a way that the information is not traceable for her colleagues of the sales or engineering departments). In the studies 6 and 11 a solution to solve this is suggested: creation of a 'repository' where designers stored UX insights and that was accessible for subjects from different activities to share UX insights. For creating such solutions, designers need an understanding of the problem and solution space to support organisers: the stage of identifying in the process of translation. Boundary actions where designers and organisers participate (purple and grey) open an opportunity for designers to do interventions that support the stage of identifying. Study 8 provides an

example of such an intervention: organisers and designers together mapping the project at the start of the project and together planning actions where design decisions are made. When doing this mapping organisers indicated the problems they have in communicating UX insights to their colleagues. This supports designers in identifying the problems to be solved with mediating artefacts.

Some interventions support concurrent translations by bringing other insights than UX insights in boundary actions. E.g., technological and economic insights have been translated by making Customer Journeys, Service Blue Prints, and Business Model Canvasses in co-creation workshops. In the studies 5, 8, 9 and 10 it has been observed that in these co-creation workshops UX insights were translated into technical specifications, costs, and profit. This demonstrates another barrier in bringing UX insights into an activity of organisation: existing tools, rules, and roles of an activity of organisation are supporting using technical and economic insights in making design decisions. The studies did not observe organisers who learned in boundary actions what tools, rules, and roles are needed to connect UX insights with technical and economical insights, and how they could adapt existing tools or change roles and rules. Designers did not do boundary interventions that supported the stage of establish in the process of translation. Designers did not support organisers to stimulate and engage colleagues to use UX insights in actions of organising.

Role of designers to support translations
It was found that boundary interventions play an essential role to bring UX insights from the activity of experiencing into design and from design into the activity of organisation. E.g., designers did workshops with organisers and provided organisers with video-reports used in these workshops, and these video reports supported organisers to bring UX insights in the activity of organisation. These observations confirm the assumption in Chapter 4 that designers can support translation of UX insights if they do boundary interventions. The observation that designers defined a problem and solutions space for interventions that support actions of designing, indicates an opportunity for doing boundary interventions that support actions of organising. If designers identify and understand the context of making design decisions in the activity of organisation in a similar vein as understanding the context of UXs in the activity of experience to create new products and services they can create interventions that support actions in the activity of organisation.

5.10.3 How can one ‘design’ these artefacts

Using the framework in the form of the mapping method and mapping tool (NCC) for observing design practice in the studies, resulted in insights on how designers can support translations through interventions and design mediating artefacts for these interventions. Discussion of the applicability of the mapping method and mapping tool for research on design practice results

in improvement of the mapping method for future research of design practice. The development of the mapping tool for researchers into a tool for designers results in a tool that supports designing mediating artefacts.

Application of the framework to study networked design projects
The studies 5 - 12 show that the mapping method does support studying design practice. However, the mapping method can be improved to include the voices of all actors in a design project. There are also doubts on accuracy of the landscape with three activities for describing design projects (studies 9 and 12).

Along the studies, the mapping materials have been improved to optimise the mapping, however, further improvement of the mapping method optimises understanding of what happens in other actions than those where designers are involved. These improvements concern the participants, procedures, and mapping materials. They are: inviting participants representing different activities, stimulate participants to also map actions in design projects where others are involved, and improve materials for describing activities and roles involved.

In studies 9 and 12 participants asked for activities that were not added in the landscape. Seemingly, some design projects could not be described with only the three activities of design, experience, and organisation. In the conference workshops in Study 12, actions have been found that did not fit one description of an activity or boundary action in the provided landscape. For example, actions of academic research or governmental actions could be better described through the context of respectively an activity of research and an activity of government due to the specific objectives, tools, communities, roles, and rules that describe these activities. In Study 9 an umbrella project of three projects with the same design vision on products and services for independent living was mapped. In each of these projects many translations took place in different contexts, when bringing the projects together in one travelogue details of these contexts got lost because contexts were described to fit one activity of organisation. With these general descriptions of actions, general solutions to support translations were described, missing the opportunity to identify solutions for the individual projects. This indicates that using the current mapping method is challenging for design projects with more different contexts of making design decisions than one activity of design, one activity of organisation, and one activity of experience. With design decision making in many different contexts (e.g., when different organisations with different rules, roles, communities, and tools are part of a design project) it could be challenging for designers to identify the problem and solutions space for interventions that support decision makers in the many different activities.

Development of the NCC tool into a tool for design practice
The studies provided insights on how designers can support translations by boundary interventions. With the NCC mapping tool the researcher has been able to identify boundary interventions in design projects. This supports the conversion of the NCC from a research tool into a tool for design practice. The observations of the use of the NCC in the studies informed this conversion, and provided insights on the applicability of the tool to identify a problem and solution space for creating materials and interactions that support boundary interventions.

One of the insights on the applicability of the tool in practice is that participants in the studies have difficulties in using the toolkit independently. Participants needed the researcher's assistance to identify activities, actions, translations, and roles in their projects. Although the researcher did explain design projects as connected actions and the process of translation at the start of the mapping, participants found it difficult to bring this in practice by mapping their own projects. The researcher's explanation of the framework, the raison d'être of the tool, seemed for participants difficult to link to their design practice and hindered them in applying the tool. Consequently, a clear link of 'networked human-centred design' to design practice and guidance how to identify actions and activities are needed to converse the research tool into a tool for design practice.

Also, the use of the canvas seems restricted for less elaborate design projects due to the too simple visualisation of a landscape of human-centred design as three activities. Figure 5.35 shows an example of a filled in canvas visualising the landscape of a design project where a fourth activity was added. Extra activities will lead to more steps in moving UX insights, leading to more extensive trajectories. More activities will also require mapping tools enabling mapping more actions and a more extensive path of UX insights without losing overview and detail. A possible solution here is to split a project where more activities are involved in subprojects, as Study 9 suggested.

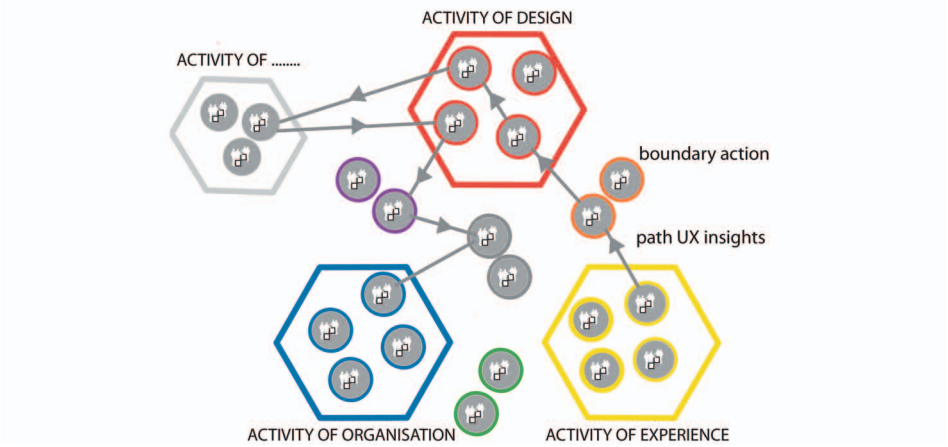


Figure 5.35: An example of a landscape of an HCD project with many translations. The canvas with the 3 main activities (experience, design, organisation) gives room for other activities (….) when relevant in a specific project. The path of UX insights shown is simple in this example, in PSS design projects with more activities more steps will be involved.

The findings above on the application of the NHCD framework for studying design practice, and the discussion of these findings, lead to the conclusions in the next section.

5.10.4 Conclusions

Applying the framework to study PSS design projects leads to two main conclusions: designers support part of the stages of translation through their deliverables especially during boundary actions in a design project, and the mapping method supports researchers finding how these deliverables support keeping UX insights alive, however, needs conversion to fit design practice.

Designers' deliverables support keeping UX insights alive in a networked design project. Important aspects of what designers can do to make deliverables supportive are:

- Designers make artefacts that mediate UX insights being used in making design decisions. Designers enable design decision makers[30] using UX insights in decision making, and designers make their deliverables actionable for making design decisions in contexts different from the context of an activity of design.
- Designers support translation of UX insights through boundary interventions in their practice of designing PSS solutions. The found designers' boundary interventions in the studies, trigger actors to use UX insights, and engage actors, in using UX insights through interactions with provid-

30 In this thesis design decisions refer to decisions that influence the final specifications of a final product or service, and how this product or service will be experienced. Design decision makers refer to actors in a development process making decisions that influence UX.

ed artefacts. An example of such an intervention is designers providing note-cards in meetings with clients, and together with the client reflect on video with UX insights, to co-create actionable UX insights.

- In addition to UX insights, technical and economic insights are traveling through a design project. Where technical and economic insights keep alive, UX insights seem to disappear after the designer left. To keep UX insights alive, designers balance UX- insights, technical insights, and economical insights in their design decisions and support others by bringing UX insights in making balanced design decisions. For example, designers supporting a product manager by making UX insights actionable for evaluation of first releases of a new product or service (as envisioned in the Study 8) or concept tests (as in Study 11).
- Artefacts (e.g., reports, guidelines, prototypes, note cards) can bring UX insights from one into another action; in the studies it was found that artefacts that were used in meetings between designers and product managers were also used by the product manager in meetings with colleagues, engaging colleagues in using UX insights in making design decisions.
- No evidence has been found of designers' interventions that support using of UX insights on a long term, when making design decisions in the activity or organisation. The studies in this chapter revealed that designers did not support all four stages of translation. They do not support the phases of identifying and establishment. In practice, designers are not aware of their potential role of facilitating translations. Therefore, they do not identify solutions to support actors in decision making, and create artefacts and boundary interventions that support actors to stimulate and help their colleagues to use UX insights in their design decision making. Because designers do not fully support all four steps of the translation process (identify, trigger, engage, and establish) they do not support design decision makers in contexts where no designers are involved.

The studies in the current chapter created understanding how designers could support the process of translations through boundary interventions. In practice, designers identify when and how to do interventions, and facilitate a step-by-step learning process in these interventions. These steps are making organisers aware of human-centred design decision making, involve organisers in making these decisions, and provide UX insights that are actionable in the activity of organisation. Chapter 6 converts this knowledge to guidelines for design practice. For these guidelines the steps of the translation process are converted to actions of designing to enable design decision makers to continue use of UX insights after the designer left.

The studies also provided insights on the applicability of the mapping method for design practice. The studies showed that the framework of NHCD enables the articulation of a networked design project and the translations that take

place in a design project. The Networked Collaboration Canvas worked well as a research tool to understand translations in most design projects, however, needs some conversion to make it a toolkit that supports design practice in creating boundary interventions. This conversion concerns:

- making a clear introduction for designers to understand their role of creating boundary interventions in the practice of networked design,
- a more unambiguous identifying and describing of activities and actions,
- enable including other activities than design, experience, and organisation in the landscape of a design project.
- the tool, the researcher used for mapping in the studies, was provisionally named ‘networked collaboration canvas’, however, this name seems not to fit a toolkit for designers. A better fitting name for the toolkit is ‘Networked Design Canvas’. This name is more related to design practice, and communicates it is a tool designers can use when doing design projects, instead of a tool for researchers to study collaborations. The NDC toolkit supports designers in doing networked human-centred design as part of doing design projects, it supports designers intervening in the activity of organisation along the process of designing PSS solutions. The name ‘NDC’ indicates the purpose of the tool to map actions, and map potential interventions to support the use of UX insights in design decision making after designers left the design project.

The converted Networked Design Canvas tool can be found in Appendix 2.

Guidelines for a Networked Human-Centred Design practice

6

6 Guidelines for a Networked Human-Centred Design practice

What can designers do to prevent UX insights from getting lost in design projects after designers leave the development process? The studies in Chapter 5 showed how UX insights vanish in a networked design project, and how designers can keep those insights alive through interventions in meetings along the process Networked Human-Centred Design (NHCD). A NHCD process can be seen as series of actions inside activities[31] of design, organisation, and experience, and boundary actions in between these activities. Keeping UX insights alive happens mainly in those boundary actions.

Designers can actively support design decision makers[32] to continue the use of UX insights after the designer left. Designers can take up this supportive role, and build a network of designers and others who use UX insights in design decision making. Designers do this in concert with designing a product or service, through supporting translations: they create interactions in boundary actions with artefacts, these interactions aim to step-by-step enable people from other activities to use UX insights as a routine in making design decisions. Human-centred design (HCD) becomes networked human-centred design (NHCD): a process in which UX insights are translated in order to assemble designers, experiencers, and organisers in considering UX insights in design decisions.

Table 6.1 shows how the findings of Chapter 5 can be applied in design practice. The terms from the theoretical framing of NHCD, in the left column, are explained in terms from design practice in the right column. The guidelines describe, in words that connect to the language of designers in current design practice, how designers can enable others to continue using UX insights after designers have left.

31 An 'activity' is a field of work with each activity forming the context of actions with actors using a specific language, tools, and criteria. For example, an activity of design is the field of actions of creating concepts of products and services, an activity of organisation is the field of actions of organising production and delivery of products and services, and an activity of experience is the field of actions of using products and services.

32 Design decisions refer to decisions that influence the specifications of a final product or service (Chapter 1). After designers left the development process, others than designers make these decisions, e.g., a marketing manager who decides on specifications of a use interface.

Table 6.1: Actions in design practice to support a translation process

Translation process in NHCD	Actions in NHCD practice
Designers support translations by creating artefacts and propose interactions that enable representing UX insights in different actions.	Designers enable design decision makers to use UX insights through creating interventions in a design project.
Translation process: UX insights continuously move from one action into another, transported by actors and artefacts, and transform design-decisions-making by the form UX insights appear in the actions they move into.	Enabling process: designers invite design decision makers to learn by doing in interventions, making use of project meetings.
Stages in a translation process: identify, trigger, engage, establish.	Steps in an enabling process: make a project map, trigger, engage, equip.
Identify problems and solutions.	Plan and maintain the enabling process through a map of the design project. Use the map of the design project to designate where it is opportune to do what interventions for what step in the enabling process.
Trigger: encouraged actors to use UX insights through interactions and artefacts.	Trigger: identify together with design decision makers where in their work, they and their colleagues make design decisions and what the consequences of these decisions are for UX quality.
Engage: support actors to use UX insights in decision making.	Engage: share knowledge and experience with design decision makers by involving them in how designers make decisions.
Establish: support actors to use UX insights as a routine in making design decisions.	Equip: provide knowledge and materials that support design decision makers to apply what they have learned.

The remainder of this chapter describes how designers can support translations: it describes a step-by-step process of enabling, guidelines for creating interventions that fit the steps in project meetings, and a tool to map and plan these interventions: the Networked Design Canvas (NDC).
The guidelines follow three basic principles, described in three parts in the guidelines:
Part 1: Enable design decision makers to use UX insights
Part 2: Make use of project meetings to do interventions
Part 3: Use a project map to plan the interventions

The guidelines in the following sections address design practitioners[33]. They can be read apart by practitioners or as part of the thesis as an outcome of the research.

33 For the guidelines a different typeface is used to emphasise the distinct audience.

Guidelines part 1: Enable step-by-step

Enabling others to use UX insights after you, designers, have left is a step-by step iterative process. A process where you invite design decision makers, not working in the field of design, to learn by doing throughout a design project. Figure G.1 shows 3 steps to enable using UX insights in design decision making: trigger use of UX insights, engage to use UX insights, and equip design decision makers to use UX insights when making design decisions. Design decision makers will continue the process to make the use of UX insights a routine in design decision making and enable their colleagues in their field of work. Also, pay attention to regularly reviewing of the planning and maintenance of the enabling process to keep pace with new insights and changes in the design project.

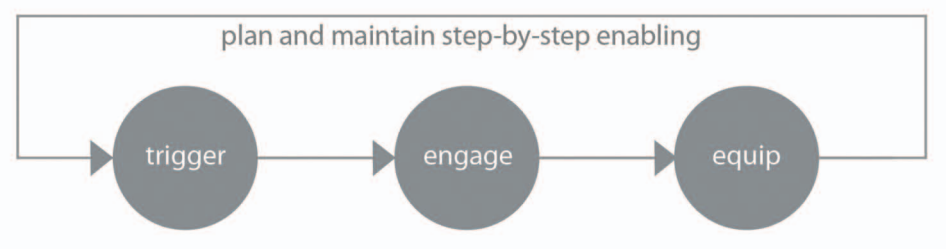


Figure G.1: Enabling the use of UX insights is a continuous process of three consecutive steps: trigger, engage and equip. Enabling is a continuous process; design decision makers continue enabling their colleagues.

The first step, is to trigger and motivate people to include UX insights when making design decisions. Trigger them by identifying where in their work, they and their colleagues make design decisions and what the consequences of these decisions are for UX quality. When they are aware of the benefits of using UX insights in their design decision making, this awareness motivates to learn how they can adapt their current process of developing a PSS. In the next step, you share knowledge and experience with design decision makers by involving them in how designers make decisions. Engage them by together basing decisions on UX insights along the design project, when making new design decisions, or verifying decisions. When design decision makers are involved in the use of UX insights when making design decisions, they will learn how this fits their own practice. Understanding, and experiencing, how it will work out in practice motivate design decision makers to make this way of making design decisions a routine, and transfer this way of working to colleagues. In the third step, you provide knowledge and materials that support design decision makers to apply what they have learned. Designers equip design decision makers to recall and apply what they have learned and transfer this to their colleagues.

You integrate the process of enabling in your design projects by intervening in project meetings to trigger and engage, and using objects already used in design

projects to equip. The next section provides guidelines how to create interventions in design-projects that support the three steps of enabling.

Guidelines part 2: Create interventions that fit project-meetings

There are many moments in a design project when you come together with people from other fields of work to discuss different aspects of the design project. These moments are opportunities for you to learn what design decision makers need, and for design decision makers to learn why and how designers use UX insights in making design decisions. Make use of these moments of exchanging knowledge and create interventions that fit the aim and participants of the specific moment. During, and after, a design project staff will change. Address the role of the participants in the meetings, their responsibilities, and tasks, to anticipate on different people taking these roles.

If interventions lead to enablement depends on in what phase of the design project the intervention takes place, and if interactions and materials used fit the steps you aim to support. The following describes interventions to trigger, engage, and equip in project-meetings.

Trigger

Interventions to trigger make design decision makers aware and motivated to use UX insights when making design decisions:

- Do the intervention in meetings where relevant roles in the project are represented. If necessary, use more meetings to address most relevant roles or invite specific roles that normally do not participate in the meeting.
- Show examples of products or services where UX insights supported design decisions.
- To trigger, tell success stories from your own practice; stories of how human-centred design projects led to products and services that receive compliments instead of complaints. Or a project where costs were saved because the help-desk was hardly called, because users easily could solve problems themselves due to your user-friendly solutions.
- Show, e.g., a video about experiencing a product or service, or show posters visualising UX insights. Present UX insights that are relevant to the design project, and fit to discuss what design decisions in the project happen.
- Make presentations actionable by providing them in a form that participants can share the presentation with their colleagues in their own field of work.
- Keep a record of the interventions you did to trigger, and when, and why you did them, to make it easier to create interventions later in the project and in future projects.

Engage

In interventions that engage, you involve design decision makers in making your design decisions.

The following guidelines address creating interventions that support engaging:

- Be sure you have triggered before you engage to motivate participants to learn to use UX insights, and to apply and share what they learned. Interventions that trigger and engage could be done in one meeting.
- Use meetings where design-team and users together make design decisions and create solutions, or meetings where the design-team co-create criteria for decision making by together analysing video of user research and presentations of research data.
- It is easier for participants to engage when they recognise their own practice when participating in the intervention. Part of the preparation of the intervention is in understanding the participants' criteria in design decision making, and integrating these criteria. E.g., an exercise where technical or economic criteria are balanced with UX insights.
- Make sure materials used in the interventions are actionable, e.g., provide note cards, presentations, video, in a form that makes it easy for participants to use the materials in their own practice.
- Keep a record of the interventions you did to engage, and when, and why you did them, to make it easier to create interventions later in the project and in future projects.

Equip

Guidelines for creating interventions that equip with knowledge and materials that enable to use UX insights:

- Integrate these interventions in meetings where the last steps before production and release of solutions are addressed. Think of meetings to prepare final technical and consumer tests, or first releases. Make sure that participants that have the role of making future design decisions, e.g., marketing managers or engineers, will be present in these meetings.
- Make sure participants are aware of these future design decisions and the impact of these decisions on UX in their own practice to support using UX insights in future design decision making. A short recapitulation of triggering and engaging helps to provide this awareness.
- Use models, prototypes and presentations, or blueprints for production and delivery, to show how UX can be linked to these materials. Show participants how they can use these materials to take UX insights into account in their design decisions. An example is co-creating set-ups for testing, or doing pilot tests together, with an emphasis on communicating the results of these tests in actionable recommendations.

- Make sure materials used in the interventions, e.g., presentations, prototypes, guidelines, are actionable. Provide materials in a form that makes it easy for participants to share the materials with colleagues in their own practice. An example is co-creating a repository of materials and insights used for decision making where UX insights live together with technical and economical insights.
- Keep a record of the interventions you did to establish, and when, and why you did them, to make it easier to create interventions later in the project and in future projects.

Guidelines part 3: Map the project and plan interventions

Plan and maintain the enabling process through a map of the design project. A map of a design project visualises what activities are involved in a design project, what roles are involved in these activities, what actions take place in a project.

The following guidelines address planning and maintaining enablement through mapping the design project:

- Make a list of the different people involved in the project, and describe the activities they are involved in, and their roles in the different actions they participate in.
- Make an overview of moments in the project where people in the project discuss and make design decisions. For each meeting, indicate the goals, outcomes, and the roles, responsibilities, and tasks of the participants.
- Include actions where design decision makers make design decisions. Think ahead and include actions as installation, or first releases, or software updates.
- Visualise the overview of actions by mapping them in and in between activities in the project. Create a first draft when preparing for a first meeting with clients and design team, e.g., preparing a presentation of what could be expected human-centred-designers do and deliver in the project.
- Make the map actionable, provide room for changes and annotations when verifying the map with other actors in the project, e.g., client and design team. Do this in meetings where also the project-planning is discussed, and link the map to the planning.
- Also, when the map is in an actionable form, you, your clients, and the other members of the design team can use the map in their own field of work.
- You use the map of the design project to designate where it is opportune to do what interventions for what step in the enabling process.
- Keep a record of opportunities for interventions and interventions already done to support planning when to do what steps of the enabling process.

- During the project new insights are gained, aims are articulated, and roles change. Adjust the map to new insights and changes throughout the design project. These changes could lead to new opportunities for interventions to enable.

The NDC toolkit has been developed to map the interventions in the design project. The toolkit consists of (examples of) templates to create an overview of actions, and instructions how to apply the NDC (see Appendix 2 for a model of the toolkit). The canvas provides room to describe fields of work, or activities, relevant for a specific design project, and actions, or meetings, that take place in and in between these activities. With the canvas it is possible to gain an understanding of actions where design decisions are made. Descriptions of these actions provide the context for doing interventions: who participates, the goal, and outcomes of the action. Together the descriptions provide a journal of how using UX insights in design decision making travels through a design project: a travelogue. The travelogue supports designers in framing problem and solution spaces for creating interventions and deliverables in a design project.

Applying the NDC toolkit

Applying the NDC toolkit takes four steps: creating a timeline, filling in a canvas, creating a travelogue and maintaining the canvas and travelogue. Figure G.2 shows these four steps.

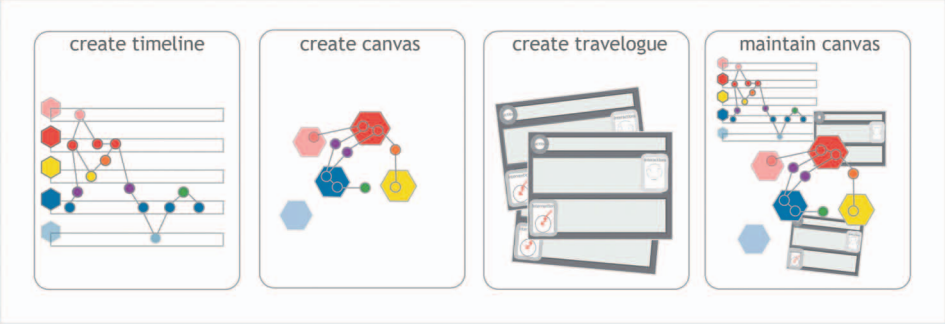


Figure G.2: the four steps of the NDC: create a timeline, create a canvas, create a travelogue, and maintain the canvas.

The following describes each step, illustrated by examples of designers using the toolkit. These examples show how UX-insights could have kept alive in the coffee-machine design project from Chapter 1, if the NDC toolkit had been used.

In the first step, a planning of the design project in the form of a list of actions in order of (expected) 'happening' is made. With this list activities for a specific project are identified and loosely described by who work within the boundaries of

the activity, and what the aim and outcomes of the activity are. Then, actions are brought together on a time-line. In a time-line actions are coded by colour and place as being an action in a specific activity or as a boundary action, outside an activity. The colour indicates the mix of roles from different activities, e.g., a role from a red activity meeting with roles from a yellow activity together meet in an orange action.

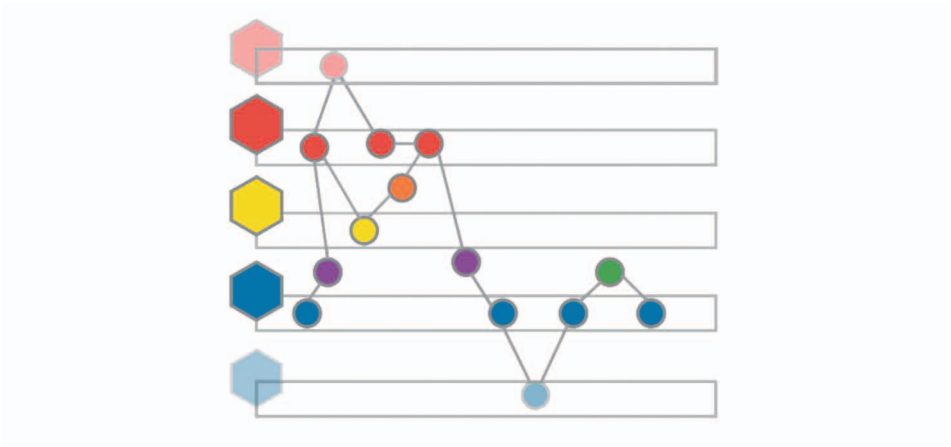


Figure G.3: Example of a time-line, with on the left fields representing activities in swim lanes with actions that take place in a specific activity or boundary actions outside activities. Actions are coded by number, place, and colour to designate when what action takes place.

Box G.1 describes how designers created a timeline, and used this to trigger the design team to use UX insights.

Box G.1: creation of a timeline for the (imaginary) coffee-machine design project.

A coffee-company asked a design agency to pitch for the design of a coffee-machine for dispensing high quality coffee to 5-40 employees and guests. For this pitching, the designers made a draft timeline of the project to present their intentions in the project. The designers based their draft on former design projects they did for the coffee-company, and drafted the following activities in the project:

design the brewing system: engineers doing research on brewing techniques, and designing the part of the machine that brews different coffee tastes with high quality

design the machine: product designers (machine) and graphic designers (touch screen) doing research and designing how users experience using the machine

experience the machine: people using the machine in offices, hotels and other self-service situations, facility managers responsible for creating and maintaining coffee-corners where max. 40 people get their coffee.

provide the machine and coffee services: product managers managing the design and production of the machine, marketing managers responsible for the release of the machine, business managers responsible for the implementation of the machine in the company's portfolio, service managers responsible for the development and provision of coffee and maintenance services.

produce the machine: engineers producing and assembling the different parts of the machine.

The designers divided the timeline in main phases in the project: exploration, concept, engineering, preproduction, production, and release. They made a list of the main actions that take place in these phases, and positioned these actions on the swim lanes.
Examples of actions they listed are a meeting of the design team in the exploration phase to discuss models for user testing, and market researchers who do consumer tests with new concepts in the preproduction phase. They positioned these actions in the swim lanes outside the red and blue and yellow activities, and coloured the actions purple and green respectively.

During the pitch meeting they used the timeline to explain that they offered a design process that results in products and services that provide high quality UX when using and maintaining the machine. They illustrated this with examples of UX with other beverage dispensers they designed. With the timeline they also explain how they supported clients, and this fits the coffee company, to maintain that UX quality after the designers left the project.

The pitch was successful, and the coffee-company commissioned the designers to do the design project. For the first meeting with the design team, they brought the printed timeline, and used it to co-create the planning of the project and discuss design decisions. They invited the team to make notes on the timeline to trigger the product manager, engineer of the brewing system, and marketing manager using UX insights in design decision making.

With the annotated time-line the designers filled in the canvas (see Box G.2). For this purpose, the designers selected actions from the time-line where they projected doing interventions for enabling. Figure G.4 illustrates how such a filled in canvas could look like.

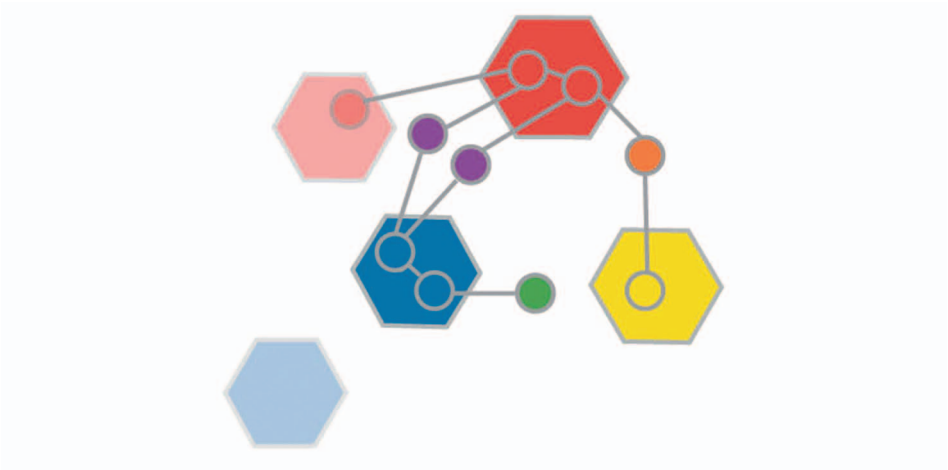


Figure G.4: Example of a filled in canvas, the actions are the main actions where interventions are (to be) brought in. These actions are further described in a travelogue.

Box G.2: filling in the canvas for the (imaginary) coffee-machine design project

The designers selected typical actions from all phases of the project where they plan interventions: meetings with the design team at the start of the project where they discuss planning and responsibilities, meetings where they expect to make choices what concepts to focus on, and meetings where prototypes are used to decide on final specifications of brewing system, machine outlooks and the touchscreen. Next to actions where they expect to exchange knowledge and skills with design decision makers, they included actions where they expect designers enable designers, and design decision makers enable design decision makers. For example, they selected actions where the product designers and graphic designers discuss how to integrate their solutions in the machine. In these actions the lead designer wants to verify that the designers use the same UX insights. For example, the insight that users will not read texts on the touchscreen. Another example is an action where product manager and marketing manager plan consumer tests. The designers want to provide prototypes and test set-ups for this action to support the managers to include testing usability of the machine as part of the consumer test.

After making some drafts on paper, the designers made the canvas digital, and added links between the different actions and supportive documentation. For example, they linked the action where product and marketing manager meet with information on the prototypes and where these are located, and with a video of how usability has been tested in the exploration phase of the project.

The designers put the canvas on a private space on their website they use to exchange deliverables, e.g., CAD files, with the design team. The design team uploaded annotated canvases they used to plan interventions, and reflect upon past intervention. In meetings with the design team they used the annotated canvas to discuss progress of, and next steps in the project. Using the canvas helped to engage the design team members in identifying and preparing design decision making, and put UX insights on the agenda.

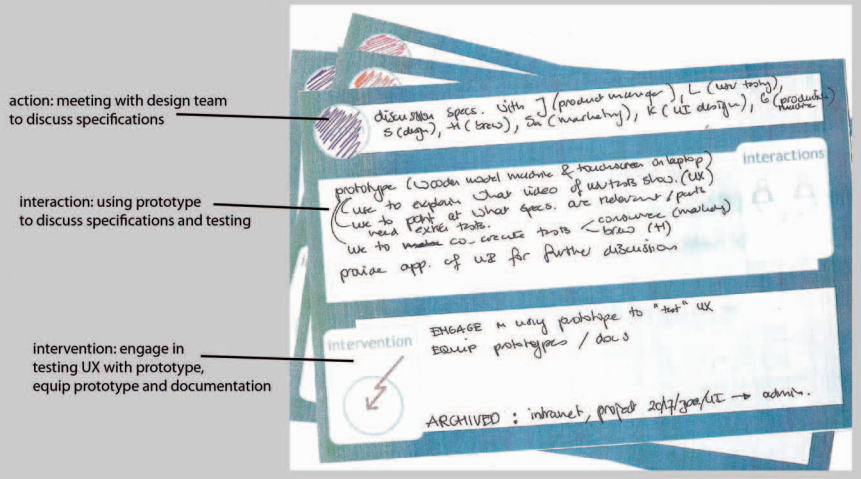
Actions on the canvas are further described in a travelogue, for this purpose the toolkit provides cards to describe activities and actions on. Figure G.5 shows an example of a card to describe an action. Now activities and actions are described on the cards, these cards together form a travelogue. The travelogue provides an accurate journal of what happens in actions, and interventions in these actions. For each action what happens, aim, who participates, and materials used are described. Also (potential) interventions are described by its aim and provided knowledge and materials.

Figure G.5: Example of a travelogue card to describe an action. In the action field the action can be briefly described (e.g., meeting between designers and product manager), to identify the type of action (e.g., boundary action between activity of design and organisation) the circle can be coloured in the associated colour (e.g., purple). The other fields provide room to describe interactions and (potential) interventions.

Finally, how and where protocols of interventions and materials are archived is filled in. Box G.3 describes how the designers in the coffee-machine project did this.

Box G.3: making a travelogue for an imaginary coffee-machine design project.

The designers kept a journal of what actions they planned and did in the project. For this journal they used printed empty travelogue cards they filled in. They bundled the cards (see picture) and used this journal to specify their work for evaluation, planning, and quotation purposes.



They used the digital canvas for digitalising this journal, and integrated the travelogue cards in the digital canvas. Per action, they linked relevant cards and show the card in a pop-up screen when selected. In the first project where they kept their journal in this way, it took some extra effort to get used to it. Now they are happy with the repository of interventions they have built in earlier projects. For the coffee-machine project they used this repository to plan and prepare interventions. The travelogue cards where not shared with the other project team members at the start of the project. Only at the end of the project they added some cards to equip the product manager with a repository he could share and maintain after the designers finished the project.

The canvas and travelogue are used for the fourth step: maintaining the canvas and travelogue. During the project changes will occur that influence the planning and interventions. E.g., new insights or staff changes lead to extra actions in the project. After the project you can use the canvas and travelogue as a repository that support you and your colleagues in future projects. For your client the canvas and (part of) the travelogue serve as a tool to enable using UX insights in making design decisions. You equip design decision makers to recall and apply what they have learned and transfer this to their colleagues.

General discussion and conclusions

7

7 General discussion and conclusions

The current research confirmed that UX insights indeed get lost when designers are no longer actively involved in a product service system (PSS) development process. More precisely, it was found that UX insights are disregarded because designers do not encourage and facilitate others to continue using UX insights in the entire PSS development process. Throughout the research it became clear that development can be framed as networked human-centred design (NHCD), an approach that contributes to keeping UX insights alive. In NHCD, designers actively build a network of actions, ensuring UX insights are used in design decision making (i.e., making decisions that influence the final specifications of a product or service and how these products and services are experienced). Actions in a NHCD project can be grouped by the shared objectives, tools, language, and criteria that actors use in these actions. In the current work, such a group, or field, of actions is referred to as an 'activity'. The constructed framework of NHCD distinguishes three such activities: the 'design activity' where actors apply design criteria, design tools, and design methods as actions to create concept of products and services; the 'organisation activity' in which the actions consist of organising production and delivery of products and services; and the 'experience activity' where the actions involve the use of these products and services. It was found that particularly in the organisation activity UX insights are neglected when making design decisions.

In the course of a design project, designers can actively bring their ideas and criteria for design decision making from one action into another in an actionable form; the current research refers to this process of moving ideas and criteria as 'a process of translation'. The research found that by supporting this process of translation designers can keep UX insights alive. The framework of NHCD specifies four stages in the translation process: identifying problems and solutions, triggering actors to use UX insights, engaging actors in using UX insights, and establishing the use of UX insights in design decision making. The studies presented in Chapter 5 showed that designers did not sufficiently support these four stages during design projects and oftentimes did not support the 'establishing' stage adequately. Designers seemed not to equip the activity of organisation sufficiently with required knowledge and tools for using UX insights in decision making.

The studies revealed that designers were unaware of their potential role of supporting the translation process next to their role of designing PSS solutions. In design project meetings, where people from different activities meet, designers supported the translation stages trigger and engage to make design decisions with the design team. However, they did not identify and create opportunities that support design decision makers to incorporate UX insights in activities beyond the design itself.

The findings described above are the main results of the current studies on the practice of design, guided by a framework of networked human-centred design. This framework contributes to the existing knowledge of the human-centred design practice. The guidelines resulting from the studies also contribute to the design by suggesting how designers could take on their new role of supporting translations, in concert with designing PSS solutions.

This chapter reflects on the current research: it first discusses how the framework contributes to the theory and practice of human-centred design, followed by a reflection on the research approach, and what future research is needed. Finally, the possible implications of the research for design practice and education are discussed.

7.1 Contribution to theory

The current research provides new understanding of the role of designers in networked design; designers support translations to keep UX insights alive in a NHCD project. Although the phenomenon of UX getting lost was noticed in literature (e.g., Norman & Tognazzini, 2015), little explanation of this phenomenon was available. A possible explanation is the networked character of human-centred design (HCD) complicating communication of UX. With the knowledge available at the start of the current research, networked human-centred design was described as a process of developing a system of products and services that meets people's needs, involving many different disciplines, different organisations, and different technologies. During the research, a new understanding of 'networked design' evolved as described in the following.

Studies 1-4 explored PSS development practices and provided an understanding of what networks are involved in networked design: three collaborating networks of designers, networks of users, and networks of people working in organisations that provide products and services. It was also found that engagement of actors in doing HCD is required to keep UX insights alive. Consequently, designers need methods and tools for understanding how they can engage the actors in an HCD process to use UX insights in their design decision making. Further exploration of literature provided theoretical concepts that explained the rationale behind networked design.

Literature in the fields of Design Research, Science Technology & Society, and Innovation provided further understanding of networked design. With this understanding, Activity Theory (AT) and 'sociology of translation' were combined to renew the preliminary framing of networked design. Borrowing from AT, the new concept of networked design describes a design process as connected actions instead of collaborating networks of professionals. 'Sociology of translation' provided the insight that designers can actively build a network of actions through supporting the process of translation. Chapter

4 frames networked human-centred design (NHCD) using this concept. In NHCD, designers are subjects in an activity of design and bring artefacts into boundary actions, and create interventions with these artefacts. Boundary actions take place outside the boundaries of a specific activity. In a boundary action, actors from different activities meet, e.g., designers from the activity of design and organisers from the activity of organisation. Through such boundary interventions, organisers interact with the artefacts the designers contributed, and bring these artefacts and what they learned in the boundary action into their activity. This is referred to as a 'translation process' in sociology of translation: ideas and criteria from one activity are brought into another activity in an actionable form. Through the creation of artefacts and boundary interventions, designers support design decision makers from other activities to use UX insights when making design decisions. This framework has been guiding the studies in Chapter 5 in the form of a mapping method derived from the framework; a new research method to study design practice by generating a map of actions and translations in a design project. The mapping method and the conjoined Networked Collaboration Canvas tool contribute to existing design research methods for studying design practice in PSS development. With the mapping method it is possible to understand the dual role of designers in creating solutions and supporting other design decision makers, while existing methods focus on the role of designers in creating solutions.

The constructed framework of NHCD referred to a first generation of studies on work and learning (Engeström, 2000) where AT has been applied in describing the context of actions in an activity. In the meantime, the Finnish activity theorists Engeström and Sannino (2021) have been evolving their application of AT in the same vein to guide their studies of work and learning as the framework of NHCD guided studies on networked design. Now they apply a fourth generation, with multiple activities and multiple interconnected 'Change Laboratories' or 'Boundary Crossing Laboratories' with longitudinal follow-up. The Finnish researchers used laboratories for interventions to enable actors in different activities to change their way of working in the same vein as designers use boundary actions for boundary interventions to enable others to adapt their design decision making. This evolution to the fourth generation, where activity theorists apply AT to study how to connect multiple activities through multiple boundary interventions, enforces the application of AT to study networked design.

The framework of NHCD extended knowledge on how designers' interventions in boundary actions support learning. In the field of Design Research, the role of designers is often described as creative problem solver (Dorst & Cross, 2001). For example, the frame-creation process supports problem solving in design (Dorst, 2015). Recently, Dorst (2018) advocated identifying practices from various fields and disciplines, and learning to think transdisciplinary from these practices for problem framing in HCD. In addition, Van der Bijl-Brouwer

and Dorst (2017) advocate to advance HCD methods for transdisciplinary thinking to deepen UX insights with the aim to support innovation. The framework of NHCD demonstrates such a proposed advancement in HCD methods because it guides a learning process by identifying different activities and opportunities for learning. Specifically, the NHCD framework promotes a short-term responsibility of designers. Designers intervene in the actions that connect the different activities to enable others to continue making HCD decisions after the designers' involvement. This new perspective of supporting translations together with the method and guidelines for supporting translations can be seen as a valuable addition to HCD methods. It adds methods for designers as facilitators of translation to the designers' toolbox as creative problem solvers.

The following elaborates on the contribution of the current research to theory by addressing the research questions how and where insights get lost, and what barriers and enablers can be identified in networked design.

How and where do user insights get lost in networked design projects?
In the introduction the importance of UX insights in networked design projects (e.g., Norman & Tognazzini, 2015; Roto, Law, Vermeeren & Hoonhout, 2011) referred to how properties of a product or service and the context of use influence UX. Consequently, changes in the properties or context of use can have an unfortunate impact on UX. This informed the assumption of the dissertation that user insights get lost when UX insights are not made actionable for actors that make design decisions along the different stages of the process of PSS development. Literature in the field of Science Technology & Society provided the knowledge that mediating artefacts, or boundary objects, support translation (e.g., Latour, 1992; Star, 2010). This informed the construction of the framework of NHCD, with designers supporting translations by applying artefacts. However, existing literature did not provide knowledge on how designers apply artefacts in design projects and how this application of artefacts supports making UX-insights actionable when designers are not present.

Studies 5-12 were guided by the framework and provided a further understanding of how to apply artefacts. These studies showed that designers and artefacts can have an active role in exchanging design knowledge and skills, and supporting others to apply and transfer this knowledge and skills after designers have left the design project. The studies brought forward that designers take this active role by supporting the process of translation by intervening in boundary actions. In these interventions they engage actors with a human-centred approach and exchange knowledge and skills on how to use UX insights to make design decisions. Designers do this in boundary actions in concert with designing solutions during a PSS design project. Intervening happens by bringing in artefacts and inviting actors to interact with these artefacts and bringing these back into their own practice. However, the

studies showed that designers do not take the opportunity to support all four steps in the translation process. Although designers do support the steps of *trigger* and *engage*, they do not support the steps *identify* and *establish*. UX insights are neglected because the entire process that enables the use of these insights was not supported; designers do not take on a new role as facilitators of the translation process.

The studies identified how and where UX insights get lost and articulated the role of designers preventing this. When designers create interventions and use artefacts in interactions in these interventions, they support all steps in the translation process if they trigger, engage, and equip participants with artefacts and knowledge. Opportunities for these interventions are identified by mapping boundary actions in design projects in the landscape of the activities of design, experience, and organisation. With the mapping, different activities and boundary crossings are identified in a design project. This identification informs designers' framing of problem and solution spaces for applying mediating artefacts or boundary objects. The finding that identification of boundaries crossed by actors in boundary actions supports creating interventions and mediating artefacts, contributes to theory of mediating artefacts and boundary objects. It articulates the active application of mediating artefacts and boundary objects with the aim that actors continue using these artefacts in their activities. Where literature in Chapter 3 mainly focused on identifying mediating artefacts and boundary objects in actions, the application of the framework provided suggestions on how to create and apply these artefacts in design projects.

What barriers and enablers can be identified in a networked human-centred design project?
Studies in Chapter 2 and 5 found that designers fail to identify opportunities for providing knowledge and artefacts that enable organisers to continue the use of UX insights in the context of the activity of organisation. They miss out opportunities in their design projects to learn what others need to use UX insights and consequently do not provide actionable knowledge and artefacts. However, the studies observed designers doing interventions in their meetings with other designers, and creating artefacts for these interventions. In these interventions, designers did demonstrate their capability to communicate actionable UX insights. Also, the studies showed that in some design projects designers do create interventions that establish new roles, rules, and tools, in an activity of organisation (sections 5.6 and 5.7). In these design projects, designers created things that did support others to change their routines. For example, in Study 10 designers created a new packaging and user manual for 'DIY installing of ICT products'. This new design mediated using UX insights when deciding on assembling and delivering ICT products. In general, the studies showed that designerly ways of working can support the identified steps of translations if designers are aware of this new role.

The main barrier found in networked design is that designers are not supporting the establishment of the use of UX insights in the activity of organising; i.e., they do not equip the organisation activity with the required knowledge and tools for using UX insights in decision making. The studies indicated that designers are not aware of their role of supporting the continuation of human-centred design decision making in other activities than design. However, it was found that designers are, to some extent, able to trigger and engage organisers to apply UX insights when taking design decisions.

The above questions were subquestions to the main research question: **'What designers can do to prevent UX insights from getting lost in a networked design process?'** Addressing this main question summarises the contribution to theory on networked human-centred design: when designers become facilitators of the translation process this opens opportunities to keep UX insights alive. When designers apply their designerly approach not only to design solutions for end users, but also to incorporate UX insights in design decision making in activities beyond the design itself, they can prevent that UX insights get lost.

General application of the framework of NHCD
The framework depicts NHCD projects as occurring in separate activities, with translation of insights taking place through interventions in boundary actions. Chapter 6 presents guidelines for designers to realise a learning process in project meetings, designers support others in learning and applying to make human-centred design decisions. The focus of the current research has been on PSS design projects. However, enabling others to continue design decision making can be supportive in any project where actions of design and design decision making are involved. The role of designers to enable design decision making through interventions is not different in design projects that include different activities, or include different insights to consider in decision making that travel through the project. As an example, actors from different fields of work learn from each other to frame the complex problems in HCD (e.g., Van der Bijl-Brouwer & Dorst, 2017). Similar to the framework, these transdisciplinary HCD methods address designing in complex sociotechnical systems, designing interventions, and facilitating a step-by-step learning process. Application of the framework in the form of the mapping method and the Networked Design Canvas can contribute as a new methods and tool to address designing in complex sociotechnical systems.

7.2 Contribution to practice

Applying the NHCD framework for mapping actions in seven design projects resulted in an overview of what actions, roles, and artefacts support translations in HCD practice. With this understanding, a conversion from theory to practice resulted in guidelines and a tool for design practice

(Chapter 6). The steps of the translation process in design have been converted into actions in design practice. The guidelines suggest how designers can enable design decision makers step by step, making use of project meetings and the NDC tool for mapping the project. The guidelines and mapping tool support design practitioners to take on the new role of facilitating translation, and enable others to make human-centred design decisions when designers are not there.

The studies show that designers think of a single role as creative problem solvers instead of the dual role of problem solver and facilitator of human-centred design decision making. Designers focus on products and services for end users, they are not thinking in providing services to enabling actors take the role of making human-centred design decisions. Instead, they think in instant solutions. For example: deliver a business case instead of facilitate business managers to write a human-centred business case. Or, deliver a card set with design tools instead of equip organisers with knowledge and skills to transform design tools into organisation tools.

The studies showed that boundary actions happen in a design project. Exemplary boundary actions are, e.g., meetings with the design-team or co-creation workshops with users and clients. The studies identified that artefacts often lack actionability. For example, presentations, videos, cards, and guidelines disappear in desk drawers, laptops, or intranets after they were used in a meeting, even though designers handed these over for later use. These artefacts may support the possessor to use UX insights in his/her own decisions, however, do not support organisers in negotiating the use of UX insights in making design decisions with other roles in their organisation.

The guidelines recommend how in practice designers can use meetings and deliverables to support keeping UX insights alive. The following scenario illustrates this and describes what could have happened if the designers in the Apple case (Chapter 1) had been aware of their new role and understood how to take on this role. In this Apple project designers created Apple's Human Interface Guidelines (HIG) together with HCD researchers. After they handed the HIG over, use of the HIG became obligatory for hardware designers and application designers that create Apple products. New staff changed focus from design to marketing, and changed the HIG that worked well for years. Apple's new managers changed the HIG by leaving out basic UX principles and introducing criteria on appearance, switching from interaction criteria to visual appearance criteria. If the designers of the first HIG would have identified this action of managers making design decisions on the HIGs, they would not have handed over the HIG as an instant solution. They would have done interventions in meetings with the managers to enable managers to change the HIG using UX insights, resulting in keeping basic UX principles included.

Bringing the guidelines and NDC to practice could contribute to design practice, as illustrated above. The guidelines support designers to extend their practice of designing solutions with enabling others to continue making human-centred design decisions in the long-term. With the guidelines, design practice can prevent that UX insights get lost.

7.3 Reflection on the research approach

The general research approach has been a generative approach, i.e., co-creation of visuals supported gathering data. Participants in the studies exchanged experiences and knowledge by sharing and reflecting through creating visuals with insights on their networked design process. Specifically, participants wrote their individual reflections down and exchanged these when making maps with insights on networked design. This approach worked well to give participants a voice, resulting in data on experiences and knowledge from a variety of disciplines.

The series of studies provided the possibility to take results from one study into the following study, aiming at gaining insights on aspects of networked design from different perspectives. Reflecting upon results from previous studies from other perspectives in following workshops increased the amount and depth of insights in each study. E.g., in Study 4 participants discussed the low hanging fruit of previous workshops from their perspective as practitioners eager to apply what they had learned in their different practices. This reflection resulted in deepening insights on networked design by ranking these in priority for application in practice. It can be said that the interactivity in the studies, together with the mix of experiences and expertise, supported a process of data gathering giving voice to a broad range of aspects of networked design.

For the studies a mapping method derived from the framework was applied to study translations in design projects. The mapping method guided the procedures and materials in the studies. The studies showed that this mapping method worked well for the research to support participants in sharing their experiences, however, in successive workshops the researcher optimised the mapping materials to function as a generative tool. In some of the studies participants were reluctant to actively use the provided mapping materials. They perceived it as a tool relevant for the researcher to study design projects, but did not link it to their design practice. However, after the researcher intervened by changing the mapping materials into a more interactive tool for mapping design practice, designers started to work with the tool. Designers started to map actively after the introduction of the swim lanes to create a timeline of a design project. Their reflections when actively mapping a project, provided details on how designers could influence actions in design projects. With these insights on the design process, it was

possible to explain the role of enabling others to continue making human-centred design decisions, and the value of mapping a design project to create interventions.

The findings of the current research confirm that the HCD framework, and mapping method used for studying design projects, develops renewed understandings of design. Mapping design projects in a landscape of actions, support researchers to reflect on what designers do and can do. However, uncertainties about the quality of the research could not be avoided.

One uncertainty is a researcher's bias throughout the research. Due to the explorative and generative approach, it was a challenge to decide on relevance of results of studies and literature. For example, decisions on relevance of results of studies in Chapter 2 were in some cases influenced by the researcher's preferences as a human-centred design professional. The findings in Chapter 2 guided the exploration of literature in Chapter 3. Literature has been explored by using a snowball method leading to many potential interesting articles. Deciding on the relevance of articles to find concepts of networked design was challenging. Clear criteria for relevance were missing leading to, sometimes, arbitrary decisions on what literature to involve. Literature on designerly ways of doing provided the criteria *contextual*, *reflective*, and *artefactual*, for further selection of relevant aspects of networked design to build a framework of NHCD.

Another uncertainty is assurance of the quality of the research. The indicators *relevance*, *validity,* and *reflexivity* were used to assure the quality of the research that led to the framework (Malterud, 2001). For the validity, researcher triangulation was applied by involving co-researchers in the analysis of the studies (Chapter 5). However, this was not done as thoroughly as planned. The researcher did most of the analyses and involved other researchers only in part of the analyses. Others were involved when most of the analysis was already done. Fully comprehending the concept of translations and how to identify the stages of translation from the mapping result was challenging. Through doing analyses, the researcher went through an iterative process of improving identification and analysing studies. Due to this process co-researchers were involved in confirmation of the analyses, not in the selection and clustering of the data. This limitation in validation makes the mapping method less valid and is a consideration for extra studies to validate the mapping method with other researchers involved in selecting and clustering the data during analyses.

The *relevance* was strengthened by involving a variety of industries, practitioners and development projects making the findings useful for the PSS design practice. Additional projects were selected from the P5 practice to enlarge the sample of projects from the PSS 101 project, increasing diversity, representation and thus relevance. *Reflexivity* was addressed by keeping a

record of my interpretations and roles, and using this diary to reflect on my actions along the research.

Future research
Further validation of the NDC toolkit and creating examples of boundary interventions and mediating artefacts could be subjects for extra studies. Validation of the NDC can be achieved by evaluating development of interventions and tools in real life design practice. However, it possibly takes several years before it can be measured if the application of NDC leads to use of UX insights in design decision making. It can take years before can be reflected on the often-long-term PSS development projects. Experiments in a design lab, e.g., one of the Delft Design Lab[34], can provide validation on a shorter term by applying the NDC in simulated PSS development projects. Short experiments with boundary interventions, and creating mediating artefacts for these interventions, could also provide requirements for artefacts that mediate using UX insights and a preliminary repository of such artefacts and related interventions.

7.4 Implications of the research

One of the main results of the research is the understanding that designers can keep UX insights alive by supporting translations through boundary interventions. This new role of designers implicates new approaches in the design practice and design education.

Design practice
In design practice, designers need to extend their HCD methods with methods for facilitating translations in networked human-centred design and apply these when creating solutions for end users. The studies found that in design practice designers already trigger and engage organisers in their current role of creating solutions. The emphasis of the new HCD methods is on identifying and facilitating the establishment of a new approach in making design decisions in other activities than design. However, designers need to be aware of these new methods. Making them aware and bringing the methods into the practice of designers is a next step. The researcher is taking this step by introducing the guidelines and NDC tool to design agencies connected to the P5 practice.

Design education
Upcoming designers will face complex sociotechnical problems and complex NHCD projects. If they understand their possible role as supporting the process of transation, they will be better equipped to deal with that complexity. Consequently, design education may prepare designers for the role of enabler of design decision making as it did prepare designers to facilitate user participation in design research.

34 https://www.tudelft.l/io/onderzoek/research-labs

Particularly courses in the design curriculum that already address HCD methods could teach designers skills to support the process of translation, as well as the necessary skills to create boundary interventions and artefacts to support the different steps of this translation process. Courses on behavioural change, e.g., persuasive design, probably already address elements of translation. The HCD curriculum teaches how to identify problems and how to create boundary interventions. However, small adaptions in design education such as extending the use of UX insights with skills to facilitate other design decision makers to use UX insights in other activities than the design activity, will prepare designers for networked human-centred design.

Glossary

The meaning of some terms in this thesis evolved during the research; a deeper understanding of networked human-centred design provided more precise explanations of some terms. Accordingly, some terms in the glossary have more explanations, with for each explanation a reference to the chapter where the particular meaning appears for the first time.

Action	In this thesis an action refers to an event where actors interact with other actors and artefacts to achieve a specific aim in PSS development.
Actionable	The ability of something to be acted on. In this thesis actionability refers mainly to UX insights. These are actionable when the insights are in a form that people can use them in making design decisions, e.g., in a form that supports to formulate criteria for decision making.
Activity	In chapter 3 the explanation borrows from Activity Theory. In this chapter an activity is: an objective (or purpose) oriented 'doing' by subjects (or actors) who are part of a community while available tools, rules, and a division of labour, mediate the 'doing' (Engeström, 2000). In Chapter 4 the term is used in the context of networked human-centred design, with three distinguished activities: design, organisation, and experience. An activity of design is explained as: the object of an activity of design is to create PSS solutions providing a good user experience. The outcome of the design activity is a product or a service. Designers are subject in an activity of design, using design tools and working in a team of designers with different specific design skills and roles.

Activity (continued)	Finally, the Chapters 6 and 7 explain activity in the language of designers as: a field of work with each activity forming the context of actions with actors using a specific language, tools, and criteria. For example, an activity of design is the field of actions of creating concepts of products and services, an activity of organisation is the field of actions of organising production and delivery of products and services, and an activity of experience is the field of actions of using products and services.
Artefact	A material thing made by a human-being. In this thesis artefacts can have a mediating role; these mediating artefacts can influence the outcomes of actions as much as the actors participating in that action can.
Boundary	Differences in activities leading to discontinuity in actions. In this thesis boundaries between activities, or fields of work, lead to discontinuity in using UX insights when making design decisions.
Boundary Action	Boundary actions can be seen as intermediary actions between different activities. Boundary actions that take place in between different activities, is where subjects from different activities exchange experience, knowledge, and skills.
Boundary Intervention	Interventions in boundary actions, taking the opportunity to exchange knowledge and skills between people from different fields of work. In this thesis a boundary intervention supports actors in changing how they make design decisions.
Boundary Object	Mediating artefact with the capacity to bridge different activities or actions. A boundary object can be shared between different activities, with each activity having its own understanding of the object. It can serve as a tool for communication, or sharing knowledge, between different fields of work.

Designer	The term ‘designers’ refer to people doing design activities (Chapter 1). Borrowing from activity theory: a designer is a subject in an activity of design, using design tools and working in a team of designers with different specific design skills and roles (Chapters 3 and 4).
Design Decision	In this thesis design decisions refer to decisions that influence the final specifications of a final product or service, and how this product or service will be experienced.
Design decision maker	Design decision makers refer to actors in a networked design process making decisions that influence UX.
Design Research	The study of and research into the process of designing in all its many fields (Cross, 2007).
Experiencer	Subject in an activity of experience, looking for good user experiences when using products and/or services.
Human-Centred Design (HCD)	A process of developing a system of products and services that meet people’s needs. In a human-centred design (HCD) process, designers use design methods and skills to gather information on UX, interpret this information into UX insights and use these insights in creating and delivering solutions that users will be experiencing as fitting their needs.
Intervention	An action taken that supports actors in changing behaviour in making design decisions.

Networked Design	Chapter 1 explains Networked Design as: a process of developing a system of products and services that meet people's needs, involving many different disciplines, organisations, and technologies. Chapter 2 includes the networks involved: Networked design takes place in collaborating networks of design professionals, organisation professionals, and experiencers. In Chapter 3, literature on Activity Theory and 'sociology of translation' supports the construction of a new concept of Networked Design. This concept explains networked design as: subjects in an activity learn by crossing the boundaries of the activity and participate in a boundary action. In this boundary action they learn how they can change the way they do their actions in an activity, e.g., making design decisions. Designers can influence the learning by facilitating translations in boundary actions. In the boundary action designers can provide interactions with artefacts that support the subject of an activity to change the way of making design decisions in an activity. Subjects in an activity learn through their interactions with artefacts in boundary actions. These subjects bring the artefacts into the boundaries of their activity to apply what they have learned, and adapt actions in their activity. In Chapter 4 this concept is used to frame Networked Human-Centred Design.
Networked Collaboration Canvas (NCC)	Mapping tool to support the mapping of actions and translations in design projects. The tool enables a researcher to co-create a map of a NHCD project with participants and allows participants to collectively reflect on actions in a project they were involved in.
Networked Design Canvas (NDC)	Tool for mapping and planning interventions in a networked human-centred design project. The canvas visualises actions in, and in between, the different activities in a design project, particularly where design-decisions are made. The boundary actions, in between activities, provide an indication where interventions are opportune.

Networked Human-Centred Design (NHCD)	A design process in which UX insights are translated in order to assemble designers, experiencers, and organisers in considering UX insights in design decisions. In other words, actively connecting actions in a human-centred design project through translation of UX insights.
Mediating Artefact	Artefacts with a mediating role that can influence the outcomes of actions as much as the actors participating in that action can.
Organisation	In Chapter 4 the term refers to: an activity with the objective to bring the products and services of a PSS into the market, and to manufacture, market, and maintain these PSS elements using management and production tools. The subjects in this activity are working in teams of managers and/or operators with specific management and operational skills, and ways of working specific for the industry involved. In the language of designers (Chapter 6 and 7): the field of actions of organising production and delivery of products and services.
Organiser	Subject in an activity of organisation.
Product Service System	An integrated bundle of products and services which aims at creating customer utility and generating value (Boehm & Thomas, 2013, p. 252).
Role	Actor's and artefact's roles are defined by what they do in actions they participate in, or the tasks they have in an action. E.g., the role of designing defines a problem and solutions space, and generates product and service solutions.
Rule	Principle governing procedures within an activity.
Timeline	In chronological order listed actions in a PSS design project.

Tool	Thing to support an action. In this thesis, tools are seen as artefacts mediating actions.
Trajectory	Visualisation of the paths of UX insights traveling through boundary actions and activities. A landscape of the activities provides the canvas for mapping. In the current research the trajectory has been used to map translations of UX insights in design projects.
Translation process	In Chapter 3, borrowing from 'sociology of translation' the explanation is: a process of including humans and non-humans in a network of actions where UX insights are used in making design decisions. This process of translation describes how UX insights continuously move from one action into another, transported by actors and artefacts, and transform design-decisions-making by the form UX insights appear in the actions they move into. In Chapter 6, in the language of designers, the translation process is referred to as 'enabling process'.
Travelogue	In the Chapters 4 and 5 a travelogue refers to a journal of how using UX insights in design decision making travels through a design project. The travelogue describes what happens in the different actions in a design project. In Chapter 6, a travelogue is part of the Networked Design Canvas tool. This tool is elaborately described in Appendix 2.

Stages of Translation (process)

The translation process can be seen as a continuing process where translations take place in different stages of connecting human and non-human actors to a network. These stages are:

1. identify problems and solutions: designers define a problem and solution space for the creation of artefacts that could support translations.
2. trigger actors to use UX insights: actors are encouraged through interactions and artefacts to use UX insights
3. engage others in using UX insights: actors are supported to actually use UX insights
4. establish always using UX insights in making design decisions: actors are supported to use UX insights as a routine when making design decisions.

Step-by-step enabling process

Supporting a translation process in practice. A process where designers invite design decision makers, not working in the field of design, to learn by doing. Enabling others to use UX insights after designers have left is a step-by step process. The 4 steps to enable using UX insights in design decision making are: make a project map, trigger use of UX insights, engage to use UX insights, and equip design decision makers to use UX insights when making design decisions.

User Experience (UX)

In this thesis, the term UX refers to the people's need to have an optimal experience of products and services, including functionality, usability, and pleasurability.

UX insights

In this thesis UX- insights refer to knowledge, or understandings, of user's aspirations and needs that guide design-decisions. UX insights include knowledge on different aspects of UX: e.g., properties of a product, user characteristics, and context of use.

References

Akkerman, S. F., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research, 81*(2), (pp. 132-169).

Akrich, M., Callon, M., & Latour, B. (2002a). The key to success in innovation part I: the art of interessement. *International Journal of Innovation Management, 6*, (pp. 187-206).

Akrich, M., Callon, M., & Latour, B. (2002b). The key to success in innovation* Part II: To Adopt is to Adapt. *International Journal of Innovation Management, 6*(2), (pp. 207-225).

Allee, V. (2008). Value network analysis and value conversion of tangible and intangible assets. *Journal of Intellectual Capital, 9*(1), (pp. 5-24).

Barabási, A.-L. s. (2016). *Network science*. Cambridge, United Kingdom: Cambridge University Press.

Bodker, S. (1998). Understanding representation in design. *Human-Computer Interaction, 13*(2), (pp. 107-125).

Boehm, M., & Thomas, O. (2013). Looking beyond the rim of one's teacup: a multidisciplinary literature review of Product-Service Systems in Information Systems, Business Management, and Engineering & Design. *Journal of Cleaner Production, 51*, (pp. 245-260).

Brandes, U., Robins, G., McCranie, A., & Wasserman, S. (2013). What is network science? *Network science, 1*(1), (pp. 1-15).

Brown, T. (2008). Design thinking. *Harvard Business Review, 86*(6), (pp. 84-92).

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, 8(2), (pp. 5-21).

Buchenau, M., & Suri, J. F. (2000). *Experience prototyping*. Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques (DIS '00) (pp. 424-433). New York, USA: Association for Computing Machinery.

Buijs, J. A. (2012). *The Delft Innovation Method: a design thinker's guide to innovation*. The Hague: Eleven International Publishing.

Burns, C., Cottam, H., Vanstone, C., Winhall, J. (2006). RED PAPER 02 Transformation Design. Design Council. Retrieved from: https://www.designcouncil.org.uk/resources/report/red-paper-02-transformation-design

Callon, M. (1986). Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. *Power, action and belief: A new sociology of knowledge, 32*, (pp. 196-233).

Callon, M., & Latour, B. (1981). Unscrewing the Big Leviathan How do Actors Macrostructure Reality and How Sociologists Help Them. In: K. Knorr and A. Cicourel (eds.), *Advances in Social Theory and Methodology: Towards an Integration of Micro- and Macro-sociologies* (pp. 277-303), London: Routledge.

Carlile, P.R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization Science*, 13(4), (pp. 442-455).

Chesbrough, H. (2006). Open innovation: a new paradigm for understanding industrial innovation. In W. V. Henry Chesbrough, Joel West (Ed.), *Open innovation: Researching a new paradigm* (pp. 1-12). Oxford: Oxford University Press.

Chesbrough, H. (2012). Open Innovation: Where We've Been and Where We're Going. *Research-Technology Management, 55*(4), (pp. 20-27). doi:10.5437/08956308X5504085

Clarkson, J., Keates, S., Coleman, R., & Lebbon, C. (2003). *Inclusive Design*. London: Springer-Verlag.

Cross, N. (1982). Designerly ways of knowing. *Design studies, 3*(4), (pp. 221-227).

Cross, N. (2001). Design cognition: Results from protocol and other empirical studies of design activity. In C. N. Eastman, W. and McCracken, M. (Ed.), *Design knowing and learning: cognition in design education.* (pp. 79-103). Oxford, UK: Elsevier.

Cross, N. (2001). Designerly ways of knowing: design discipline versus design science. *Design Issues, 17*(3), (pp. 49-55).

Cross, N. (2004). Expertise in design: an overview. *Design studies, 25*(5), (pp. 427-441).

Cross, N. (2007). Forty years of design research. *Design studies, 28*(1), (pp. 1-4).

Czarniawska, B. (2004). On time, space, and action nets. *Organization, 11*(6), (pp. 773-791).

Dankert, R. (2011). *Balanceren tussen uitvoering en bewuste afwijking van beleid: De implementatie van strategisch voorraadbeleid door woningcorporaties*. Doctoral Thesis. Delft University of Technology.

De Bont, C., Den Ouden, P. H., Schifferstein, R., Smulders, F. E. M. H., & Van der Voort, M. (2013). *Advanced design methods for successful innovation*. Den Haag: Design United.

De Lille, C. S. H. (2014). *UCD4SME: Small to Medium-sized Enterprises involving their users and clients for product innovation*. Doctoral Thesis. Delft University of Technology.

Den Ouden, E. (2011). Innovation Design: Creating Value for People, Organizations and Society. London: Springer.

Den Ouden, E., & Valkenburg, R. (2011). Balancing Value in Networked social Innovation. In Buur, J., *Participatory Innovation Conference 2011 Proceedings* (pp. 303-309), University of Southern Denmark.

Design Council (2007). *Eleven lessons: managing design in eleven global brands. A study of the design process.* Retrieved from https://www.designcouncil.org.uk / resources/report/11-lessons-managing-design-global-brands

Dorst, K. (2015). Frame Creation and Design in the Expanded Field. *She Ji: The Journal of Design, Economics, and Innovation, 1*(1), (pp. 22-33).

Dorst, K. (2017). Stepping Stones between Design Research and Cognitive Science. *She Ji: The Journal of Design, Economics, and Innovation, 3*(2), (pp. 105-106).

Dorst, K. (2018). Mixing Practices to Create Transdisciplinary Innovation: A Design-Based Approach. *Technology Management Review,* 8(8), (pp. 60-65). https://doi.org/10.22215/timreview/1179

Dorst, K., & Cross, N. (2001). Creativity in the design process: co-evolution of problem–solution. *Design studies, 22*(5), (pp. 425-437).

Ehn, P. (2008). *Participation in design things.* Proceedings of the Tenth Anniversary Conference on Participatory Design 2008 (pp. 92-101). Indiana University.

Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics, 43*(7), (pp. 960-974).

Engeström, Y., & Sannino, A. (2021). From mediated actions to heterogenous coalitions: four generations of activity-theoretical studies of work and learning. *Mind, Culture, and Activity. 28(1),* (pp. 4-23) https://doi.org/10.1080/10749039.2020.1806328

Eriksen, M.A (2012) *Material Matters in Co-designing - Formatting and Staging with Participating Materials in Co-design Projects, Events and Situations.* PhD Dissertation. Malmö University, Sweden.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative inquiry, 12*(2), (pp. 219-245).

Forlizzi, J., & Ford, S. (2000). *The building blocks of experience: an early framework for interaction designers.* Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 419-423). New York, USA: Association for Computing Machinery.

Friedman, K., Norman, D., Stappers, P. J., Voûte, E., & Whitney., P. (2014). DesignX: A Future Path for Design. Retrieved from http://www.jnd.org/dn.mss/designx_a_future_pa.html

Fujimura, J. H. (1992). Crafting science: Standardized packages, boundary objects, and "translation.". In A. Pickering (Ed.), *Science as practice and culture* (pp. 168-211). Chicago: The University of Chicago Press.

Granovetter, M. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory, 1*(1), (pp. 201-233).

Green, W., & Jordan, P. W. (1999). *Human factors in product design: current practice and future trends.* London: Taylor and Francis.

Grönroos, C. (2011). Value co-creation in service logic: A critical analysis. *Marketing Theory, 11(3), (*pp. 279-301).

Henderson, K. (1991). Flexible sketches and inflexible data bases: Visual communication, conscription devices, and boundary objects in design engineering. *Science, Technology & Human Values, 16*(4), (448-473).

Henze, L., & Kahmann, R. (1999). Usability testing under time-pressure in design practice. In W. Green & P. Jordan (Eds), *Human Factors in Product Design: Current Practice and Future Trends.* (pp. 113-123). London: Taylor & Francis.

Henze, L., & Kahmann, R. (2003). Communicating product experience. In McDonagh, D., Hekkert, P., Van Erp, J., & Gyi, D. (eds) *Design and Emotion, Episode III: The Experience of Everyday Things* (pp. 109-113). London: Taylor and Francis.

Henze, L., & Kahmann, L. (2012). *Usability Test Cleaning Instruction.* Intern report, Hilversum: P5consultants.

Henze, L., Mulder, I., & Stappers, P. J. (2011). *Conceptualizing Product Service Networks: Towards an Initial Framework*. In K. Thoben, V.Stich, & A. Imtiaz (Eds.), Proceedings of the 17th International Conference on Concurrent Enterprising: ICE 2011, (pp. 157-165).

Henze, L. A. R., Mulder, I.J., Stappers, P.J. (2013). *Understanding Networked Collaboration: Fields and Patches of Interactions*. Proceedings of the IEEE International Technology Management Conference & 19th ICE Conference, The Hague (The Netherlands), June 24-26, (pp 1-8) https://doi.org/10.1109/ITMC.2013.7352661

IDEO.org. (2015). *The field guide to human-centered design*: IDEO.org.

Jordan, P.W. (1999), Pleasure with Products: Human Factors for Body, Mind and Soul. In Green, W., & Jordan, P. W., *Human factors in product design: current practice and future trends* (pp. 206-217). London: Taylor and Francis.

Kimbell, L. (2009). The turn to service design. In Julier, G. and Moor, L. (eds) *Design and creativity: Policy, management and practice* (pp. 157-173). Oxford: Berg.

Kuutti, K. (1995). Activity theory as a potential framework for human-computer interaction research. In B. Nardi (Ed.), *Context and consciousness: Activity theory and human-computer interaction* (pp. 17-44). Cambridge, MIT Press.

Latour, B. (1992). Where Are the Missing Masses: The Sociology of a Few Mundane Artifacts. In Bijker, W., Law, J. (eds), *Shaping Technology/ Building Society: Studies in Sociotechnical Change* (pp. 225-258). Cambridge, MIT Press.

Latour, B. (1999). On recalling ANT. In *Actor Network Theory and after* (pp. 15-25). Oxford: Blackwell Publishing.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press, USA.

Latour, B. (2008). A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk). In *Networks of Design. Proceedings of the 2008 Annual International Conference of the Design History Society (UK), University College Falmouth* (pp. 2-10). 2008

Latour, B. (2011). Drawing Things Together. In Dodge, M., Kitchin, R., & Perkins, C. (eds) *The Map Reader* (pp. 65-72). Hoboken, N.J.: Wiley & Blackwell.

Latour, B. (2011). Networks, Societies, Spheres: Reflections of an Actor-Network Theorist. *International Journal of Communication, 5*(15), (pp. 796-810). Retrieved from https://ijoc.org/index.php/ijoc/article/view/1094

Laurel, B. (2003). *Design research: Methods and perspectives*. Cambridge: MIT press.

Leigh Star, S. (2010). This is not a boundary object: Reflections on the origin of a concept. *Science, Technology & Human Values, 35*(5), (pp. 601-617).

Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The lancet, 358*(9280), (pp. 483-488).

Miettinen, R. (1999). The riddle of things: Activity theory and actor network theory as approaches to studying innovations. *Mind, Culture, and Activity, 6*(3), (pp. 170-195).

Newman, M. (2010). *Networks: an introduction*. Oxford: Oxford University Press, Inc.

Norman, D. A. (1990). *The design of everyday things* (paperback edition ed.). New York: Doubleday.

Norman, D., & Tognazzini, B. (2015). How Apple is giving design a bad name. *Co. Design*. Retrieved from https://www.fastcompany.com/3053406/how-apple-is-giving-design-a-bad-name

Papanek, V. (1984). *Design for the real world* (Second Edition ed.). Chicago: Academy Chicago Publishers.

Parsfield, M. (Ed.) (2015). *Community Capital: the value of connected communities*. RSA Action and Research Centre. Retrieved from: https://www.thersa.org/reports/community-capital-the-value-of-connected-communities

Pruitt, J., & Adlin, T. (2006). *The persona lifecycle: keeping people in mind throughout product design*. Morgan Kaufmann.

Raijmakers, B., Gaver, W. W., & Bishay, J. (2006). Design documentaries: inspiring design research through documentary film. In *Proceedings of the 6th conference on Designing Interactive Systems* (DIS 2006), (pp. 229-238). University Park, Pennsylvania, USA.

Roozenburg, N. F. M., & Eekels, J. (1995). *Product design : fundamentals and methods*. Chichester: Wiley.

Roto, V., Law, E., Vermeeren, A., & Hoonhout, J. (2011). *USER EXPERIENCE WHITE PAPER Bringing clarity to the concept of user experience*. Retrieved from http://www.allaboutux.org/uxwhitepaper

Rowson, J., Broome, S., & Jones, S. (2010). *Connected Communities: How social networks power and sustain the Big Society*. RSA Action and Research Centre. Retrieved from https://www.thersa.org/reports/connected-communities-how-social-networks-power-and-sustain-the-big-society

Sanders, E., & Stappers, P. (2012). *Convivial toolbox*. Amsterdam: BIS Publishers.

Sleeswijk Visser, F., Stappers, P.J., Van der Lugt, R., & Sanders, E. (2005). Contextmapping: experiences from practice. *CoDesign,* 1(2), (pp. 119-149).

Sleeswijk Visser, F. (2009). *Bringing the everyday life of people into design*. Doctoral Thesis. Delft University of Technology.

Stappers, P. J., Hekkert, P., & Keyson, D. (2007). *Design for Interaction: Consolidating the User-Centred Focus in Industrial Design Engineering*. In Proceedings of the 9th International Conference on Engineering and Product Design Education (pp. 69-74), University of Northumbria, Newcastle, UK.

Stappers, P. J., & Sleeswijk Visser, F. (2014). Meta-levels in design research: Resolving some confusions. In Lim, Y., Niedderer, K., Redström, J., Stolterman E., & Valtonen, A. *Proceedings of DRS 2014 International Conference: Design's Big Debates*, 16-19 June, Umea, Sweden. (pp.847-857)

Stappers, P. J., Sleeswijk Visser, F. S., & Keller, I. (2014). The role of prototypes and frameworks for structuring explorations by research through design. In *The Routledge Companion to Design Research* (pp. 163-174): Taylor & Francis.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology,translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social studies of science, 19*(3), (pp. 387-420).

Steen, M. (2012). Human-centred design as a fragile encounter. *Design Issues, 28(1), (*pp.72-80).

Stickdorn, M., Hormess, M. E., Lawrence, A., & Schneider, J. (2017). *This is service design doing : applying service design thinking in the real world : a practitioner's handbook*. Retrieved from https://learning-oreilly-com.tudelft.idm.oclc.org/library/view/this-is-service/9781491927175/ch12.html

Stickdorn, M., & Schneider, J. (2010). *This is Service Design Thinking*. Amsterdam: BIS Publishers.

Stompff, G. (2012). *Facilitating Team Cognition: How designers mirror what NPD teams do*. Doctoral Thesis. Delft University of Technology.

Stompff, G., Henze, L., De Jong, F., Vliembergen, E., Stappers, P. J., Smulders, F., & Buijs, J. (2011). User Centered Design in the Wild. In Culley, S., Hicks, B.J., McAloone, T.C., Howard, T.J., & Clarkson, P.J., *Proceedings of the 18th International Conference on Engineering Design (ICED11)*, Kopenhagen. (pp. 79-90)

Stompff, G., Smulders, F., & Henze, L. (2016). Surprises are the benefits: reframing in multidisciplinary design teams. *Design studies, 47*, (pp. 187-214).

Valkenburg, R., & Dorst, K. (1998). The reflective practice of design teams. *Design Studies,* 19/3, (pp. 249-271).

Van Boeijen, A., Daalhuizen, J., Zijlstra, J., & Van der Schoor, R., (eds) (2013). *Delft Design Guide*. Amsterdam: BIS Publishers.

Van der Bijl-Brouwer, M., & Dorst, K. (2017). Advancing the strategic impact of human-centred design. *Design Studies, 53* (pp. 1-23)

Van Erp, J., De Lille, C., & Vervloed, J. (eds) (2013). *Crsip#1: Don't you design chairs any more*. Retrieved from: www.crsiprepository.nl

Van Erp, J., De Lille, C., & Vervloed, J. (eds) (2015). *Crsip#5: This is CRISP*. Retrieved from: www.crsiprepository.nl

Van Kuijk, J. I. (2010). *Managing Product Usability. How companies deal with usability in the development of electronic consumer products*. Doctoral Thesis. Delft University of Technology.

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science, 36*(1), (pp. 1-10).

Verbeek, P.-P. (2010). *What things do: Philosophical reflections on technology, agency, and design*. University Park, Pa: Pennsylvania State University Press.

Verbeek, P.-P. (2015). Beyond Interaction: A Short Introduction to Mediation Theory. *Interactions, 22*(3), (pp. 26-31).

Verbrugge, J. K. (2012). *Creative reflection in industrial design*. Doctoral Thesis. University of Twente.

Vermaas, P. E. (2014). Design Theories, Models and Their Testing: On the Scientific Status of Design Research. In A. Chakrabarti & L. T. M. Blessing (Eds.), *An Anthology of Theories and Models of Design: Philosophy, Approaches and Empirical Explorations* (pp. 47-66). London: Springer London.

Von Hippel, E. (2005). *Democratizing innovation*. Cambridge: MIT Press.

Wenger, E. (2010). Conceptual tools for CoPs as social learning systems: boundaries, identity, trajectories and participation. In C. Blackmore (Ed.), *Social Learning Systems and Communities of Practice* (pp. 125-143).

Wohlin, C. (2014). Guidelines for snowballing in systematic literature studies and a replication in software engineering. *Proceedings of the 18th international conference on evaluation and assessment in software engineering*. London, May 12th-14th 2014. https://doi.org/10.1145/2601248.2601268

Summary

Designers generally use human-centred design (HCD) methods to gain insights on the needs of the people they are designing for, and keep focus on these needs when creating solutions. In keeping with this focus, designers use their insights on User Experiences (UX) when making design-decisions.

The focus of human-centred design expanded in the last decades from designing user-friendly products to designing a system of products and services (PSS) that provide good user experiences (UX). In a PSS design process, many actors and disciplines are involved: various professionals with different values depending on their expertise in the process of product design, service design, or business development. Put differently, PSS design can be seen as a networked process with many actors involved who are potential design decision makers in addition to the design professionals. Next to designers, e.g., product managers, marketeers, and service engineers make design-decisions that influence how products and services will be experienced. These design decision makers seem not to continue using the earlier gained UX-insights in decision making. As a result, changes on the original design are made that reduce UX quality.

This research addresses the challenge of supporting design decision makers to continue the use of UX insights in networked design projects. The main research question guiding the research is what designers can do to prevent UX insights from getting lost in a networked design process. The research addresses this main question by exploring how and where UX insights get lost in networked design projects, and what barriers and opportunities can be identified to make networked design a human-centred project.

The research took place in two phases: in the first phase (Chapters 2 and 3) practice and theory were explored to find building blocks to construct a framework of Networked Human-Centred Design (a framework of NHCD presented in Chapter 4). The second phase used this framework to study the questions in a series of empirical case reviews: the framework has been operationalised with a mapping method and tool to support participants in the studies to review their practices.

The general research approach in the current research involved professionals reflecting on their practice of PSS design through generative research. This reflection was supported with generative tools, e.g., by together making visualisations of, and discussing, their insights on design practice. Chapter 2 reviewed cases of product and service development in four studies, describing aspects of networked design that kept UX insights alive (or not). The studies were embedded in the PSS101 project, where a team of practitioners and academic researchers reviewed PSS design practices in leading industries. I

Insights from the studies were:

- Networked design takes place in collaborating networks of design professionals, organisation professionals, and end-users.
- Networked design seems to happen through getting and keeping actors engaged.
- Designers need methods and tools for understanding the process of networked design and how they can influence design decision making.
- Finally, the professionals did not already have a language or theory to frame these aspects of UX insights getting lost or staying alive.

Chapter 3 explored theory from existing literature on networked design, to identify promising theories for framing this journey of keeping UX insights alive.
Literature was found in the fields of design research, innovation, and Science Technology & Society (STS). The fields of design research and STS provided a theoretical concept of networked design, borrowing elements of Activity Theory and sociology of translation. With elements of Activity Theory, the concept of networked design describes a design process as connected actions. The structure in the network is not described through the aforementioned professionals (and end-users), but by what they do in actions in a PSS development process. The language, tools, and criteria actors use in these actions differ between fields of work or 'activities'. Each activity forming the context of actions in a specific field of work. In networked design one of these fields is the activity of design where actors use design criteria, design tools and design methods in actions to create concept of products and services. In between activities, in boundary actions, actors from different activities interact. For example, in the boundary between design and another activity, designers (from the activity 'design') hand over concept designs and UX insights to product managers (from another activity). In boundary actions actors can learn how they can change the way they do their actions (e.g., making design decisions) by interacting with tools and actors from other activities. Following sociology of translation, this is referred to as a 'translation process': ideas and criteria from one activity are brought into another activity in an actionable form. In a boundary action, designers can equip other activities with the means to make UX-based design-decisions later on. Instead of working in collaborative networks of professionals, designers actively build a network of actions where UX insights are used in design decision making in networked design. Their main way of doing this is to provide artefacts (e.g., product concepts and UX insights), and have their counterparts interact with these. The latter then bring the artefacts into the boundaries of their activity so that they may later apply these as criteria. But, as Chapter 2 found, often these criteria are not used in later decision making.

Chapter 4 merges the insights from practice and literature into a framework of networked human-centred design. This framework describes a design project as connected actions in, and in between, three distinguished

activities: design (the field of actions of creating concepts of products and services), organisation (the field of actions of organising production and delivery of products and services), and experience (using products and services). The framework highlights the role of designers:
designers support translations to build a network of actions where UX insights are used in design decision making as is basic in the activity of design. In a human-centred project, designers make UX insights visible and applicable in actions where design-decisions are made, especially in the activity of organisation. The framework describes four steps to support translations, based on the four steps of a translation process or 'moves' as found in literature:

1. **Identify**: understanding the actions where UX insights are 'moved' from the activity of design into the activity of organisation for their further use in design decision making.
2. **Trigger**: encourage actors to use UX insights in their decision making.
3. **Engage**: support actors to use UX insights in their decision making.
4. **Establish**: support actors to use UX insights as a routine in making design decisions in their own field of work.

The framework formed the basis for a mapping tool which was used in the second part of the research to support professionals reflecting on their design practice. Eight studies addressed the questions how UX insights are 'moved' through a design project, and what artefacts and methods support these moves (Chapter 5). With this mapping tool, the Networked Collaboration Canvas (NCC), a route of UX insights in the landscape of a design project is created to reflect on where UX insights were used and moved. By mapping the path of moves and uses the steps in the translation process are described along the way. These descriptions led to a deeper understanding of how designers can support translations. This understanding distinguishes the importance of actions, roles, and artefacts in supporting translations when doing HCD projects. In summary, the studies led to two main conclusions. First, designers support translations through their deliverables and interventions in a design project, especially in boundary actions. However, they do not support all steps of translation: mainly 'establish' is missing. Secondly, the mapping method supports researchers in gathering data and analysis on how designers support keeping UX insights alive. But the participating designers not experienced the form of the mapping tool, and mapping procedures, were as useful for themselves.

The research contributes insights how designers support the process of translations through boundary interventions in practice. Chapter 6 describes a step-by-step process that guides designers in supporting translations:

- identifying when and how to do interventions by making a project map (**identify**),
- in these interventions making organisers aware of human-centred de-

sign decision making (**trigger**),
- involve organisers in making these decisions (**engage**),
- and provide UX insights that are actionable in the activity of organisation (**equip**), so that the organisers can continue using UX insights in design decision making.

In their supportive role designers build a network of actions of making human-centred design decisions in concert with designing a product or service.

Observations of the use of NCC in the studies informed the design of a tool that would better serve designers: the Networked Design Canvas (NDC) (Appendix 2). Where the researcher used the NCC to identify where, and what, translations occur in a design project, designers can use the NDC tool to identify when design decisions will be made later in the process and what actions they can take to support those on beforehand.

Chapter 6 presents guidelines that accompany the tools, based on the insights from the studies. These guidelines follow the three basic principles: (1) enable design decision makers to use UX insights, (2) make use of project meetings to do interventions that enable others step-by-step, (3) use a project map to plan the interventions.

In more detail, the guidelines recommend designers to undertake the following
actions in order to lead design decision makers in an 'enabling process' to use UX insights later on:
- Create interventions to use in project meetings.
- Use these interventions so design decision makers learn by doing in these meetings.
- **Identify** steps in the process: make a map of the design project, and identify on the map when to trigger, engage, and equip.
- Use your map to plan and maintain the enabling process. Use the map of the design project to determine which interventions are best done at what step in the enabling process.
- **Trigger**: together with design decision makers identify where in their work, they and their colleagues make design decisions and what the consequences of these decisions are for UX quality.
- **Engage**: share knowledge and experience with design decision makers by involving them in the project meetings in how you use UX insights when you make decisions.
- **Equip**: provide knowledge and materials that support design decision makers to apply what they have learned on using UX insights in decision making.

The guidelines describe how to create interventions in project meetings that fit the translation process, and the NDC tool to map and plan these interventions.

The research concludes (Chapter 7) that UX insights indeed get lost when designers are not present, and that UX insights get lost because designers do not enable others to continue using UX insights by themselves. UX insights are not used when design-decisions are made in fields of work other than design, particularly in the field of organisation of production and delivery of products and services. In design-project-meetings where people from different fields of work meet, designers do take steps to motivate and engage others in using UX insights. However, designers do not take the four steps (identify, trigger, engage, and equip) that seem necessary to enable using UX insights in actions of decision making in the activity of organisation: designers do not equip. The research also reveals that designers are not aware they have an active role of enabling others in keeping UX insights alive; they focus on designing PSS solutions for end-users, they do not facilitate the decisions made by others later on in the design project.

The framework of NHCD contributes to networked design, particularly on the role of designers. In a similar vein as the framework, earlier design research highlighted the importance of extending HCD methods with methods for addressing complex sociotechnical problems. These extended methods involve identifying practices from different fields and disciplines, and learning about the problems from these practices. The current research identifies and provides support for the role designers can take to networked design beyond their own design activity. It provides insights on the specific role of designers as enablers of design decision making and could be a valuable addition to HCD methods that support innovation in emerging and future practices of design. The guidelines and NDC support designers to take up a new role of supporting translations to facilitate others to make human-centred design decisions when designers are not there.

Although this project provided insights into a new role for designers, and a tool to support it, further research is needed before it can be confidently advocated for design practice. Reflection on the research approach informs on uncertainties about the quality of the research. In particular, limitation in validation of the mapping method is a consideration for extra studies. Measuring a long-term effect of a boundary intervention in design projects, through artefacts created by designers, could be subject of future research.

The research specified a new role for designers. Design education may prepare designers for the role of enabler of design decision making as it did prepare designers to facilitate user participation in design research. Small adaptions in design education, such as extending the use of UX insights with skills to facilitate other design decision makers to use UX insights in other activities than the design activity, will prepare designers for networked human-centred design.

Samenvatting

Ontwerpers hebben human-centred design (HCD) algemeen aanvaard om producten en diensten te ontwikkelen die aansluiten bij de behoefte en wensen van de toekomstige gebruikers. Met behulp van HCD-methoden verzamelen ontwerpers inzicht in die behoeften, en gebruiken ze die inzichten om richting te geven aan de te nemen ontwerpbeslissingen. De beleving van de toekomstige gebruiker (in het Engels: user experiences; UX) staan centraal bij het creëren van oplossingen.

Alhoewel de initiële toepassing van HCD zich vooral richtte op het ontwerpen van gebruiksvriendelijke producten, is de toepassing van HCD in de afgelopen dertig jaar uitgebreid naar het ontwerpen van Product Service Systemen (PSS) met goede gebruikservaringen (UX). Wat een PSS-ontwerpproces anders maakt is de verscheidenheid aan betrokken actoren en disciplines met verschillende waarden afhankelijk van hun expertise in productdesign, servicedesign, of business development. Anders gezegd, het ontwerpen van een PSS kan gezien worden als een networked designproces[35], waarbij de betrokken actoren allemaal potentiele ontwerpbeslissers zijn. Naast ontwerpers maken bijvoorbeeld productmanagers, marketeers, en servicemonteurs ontwerpbeslissingen waarmee zij mede bepalen hoe het uiteindelijk product ervaren wordt. In de praktijk blijkt echter dat er producten en diensten op de markt verschijnen waarbij veranderingen aan het originele ontwerp zijn gemaakt die een nadelig effect hebben op de UX. Het lijkt zo te zijn dat UX-inzichten niet altijd benut zijn bij het nemen van ontwerpbeslissingen.

Het huidige promotieonderzoek richt zich op de uitdaging van het continu gebruik van UX-inzichten bij het maken van ontwerpbeslissingen in networked designprocessen. Het onderzoek wordt gestuurd door de hoofdonderzoeksvraag: wat kunnen ontwerpers doen om te voorkomen dat UX-inzichten verloren gaan in een networked designproces? Het onderzoek zoekt een antwoord op deze hoofdvraag door te exploreren hoe en wanneer UX- inzichten verloren gaan tijdens networked designprojecten, en welke belemmeringen en mogelijkheden er bestaan om een networked designproject een HCD-project te maken.

Het onderzoek bestaat uit twee delen: in het eerste deel wordt een framework van Networked Human-Centred Design ontwikkeld, en in het tweede deel wordt dit framework toegepast in empirisch onderzoek.

Het onderzoek benut een generatieve aanpak; mensen uit de ontwerppraktijk reflecteren op hun werk met behulp van generatieve technieken zoals het

35 De Engelse term ‘networked design’ laat zich lastig vertalen in het Nederlands, daarom is ervoor gekozen in de Nederlandse samenvatting de Engelse term te gebruiken. Dit is ook gedaan voor andere specifieke termen die verder aan de orde komen, zoals ‘boundary’, ‘design tools’, en ‘equip’.

maken van visualisaties. Hoofdstuk 2 beschrijft PSS-ontwikkeling in vier studies uit het PSS101-project. Een project waar mensen uit de praktijk en academici samen kennis over, en methoden en technieken voor, het ontwerpen van een PSS ontwikkelen. Door het uitwisselen van kennis en ervaringen kregen de deelnemers inzicht in welke aspecten van networked design van invloed zijn op het verloren gaan van UX-inzichten.

De volgende inzichten zijn in de studies verkregen:

- Networked design vindt plaats in drie samenwerkende netwerken van design, organisatie, en beleving.
- Networked design is er afhankelijk van dat mensen betrokken raken en blijven.
- Als ontwerpers het gebruik van UX-inzichten door andere ontwerpbeslissers moeten aanmoedigen hebben ze daar (nieuwe) methoden voor nodig.
- De professionals hebben nog geen gedeeld begrip of theorie over networked design die de gevonden inzichten onderbouwt.

Hoofdstuk 3 exploreert theorie over networked design, om bloot te leggen hoe en waar het het gebruik van UX-inzichtenvcontinueert of vastloopt. Literatuuronderzoek in de gebieden van design research, innovatie, en Science Technology & Society (STS) heeft de basis gevormd voor een theoretisch concept van networked design waarin Activity Theory (AT) en 'sociology of translation' zijn samengebracht. In dit nieuwe concept staan de acties centraal: networked design wordt neergezet als het verbinden van acties, in plaats van het verbinden van personen. De terminologie, tools en criteria die actoren in acties gebruiken verschillen per werkveld of 'activiteit'. Elke actie vindt plaats in een zo'n activiteit, of in de overlap van activiteiten. Het werkveld 'design' is een van de activiteiten in networked design. In deze activiteit gebruiken actoren design criteria, design tools, en design-methoden in acties waar product- en service-concepten worden gecreëerd. Actoren uit verschillende activiteiten nemen ook deel aan acties die plaatsvinden buiten een specifieke activiteit. Deze acties worden in het concept 'boundary' acties genoemd. Bijvoorbeeld, in een boundary actie tussen de designactiviteit en een andere activiteit dragen ontwerpers (uit de designactiviteit) concepten en UXinzichten over aan een productmanager (uit een andere activiteit). In een boundary actie kunnen actoren leren hoe zij acties in hun eigen werkveld kunnen aanpassen, bijvoorbeeld het maken van ontwerpbeslissingen. Het leren gebeurt tijdens interacties met tools en actoren uit andere activiteiten. Sociology of translation noemt dit proces 'translatie': ideeën en criteria van een activiteit worden in een toepasbare vorm ingebracht in een andere activiteit. Een bevinding van het huidig onderzoek is dat ontwerpers andere activiteiten kunnen voorzien van de middelen om UX-inzichten te blijven gebruiken bij het nemen van ontwerpbeslissingen. Ontwerpers dragen actief bij aan de vorming van een netwerk van acties waarin ontwerpbeslissingen worden gemaakt op basis van UX-inzichten. De belangrijkste aanpak daarbij

is het inbrengen van artefacten (bijv. productconcepten en UX-inzichten) in interacties met andere actoren. Deze andere actoren brengen deze artefacten binnen de grenzen van hun eigen activiteit, zodat ze deze later als criteria kunnen gebruiken. Echter, Hoofdstuk 2 heeft laten zien dat deze criteria niet gebruikt worden bij latere ontwerpbeslissingen.

In hoofdstuk 4 is het theoretisch concept van networked design toegespitst naar een framework van networked human-centred design (NHCD). Dit framework onderscheidt drie activiteiten: (i) design (het veld van acties waarin concepten van producten en services worden gecreëerd), (ii) organiseren (het veld van acties waarin productie en levering van producten en services worden georganiseerd), en (iii) beleven (het veld van acties waarin gebruik wordt gemaakt van producten en services). Het framework beschrijft een networked designproject als een stel verbonden acties die plaats vinden in, en tussen, deze drie activiteiten. Het framework benadrukt de rol van ontwerpers in NHCD-processen: ontwerpers ondersteunen translaties om een netwerk van acties mogelijk te maken waarin UX-inzichten worden gebruikt om ontwerpbeslissingen te maken. Zo verbreden ze de impact van UX-inzichten voorbij de designactiviteit. In een HCD-project maken ontwerpers UX-inzichten zichtbaar en toepasbaar in acties waar ontwerpbeslissingen worden gemaakt, vooral in de activiteit van organiseren. Het framework beschrijft vier stappen in het ondersteunen van translaties, gebaseerd op de vier fasen van het translatieproces beschreven in de literatuur:

1. **Identificeer**: vaststellen en begrijpen van de acties waar UX-inzichten ingebracht worden om met dat begrip een vorm te creëren die het gebruik van UX-inzichten obligatoir maken.
2. **Trigger**: maak participanten in een ontwerpproces bewust, en moedig ze aan om UX-inzichten te gebruiken wanneer ze ontwerpbeslissingen nemen.
3. **Engageer**: betrek en ondersteun participanten in een ontwerpproces bij het gebruik van UX-inzichten bij het maken van ontwerpbeslissingen.
4. **Implementeer**: help participanten in een ontwerpproces bij het tot een routine maken van het gebruik van UX-inzichten bij ontwerpbeslissingen in hun eigen werkveld.

Het tweede deel van het onderzoek beschrijft een empirische studie naar het NHCD translatieproces. Hiervoor wordt het NHCD framework geoperationaliseerd met een mapping methode om de translatie van UX-inzichten in ontwerpprojecten te onderzoeken. Het ontwikkelde Networked Collaboration Canvas (NCC) helpt participanten in de acht studies bij het uitwisselen van ervaringen in networked designprojecten door van het traject dat UX-inzichten afleggen vast te leggen in een project landschap. Hoofdstuk 5 beschrijft het translatieproces in de geselecteerde ontwerpprojecten en welke methoden en artefacten de translatie ondersteunen.

De studies resulteerden in inzicht hoe ontwerpers een translatieproces kunnen ondersteunen. Dit is uitgewerkt in een overzicht van welke acties, rollen, en artefacten in de HCD-praktijk translaties kunnen ondersteunen. Dit overzicht is samengevat in de volgende hoofdconclusies. Allereerst laat het onderzoek zien dat ontwerpers translaties ondersteunen, in het bijzonder wanneer zij hun ontwerpresultaten communiceren in boundary actions in ontwerpprojecten. Echter, ze ondersteunen niet alle stappen van het translatie proces: vooral de implementeer stap ontbreekt. Daarnaast ondersteunt de mapping methode onderzoekers in de dataverzameling en analyse van bijdragen van ontwerpers om UX-inzichten in leven houden. Maar de deelnemende ontwerpers vonden de vorm van de gebruikte mapping tool en procedures niet erg bruikbaar in hun eigen praktijk.

Het onderzoek draagt bij aan inzicht hoe ontwerpers een proces van translatie ondersteunen via boundary interventies in de ontwerppraktijk. Hoofdstuk 6 beschrijft hoe ontwerpers een translatieproces stap-voor-stap kunnen ondersteunen. Ze ondersteunen dit proces door:

- te identificeren wanneer en hoe interventies te doen (**identificeer)**,
- in deze interventies actoren uit andere werkvelden bewust te maken van human-centred ontwerpbeslissingen (**trigger**),
- en ze te betrekken bij het gebruiken van UX-inzichten bij ontwerpbeslissingen (**engageer**),
- en als laatste stap deze actoren te voorzien van UX-inzichten in een vorm die bruikbaar is om ontwerpbeslissingen te nemen in het eigen werkveld (**equip**).

Met deze stappen nemen de ontwerpers een nieuwe ondersteunende rol op zich: tijdens een ontwerpproject een netwerk te bouwen waardoor ontwerpers en anderen een human-centred besluitvormingsproces gebruiken.

Ook is op basis van observaties in de studies van het gebruik van het NCC een tool voor ontwerpers ontwikkeld: het Networked Design Canvas (NDC) (Bijlage 2). Waar de onderzoeker de NCC heeft gebruikt om te identificeren waar, en welke, translaties gebeuren, kunnen ontwerpers in de praktijk het NDC gebruiken om te identificeren wanneer ontwerpbeslissingen worden gemaakt, en welke interventies geschikt zijn om te zorgen dat daar UX-inzichten benut worden.

De richtlijnen in hoofdstuk 6 zijn opgebouwd uit de drie principes, (1) stel ontwerpbeslissers in staat om UX-inzichten te gebruiken, (2) maak gebruik van projectmeetings voor interventies die ze stap-voor-stap in staat stellen ontwerpbeslissingen te maken, (3) breng een project in kaart om de interventies te plannen.

Meer in detail bevelen de richtlijnen ontwerpers aan om de volgende acties te ondernemen om het ‘enabling’ proces te ondersteunen:

- Ontwerpers stellen ontwerpbeslissers in staat om UX-inzichten te ge-

bruiken door interventies in een ontwerpproject te creëren.

- Ontwerpers nodigen ontwerpbeslissers uit ‘to learn by doing’ in interventies, gebruik makend van project meetings.
- Breng het ontwerpproject in kaart, en **identificeer** wanneer de stappen **trigger**, **engageer**, en **equip** kunnen worden genomen.
- Plan en onderhoud de stappen middels het in kaart gebrachte ontwerpproject. Gebruik de kaart om vast te stellen waar mogelijkheden zijn voor interventies voor elke stap bij het in staat stellen.
- **Trigger**: identificeer samen met ontwerpbeslissers wanneer zij, en hun collega’s, ontwerpbeslissingen maken en wat de consequenties van die beslissingen voor de UX-kwaliteit zijn.
- **Engageer**: deel kennis en ervaring met ontwerpbeslissers door ze te betrekken in hoe ontwerpers UX-inzichten gebruiken bij ontwerpbeslissingen.
- **Equip**: voorzie ontwerpbeslissers van kennis en materialen om wat ze hebben geleerd in de interventies toe te passen in hun eigen werk.

Hoofdstuk 7 beschrijft de conclusies van het onderzoek: UX-inzichten gaan inderdaad verloren wanneer ontwerpers niet langer aanwezig zijn, en omdat ontwerpers anderen niet in staat stellen om het gebruik van UX-inzichten in ontwerpbeslissingen te continueren, met name bij de productie en levering van producten en diensten. In meetings waar actoren uit verschillende werkvelden deelnemen, nemen de ontwerpers stappen om anderen te motiveren om UX-inzichten te gebruiken. Echter, ontwerpers nemen niet alle vier stappen (identificeer, trigger, engageer, equip) die nodig blijken te zijn om anderen in staat te stellen UX-inzichten te gebruiken bij het nemen van ontwerpbeslissingen: ontwerpers vergeten ‘equip’.
Het onderzoek maakt ook duidelijk dat ontwerpers zich niet bewust zijn van de rol die ze kunnen nemen bij het in staat stellen van anderen om UX-inzichten levend te houden; ze zien hun rol als het creëren van producten en services voor de eindgebruiker, (nog) niet als het faciliteren van ontwerpbeslissingen later in het ontwikkelingsproject.

Het NHCD framework draagt bij aan networked design, met name met deze nieuwe rol van ontwerpers. Eerder onderzoek bracht al het belang van nieuwe HCD methoden naar voren. Dit onderzoek leert dat er behoefte is aan methoden om verschillende werkvelden en disciplines te identificeren, en te leren van deze praktijken. Dit wordt des te belangrijker nu ontwerpers worden ingezet om complexe socio-technische problemen aan te pakken. Het huidig onderzoek identificeert en ondersteunt de rol die ontwerpers kunnen nemen naast hun rol als probleemoplosser. Het draagt bij met inzichten over de specifieke rol van ontwerpers als ondersteuners van ontwerpbeslissers in PSS development, en kan daarmee een waardevolle aanvulling zijn op HCD methoden die innovatie ondersteunen in een nieuwe en toekomstige ontwerppraktijk.

De richtlijnen en NDC ondersteunen de ontwerppraktijk bij het opnemen van deze nieuwe rol: ontwerpbeslissers in staat stellen een networked human-centred designproces te continueren wanneer ontwerpers niet aanwezig zijn.

Voordat er bewustzijn wordt gecreëerd over de nieuwe rol van ontwerpers, en voordat de richtlijnen en NDC naar de ontwerppraktijk worden gebracht, is aanvullend onderzoek gewenst. Reflectie op de onderzoekaanpak laat onzekerheid zien over de kwaliteit van het onderzoek. Met name beperkingen in de validatie van de mapping methode is een overweging om extra studies te doen. Vervolgonderzoek kan meer helderheid bieden en het lange-termijn effect van de voorgestelde boundary interventies valideren. Ook kan er verkend worden welke artefacten die interventies het beste ondersteunen.

De in het onderzoek gevonden nieuwe rol van ontwerpers kan voor het ontwerponderwijs betekenen dat ontwerpers worden voorbereid op deze faciliterende rol zoals ook gebeurd is bij het faciliteren van gebruikersparticipatie in design research. Door kleine aanpassingen in het ontwerponderwijs te doen, zoals het onderwijzen van vaardigheden om ontwerpbeslissers in andere activiteiten dan de design activiteit te ondersteunen om UX-inzichten te gebruiken bij maken van ontwerpbeslissingen, wordt de nieuwe generatie ontwerpers voorbereid op hun rol in networked human-centred design.

Publications about the research

Henze, L.A.R. & Mulder, I.J. (2014), Networked collaboration canvas: How can service design facilitate networked collaboration? In Sangiorgi, D., Hands, D. & Murphy, E. (eds.) *ServDes.2014 Service future, Proceedings of the fourth service design and service innovation conference (*pp. 451-453). Linköping: Linköping University Electronic Press.

Henze, L. A. R., Mulder, I.J., Stappers, P.J. (2013). *Understanding Networked Collaboration: Fields and Patches of Interactions*. Proceedings of the IEEE International Technology Management Conference & 19th ICE Conference, The Hague (The Netherlands), June 24-26, (pp 1-8)

Henze, L.A.R., Mulder, IJ., Stappers, PJ. & Rezaei, B. (2012). *Right service and service right: How collaborating heterogeneous networks at the front end of service development benefit the process to get the service right*. Linkoping Electronic conference proceedings (67) of the Third Nordic conference on service design and service innovation. s.n. (ed) (pp. 1-10.), Linkoping University Electronic Press.

Henze, L., Mulder, I., & Stappers, P. J. (2011). *Conceptualizing Product Service Networks: Towards an Initial Framework*. In K. Thoben, V.Stich, & A. Imtiaz (Eds.), Proceedings of the 17th International Conference on Concurrent Enterprising: ICE 2011, (pp. 157-165).

About the author

During her study Industrial Design Engineering (1980-1986), Lilian Henze focused on the design of products that fit people's needs. Her graduation project was on developing a new generation of mobility aids for disabled children. The project resulted in the vision that products for disabled children should focus on abilities of the children and be playful to fit both functional and emotional needs of children. Building on this vision she identified solution spaces for aids for children in different stages of their (motor, cognitive, and emotional) development. A prototype of a toy that provides mobility when playing at floor level was built meeting functional requirements for children with cerebral palsy. This project was one of the first projects of the Bio-project, a collaboration between a Dutch centre for children's rehabilitation and the Faculty of Industrial Design Engineering. In the approximately twenty graduation projects that followed, Lilian's vision was further developed.

Lilian's graduation project was the starting point for a career in human-centred design. In 1987 she started working at the design department of a rehabilitation centre in Amsterdam, focusing on research, and development of requirements, of aids for disabled. Over the years the focus broadened to facilitating designers of consumer and professional products with usability testing. In 1995 she co-founded P5 consultants, professionals in human-centred design. Up to now Lilian further evolved methods and tools for improving human-centred design together with her partners at P5.

In the period 1995-2004 she was actively involved in Dutch and European foundations on inclusive design (Dutch Platform Design for All, board member; European Institute for Design and Disability, board member; European Design for Ageing Network, founding member).

Eager to share knowledge on user research, Lilian tutored students at Design Academy Eindhoven (1997-2000) and the Faculty of Industrial Design Engineering (1997-2018).

Acknowledgements

After years of doing user research in a broad variety of design projects, I had a desire to do a research project without the obvious restrictions that exist when participating in commercial design projects. I wanted to immerse myself in scientific research to broaden my horizon and stretch the limits of my research capacity. My aim was to deepen my knowledge on human-centred design and broaden my expertise as a human-centred design professional.

Finally, I did it with the support of many people:

Pieter Jan, you welcomed me with open arms in the 'scientific world' and offered me the opportunity to participate in the 'usability by design' project to test my scientific research capabilities. Guido, through this project you involved me in your PhD research. Thank you, Pieter Jan and Guido for involving me. This involvement provided me with the necessary drive and confidence to start my own research.

Pieter Jan and Ingrid, thank you for inviting me to be the leading researcher in the PSS101 project. I was not sure if I was the right person for this project, and if I wanted to do a PhD research. But you convinced me to start this project with you two as my supervisors. That it would take me over ten years to finish the research was something you did not had in mind, and neither had I. Nevertheless, you both stayed with me and kept on supporting me. A big thank you!

Doing the research had not been possible without the PSS101 team. Thank you, Ingrid, Pieter Jan, Yao-Hua, Bas & Marie, Monique & Toon & Gerard, Toine, KlaasJan, Behzad, and Karianne & Bas for discussing networked design with me in the many meetings and workshops in the five years we worked together in the project. Also, designers and their colleagues (who did not participate in the PSS101 project) participated in case studies where we together mapped design projects. Thank you Roelof & Jeroen and Stephan & Jeroen & Clemence for sharing your experiences with me.

The projects we did at P5 provided me with experiences in research and the practice of design that both turned out to be an enabler and a barrier in the research. Roel, thank you for supporting me in combining the research with our work at P5. I am so pleased to have you as my paranymph together with Ineke, dear 'academic' member of my family.

During the research so many people supported me that it is a challenge to thank you all on this page. So, even if I did not explicitly mentioned your name, you are in my mind and I thank you.

Drie dames hebben reeds geanticipeerd op het niet volledig kunnen zijn in alle bedankjes en hebben mij op het hart gedrukt hen vooral niet over te slaan: Annelies, Karin en Miriam, dank voor de broodnodige ontspanning (en inspanning) op de Amstel en jullie geduld met mij tijdens de jaren van onderzoek.

Hans, je wilt eigenlijk niet genoemd worden maar deze keer ga ik tegen jouw wens in. Hoe kan ik zoveel mensen bedanken en dan mijn belangrijkste steun overslaan? DANK!

Appendix 1: CRISP PSS101 project & P5 consultants

The real-life design situations in this thesis research are grounded in the CRISP PSS 101 research project and experiences in design projects at P5 consultants. This appendix provides more elaborate information on the contexts of these projects: CRISP PSS101 and P5 consultants.

CRISP PSS101 project

The PSS101 project was one of the eight projects in the Creative Industry Scientific Programme (CRISP), a scientific research programme tailored to the Dutch creative industry. In the four years of CRISP (2011 - 2015) a consortium of industry, academics and creative professional addressed the following central research question:
'*How can we effectively and efficiently design successful Product Service Systems that provide a holistic and fulfilling user experience and provide strong economic and societal benefits?*'

Of eight projects, four of the projects were designed to deliver knowledge, tools and methods on PSS development. These projects were seen as fundamental projects, where the other four projects were designated as testbed projects.

The PSS101 project was one of the fundamental projects, and derived the name of the project from the use of '101' as a term to indicate an introduction to a body of knowledge. PSS101 aimed at '*developing a framework of tools, techniques and methods that improves conceptualization and communication between all those involved in designing PSS, across industries.'* The PSS101 research project started from a human-centred design perspective, acknowledging that the future of PSS design would lie in an emerging focus on the end-user guiding communication and collaboration among different parties during a PSS development process. Figure A1.1 shows the model describing this future collaboration emerging from past and contemporary models where collaboration with clients changed from one-to-one relations between provider and client to limited connections of specific provider's silos with specific clients. The model describes a network of providers linked to a network of clients, with during innovation a link of a temporary network of creative companies to both clients' and providers' networks.

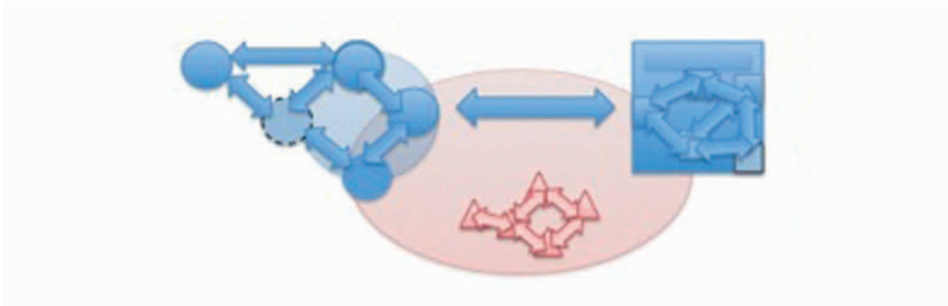


Figure A1.1: Network of provider (visualised by blue network on the right) tied to a network of clients (blue network on the left) with during an innovation process a temporary network of creative companies involved (pink network in the middle)

Expected outcome of the project was a methodology of (i) understanding the needs, values, and ambitions of end-users in their networks; (ii) formulating a shared vision for a PSS proposition to fit and fill those needs, goals and motives, and (iii) developing and evaluating that vision iteratively into a context-driven PSS concept. Next to that it would (iv) provide a guideline for developing roadmaps for companies to implement such services.

The project team included academic and industrial professionals from various disciplinary backgrounds among others such as industrial design, change management, software and service engineering, human-centred design, organisational development, business strategy, product development and service design and about 15-25 years of project experiences regarding product-service systems and/or networked collaboration.

All participants were involved in all activities throughout the project enabling multidisciplinary discussions and enabling them (we expected) to look beyond traditional paradigms. The 4-year-project distinguished 3 phases: 1) exploration, 2) design and evaluation, and 3) consolidation (see Figure I.I). The first phase consisted of a historical review and a first formulation of a conceptual framework. Completed case experiences of all parties are collected and analysed leading to a first framework for conceptualisation and implementation of PSS.
This framework guided the second phase: iterative design and evaluation in case studies. In this phase, the initial framework, tools and methods were iteratively developed. It was planned to conduct three case studies in complementary fields with the industrial partners. Each case focusing on developing PSS involving a PSS providing company (industrial partner) and a network of its users (SMEs, departments, citisens/consumers). Researchers and designers from both Delft University of Technology and the Design Academy Eindhoven designed tools and techniques to support the exploration, conceptualisation, and implementation process. During each case, several iterations were made of design and evaluation, leading to improvements in the PSS concept, improvements in the PSS design method, and improvements

to the theoretical framework and tools. In several events throughout this phase, the evolving framework was shared with international academic and Dutch creative industry communities, and in design education. This also was a two-way process, serving dissemination and recalibration of the framework to optimally serve the needs of these audiences. After the case studies, in the third phase all findings were combined and consolidated.

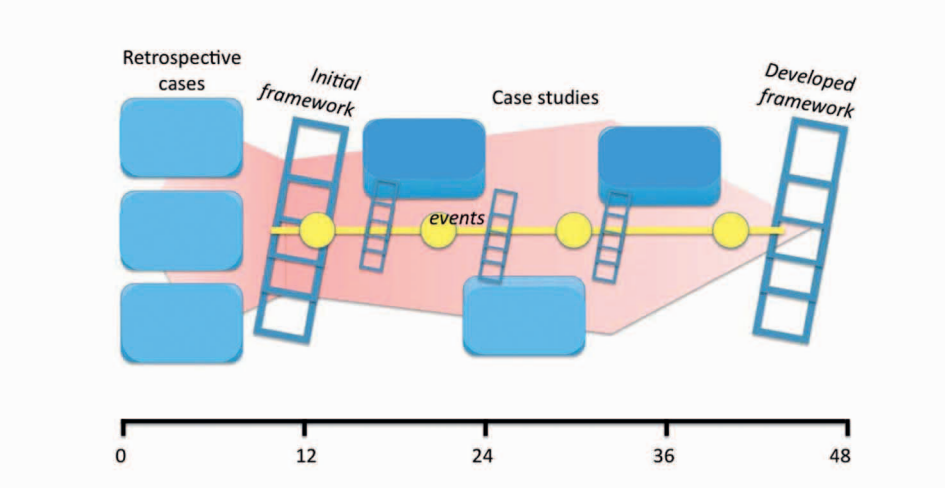


Figure A1.2: 3 phases of the PSS101 project, in phase 1 retrospective cases and initial framework, in phase 2 case studies and in phase 3 consolidation into a developed framework. iterative process of evolving the framework during case studies. The arrow in the background visualises the

The PSS101 project finally resulted in:

- Framework of Networked Human-Centred Design, and the Networked Design Canvas tool (this thesis),
- Tools for Proximity, a toolkit consisting of a 3D tool (Value Network Mapping Tool), and 2D tools (Value Canvas, Innovation Mindsets, Social Innovation Process, The Iceberg) and guidelines helping designers to make sense in the boardroom (Leurs, 2014),
- Value Pursuit, a tool (Value Pursuit board, game board and playing pieces) and workshop guidelines for clarifying how stakeholders in a specific PSS can be of value to one and other (Rygh, 2013),
- Super Maker (Rygh, 2015), investigating how creative industries can contribute to determining new applications and markets for innovative technology through the development of a *Super Maker* co creation workshop methodology following thinking-through-making (case: new applications of elevated printing technology in the field of architecture).

CRISP was funded by Dutch Government FES funding and the consortium of scientific, industrial, and creative partners, supported by the Dutch Ministry of Education, Culture and Science.

References CRISP PSS101
Henze, L., Mulder, I., & Stappers, P.J. (2011). *Conceptualizing Product Service Networks: Towards an Initial Framework*. In K. Thoben, V.Stich, & A. Imtiaz (Eds.), Proceedings of the 17th International Conference on Concurrent Enterprising: ICE 2011 (pp. 157-165).

Leurs, B., (2014). *Tools for Proximity, helping designers to make sense in the boardroom*. MSc thesis, Delft University of Technology, Faculty of Industrial Design Engineering.

Rygh, K. (Ed) (2013) Value Pursuit. Eindhoven: The Design Academy. ISBN 978-94-91400-19-3

Rygh. K. (Ed) (2015) Super-Maker. Eindhoven: The Design Academy. ISBN 978-94-91400-20-9

Van Erp, J., De Lille, C., & Vervloed, J. (eds) (2013). *Crsip#1: Don't you design chairs any more*. Retrieved from: www.crsiprepository.nl

Van Erp, J., De Lille, C., & Vervloed, J. (eds) (2015). *Crsip#5: This is CRISP*. Retrieved from: www.crsiprepository.nl

P5 consultants, professionals in human-centred design

P5 consultants is a consultancy founded in 1995 as a follow up of a design & research department at a rehabilitation centre. The P5 founders worked at this research department doing research on reliability, functionality, and usability of a broad range of products for users with specific needs. Products they addressed were for example mobility products for paraplegic users, products for blind and deaf users, and household products for rheumatic users. Most research resulted in guidelines and directives for designers and suppliers of these products.

The name P5 originates in the philosophy that when taking the extremes of human characteristics into account (less than the fifth percentile, or P5, and more than the ninety-fifth percentile, or P95, in a normal distribution of human characteristics) more users will be included than when taking an average (P50) user into account.
With the experience and knowledge on usability research on products for disabled, together with the P5 team's background in Industrial Design and Human Factors, P5 started off with usability research projects and creation of guidelines, with an emphasis on design for an as broad possible range of users.

P5 supported design projects for a broad variety of clients, e.g., Bugaboo

(strollers), Stokke (baby carrier, strollers), KPN (Packaging for internet hardware), Honeywell (thermostats), DECS (coffee machines), Steelcase (chairs, storage), City of Amsterdam (parking meters), Heineken (draught beer systems).

In most projects P5 consultants work in close collaboration with design teams, in all phases of design projects, with a focus on actionable research results through appropriate communication.

Research at P5 has always been based on academic research, and is best described as applied research with a clear understanding of the client's budget and time restrictions. Consequently, the consultants participate in academic research (as in this thesis) and conferences to keep informed on latest insights in related practices of design, user research, UX research, human factors, and market research (e.g., Henze & Kahmann, 1999, 2003). Also, P5 consultants have been lecturing and tutoring at industrial design departments at Delft University of Technology, Design Academy Eindhoven, and The Hague University of Applied Sciences to share knowledge on human-centred design.

References P5

P5 website, https://www.p5consultants.com

Henze, L., & Kahmann, R. (1999). Usability testing under time-pressure in design practice. In W. Green & P. Jordan (Eds), *Human Factors in Product Design: Current Practice and Future Trends.* (pp. 113-123). London: Taylor & Francis.

Henze, L., & Kahmann, R. (2003). Communicating product experience. In McDonagh, D., Hekkert, P., Van Erp, J., & Gyi, D. (eds) *Design and Emotion, Episode III: The Experience of Everyday Things* (pp. 109-113). London: Taylor and Francis.

Appendix 2: Networked Design Canvas

The Networked Design Canvas (NDC) is a tool to plan and create interventions in design projects that enable decision makers to continue making design decisions after designers left the project. The tool is especially supportive to create interventions in design projects where many different disciplines and different organisations are involved, as in e.g., designing for product service systems. In these projects many people make design decisions without the involvement of a designer. Through interventions during design projects, designers can equip these design decision makers with knowledge and tools that enable them to continue making design decisions that lead to products and services as envisioned by the designer.

The tool is developed particularly for human-centred design projects, where UX insights are used to decide on specifications of products and services. Human-centred design decision makers consider how their decisions could influence how users will experience the products and services. The NDC supports understanding and planning of decision making in design projects. With the tool designers can map a design project as the context of making design decisions. This context supports creating solutions that equip people to continue using UX insights when they decide on specifications of products and services.

The rationale of the NDC is that interventions to support people to change, or adapt, their way of working, best happens in meetings with people from other fields of working, or activities. By interacting with people from different fields of work, and interacting with methods and tools from different fields, people become aware of different ways of working, learn how they can do this, and how they can apply this in their own working field. The NDC visualises a design project as connected actions in a design project. Thinking in actions, and interactions between roles and artefacts in these actions, help to distinguish fields of work, and when and where people of different fields of work meet, and identify these meetings as opportunities for interventions[36]. Designers create interventions where designers and design decision makers exchange knowledge, skills, and tools for using UX insights in design decision making. These interventions enable others to continue using UX insights in their field of work. Enabling is a step-by-step process where you invite design decision makers, not working in the field of design, to learn by doing. With the NDC you plan and maintain the enabling process.

36 Another advantage of thinking in actions and roles is that changes in staff do not influence identification of opportunities for interventions.

This tool accompanies guidelines for enabling continuation of design decision making, in summary these guidelines are:

- Enable step-by-step by inviting design decision makers to learn by doing: first make them aware of the design decisions they make, and motivate them to use UX insights. Then, engage them in how you as designers use UX insights when you make design decisions. Finally, equip them with knowledge and materials that support them to apply what they have learned.
- Create interventions that fit project meetings: make use of moments in design projects where you come together with people from other fields of work to discuss the different aspects of the design project as e.g., planning, deciding on requirements, co-creating solutions, preparing final technical and consumer tests. Fit the interventions to the participants and aim of these meetings.
- Map the project to understand the context of design decision making and find opportunities for interventions that trigger, engage, and equip. A map of the design project visualises what activities (or fields of work) are involved in the project, what roles are involved in these activities, and what actions (or meetings) take place in the project.

The NDC tool supports mapping the project, and consists of templates that guide the creation of a timeline of a design project, mapping a project on a canvas, and creating a journal of interventions in design projects. The timeline and canvas are tools to create the project map that supports planning of interventions. The journal provides building a repository of interventions you can use again in the project or future projects. The next section describes these templates and instructs how to use the templates.

NDC templates and instructions

Applying the NDC takes four steps: creating a timeline, create a map by filling in the NDC canvas, creating a journal, or travelogue[37], and maintaining the canvas and travelogue (Figure A2-1). For each step the NDC provides materials, in the form of templates that can be adapted to the user's preferences, and instructions to take full advantage of the NDC.

37 The travelogue describes what happens in the different actions in a design project. It is a tool for making the journal of interventions and is named 'travelogue' referring to films and books about places visited and experiences of a traveller.

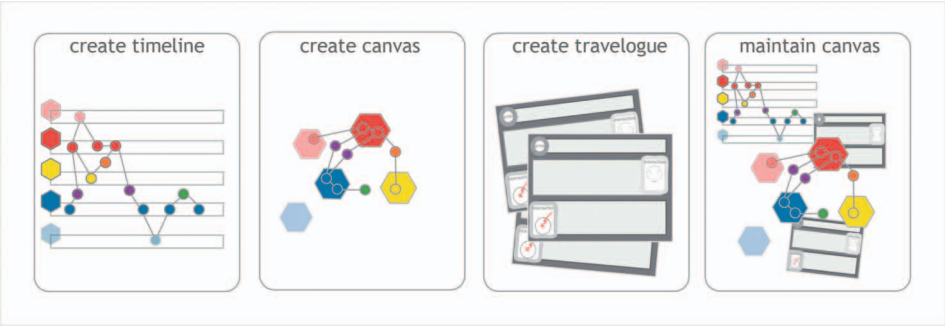
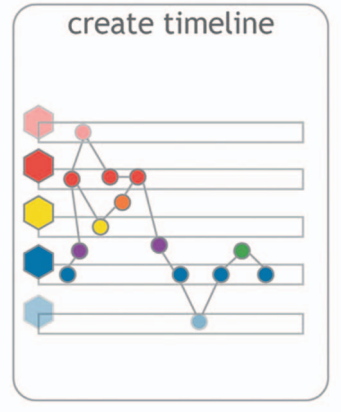


Figure A2-1: NDC's four steps and materials provided for each step. Materials to create a timeline, create a canvas, create a travelogue and finally maintain the created canvas and travelogue.

With the creation of a timeline you get an overview of what fields of work, or activities, are involved in your design project and what actions take place in and in between these activities. For interventions, the actions that take place in between activities, where people from different fields of work participate, are particularly valuable. The NDC calls these actions boundary actions.



In this first step, you make a planning of the design project in the form of a list of actions in a timeline. Do this in concert with first planning of what and when you deliver in the project. Examples of actions in a design project are: briefing and planning meetings, exploring user needs, meetings to decide on requirements and specifications, create concepts, prototyping, meetings to discuss concepts, etcetera.

Materials to create a timeline are (Figure A2.2):

- *Post-its*, to make a quick chronological overview of all (expected) actions in the project.
- *Activity* templates, to make a first rough description of relevant activities, or fields of work, involved in the project.
- *Timeline* template, to create an overview of all actions in the context they happen.
- *Action* template, to code actions as part of a specific activity or specific boundary action.
- *Role* template, to code roles that take part in specific actions.

- *Artefact* template, to code artefacts or materials that are used in specific actions.

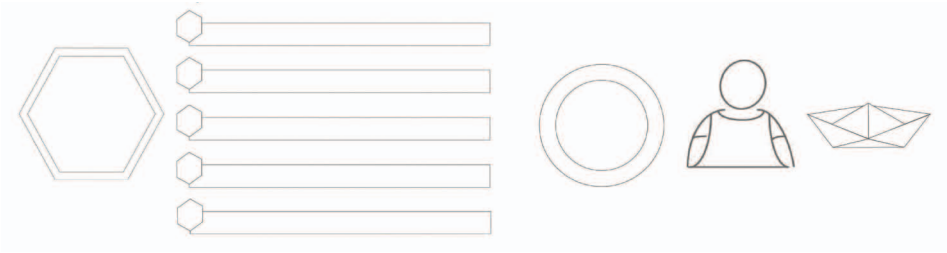


Figure A2-2: templates for creating timelines, left to right: activity, timeline, action, role, and artefact.

Instructions how to create a timeline

Start with listing actions in the design project on post-its and put them in order of (expected) 'happening'.

Recommendation:

> Make an overview of moments in the project where people in the project discuss and make design decisions. For each meeting, indicate the goals, outcomes, and the roles, responsibilities, and tasks of the participants. Include actions where design decision makers make design decisions. Think ahead and include actions as installation, or first releases, or software updates.

Use this list of actions to get an overview of all roles involved in the project. What works well is to print the *role* and *artefacts* templates on labels, and use these to make a first draft of what roles and artefacts are involved in what actions.

Then identify activities, or working fields, involved in the specific project. Describe activities by the objectives, actions, and roles in the activity. The *Activity* and *Role* templates support the description of the activities. Use colour to distinguish activities and roles, in the tool the following colours are suggested: red for design, blue for organisation, and yellow for experience.

Bring all actions together on a time-line, with swim lanes for the different activities with actions coded by colour and place as being an action in specific activity or as a boundary action. For boundary actions the NDC suggests to mix the colours of the roles involved in the boundary action. E.g., when designers and organisers are involved the colour is a mix of red and bleu: purple.

Recommendation:

Prepare a timeline session carefully by prefilling in activity fields and the timeline. A prefilled in timeline supports participants of the session, who are not familiar with the NDC tool, to actively co-creation of the project's timeline and trajectory. A prefilled in timeline also reduces the length of the session. Trigger participants to gather information before the session and bring this in during the session.

Introduce the timeline and what you have prefilled-in to the participants before reflecting on what you have prepared. Explain what participants can do during the session to add comments and new input on activities and actions. In practice one or two participants will take the lead to write down what is brought in and add actions to the timeline spontaneously. If this does not happen take the role of moderator and start creating while inviting others to help you.

Recommendation:

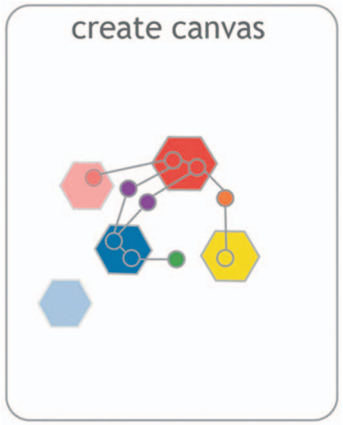
In order to get as much accurate information as possible on roles, artefacts and interactions invite participants with experience in different activities in design projects. Invite no more than eight participants, including yourself, for a timeline session. More participants will make it difficult for participants to actively co-create during the session. A good opportunity for the timeline session would be in combination of project planning discussions with the design team. A timeline could serve as an addition to existing project management and planning tools.

Recommendation:

For the timeline session a big table or wall, where all participants can stand around the prefilled in timeline, supports interaction with all materials and co-creating the timeline together. Have all material and information accessible on the table for describing activities and actions to support participants to adjust and complete the timeline.

After the timeline has been created assure solid documentation of the timeline. If possible, make the timeline interactive to add changes along the project. When adding changes make sure these changes can be recognised as later additions. This is necessary to prevent extra work and you only add changes in the trajectory and travelogue, you made based on the first timeline, instead of rewriting them.

In some projects, separate timelines for specific subprojects are necessary to prevent a too elaborate timeline. However, these separate timelines will together form one trajectory that visualises main actions and the path UX insights follow when traveling from one action into another.



With the time-line the canvas can be filled in. For this purpose, actions from the time-line are selected where UX insights are/will be brought in.

Materials to create a canvas are (figure A2.3):

- *Canvas* template, to create the project with the basic activities of design (red), experience (yellow), and organisation (blue).
- *Activity* templates, to add activities on the canvas if needed.
- *Action* template, to add actions on the canvas.

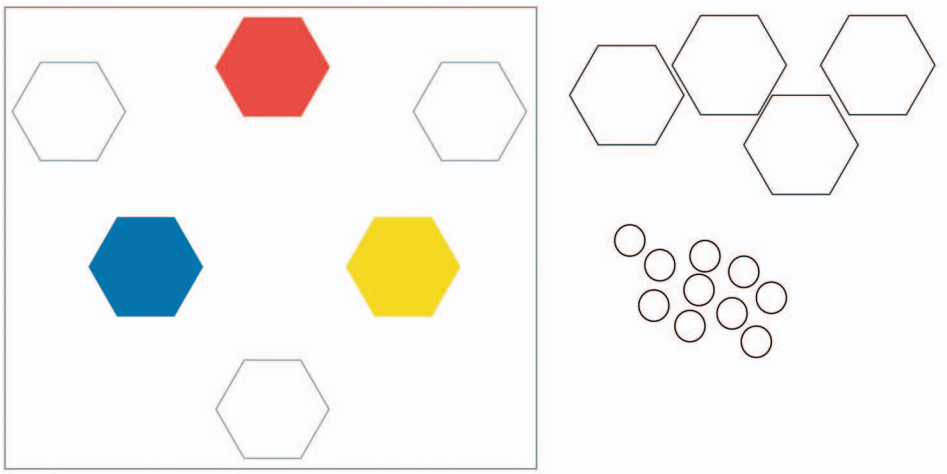


Figure A2-3: templates for creating the canvas, left to right: canvas with activities, templates for activities (hexagons) and actions (circles).

Instructions how to create a canvas

Select actions from the timeline, from all phases of the project, where you project doing interventions for enabling.

Next to actions where you expect to exchange knowledge and skills with design decision makers, include actions where you expect designers to enable designers,

and design decision makers enable design decision makers.

Recommendation:

Make the canvas digital, this makes it possible to add links between actions and supportive documentation. Put the canvas on a private space you already use to exchange deliverables with your team and client.

You describe the actions on the canvas further in a travelogue, providing an accurate journal of what happens in actions, and interventions in these actions.

Materials to create a travelogue (figure A2-4) :

- *Card* template with fields to briefly describe an action, to identify the type of action, and to describe interactions and (potential) interventions.

Figure A2-4: template of a travelogue card for creating a travelogue.

Instructions how to create a travelogue

Fill a card for each action on the canvas, the aim of the meeting, who participates, and the materials used.

Describe (potential) interventions in the action by its aim and what materials and knowledge you provide to the participants. Also, fill in where you archive protocols of interventions and materials. Figure A 2-5 shows an example of a filled in card.

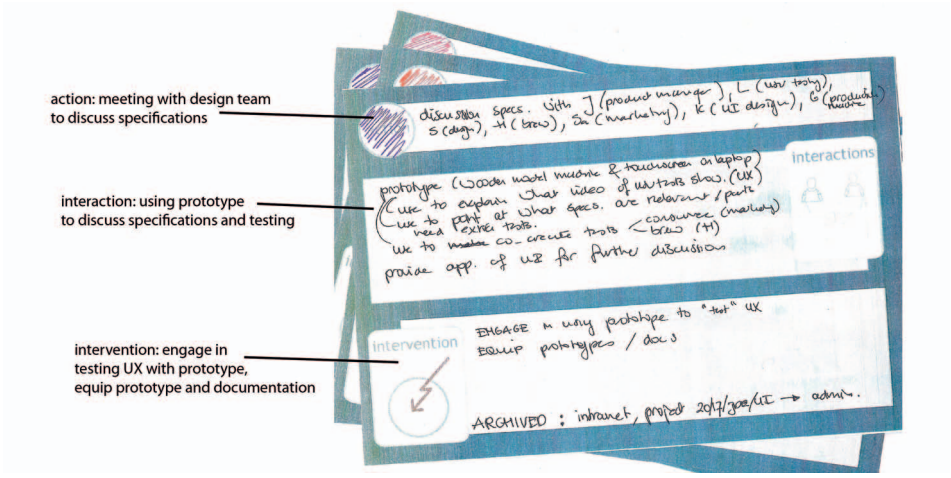
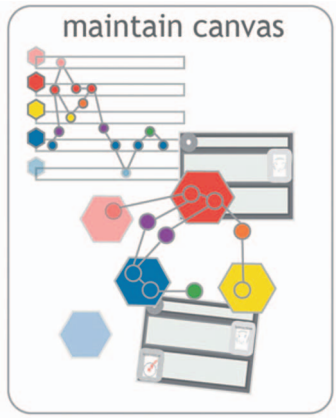


Figure A2-5: example of a filled in travelogue card.

Recommendation:

> Keep a journal of what actions you plan and do in the project on printed travelogue cards, and bundle these cards. You can use this bundle to specify work for evaluation, planning, and quotation purposes.



Use the canvas and travelogue for the fourth step: maintaining the canvas and travelogue.

During the project changes will occur that influence the planning and interventions. E.g., new insights or staff changes lead to extra actions in the project. After the project you can use the canvas and travelogue as a repository that support you and your colleagues in future projects. For your client the canvas and (part of) the travelogue serve as a tool to enable using UX insights in making design-decisions. You equip design decision makers to recall and apply what they have learned and transfer this to their colleagues.

Recommendation:

Store the canvas and travelogue visible in a place where it invites to update when new insights and/or actions emerge. This can be digital or as a print. Regularly checks and updates keep the canvas alive to keeping UX insights alive. The canvas could also be reused when a new project starts. Canvasses from earlier projects can help to build a repository of key actions and artefacts that directly, or with slight adaptions, can be used in the new project.