Design for Well-Being

An Approach for Understanding Users' Lives in Design for Development

Mink, Annemarie

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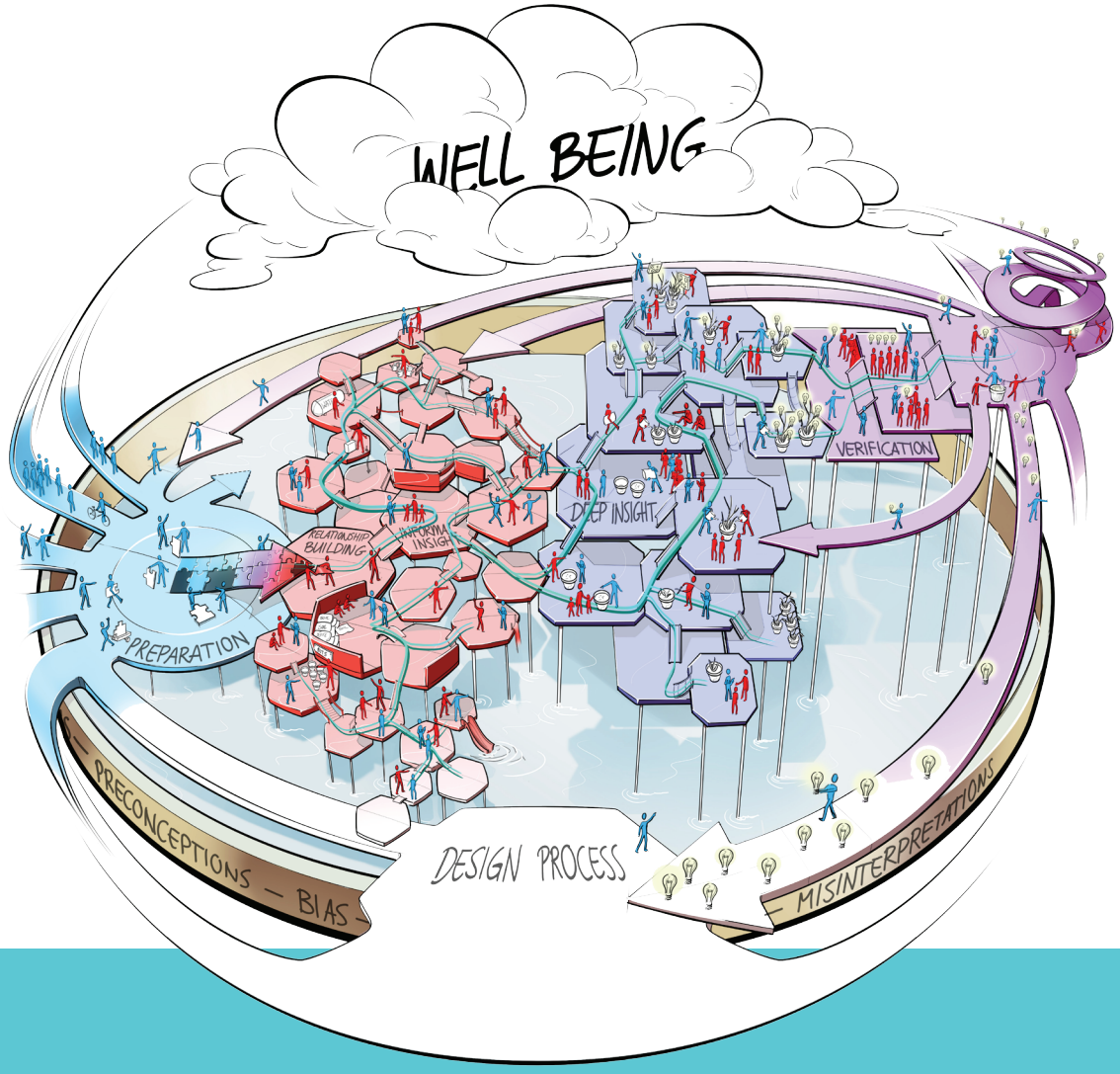

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Design for Well-Being

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Annemarie MINK

Ingenieur Industrieel Ontwerpen
Technische Universiteit Delft, Nederland
geboren te Zijpe, Nederland

This dissertation has been approved by the
promotor: Prof.dr. P.V. Kandachar
co-promotor: Dr. ir. J.C. Diehl

Composition of the doctoral committee

Rector Magnificus	Chairman
Prof.dr. P.V. Kandachar	Delft University of Technology, promotor
Dr. ir. J.C. Diehl	Delft University of Technology, co-promotor

Independent members

Prof. dr. ir. I.R. van de Poel	Delft University of Technology
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To my parents & to Tom

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PREFACE

In 2004 I travelled outside of Europe for the first time for a four-month internship with PRADAN in Deoghar, Jharkhand, India. My assignment was to re-design a Tasar silk reeling machine, which eventually took me 3 years of which half I spent in the field. For me, this was a life changing experience. The significantly different culture changed my ideas and views of the world. I travelled to India with the perception of using my expertise to do something good for a 'developing country'. This turned out to be nowhere near the truth. The reason that PRADAN had asked a Dutch University to help out in the re-design of a silk reeling machine was not that there were no Indian people educated or skilled enough to do so. It was merely that not many were interested in an assignment with a low-profit margin and small-scale production. During my stay in Deoghar and my regular visits to villages in Jharkhand and Bihar I got to know the people living there as being very open, sharing, interested and helpful. People invited me into their homes, gave me food, and provided me an insight in their daily lives without expecting anything in return. They gave me jewellery, as they assumed I could only be very poor as I was not wearing any. When I was suffering from a tooth infection and the prescribed antibiotics did not help, my neighbours gave me guava leaves to chew on instead and the unexpected happened: within three days the infection had entirely disappeared. I started to realise that one culture is not better than another, that culture, practices, values and beliefs are just different – and that we can learn from each other.

When I started this PhD project, I was very much aware that I was beginning to explore a very broad and complex topic. I knew that I would not be able to answer all questions that would arise during this research project. However, I was motivated to find a way for product designers to learn to comprehensively understand a radically different culture in a time span much shorter than the time I had been able to spent on my design project. I knew that my research would involve a transdisciplinary exploration combining a wide range of knowledge domains from development to philosophy, social and technical sciences, ethics, and the interdisciplinary field of design. I knew I would face many unanswered and not-yet-answerable questions from the associated disciplines and directions. I started with the idea of contributing some knowledge to the field of 'Design for Development' while the entire development enterprise has increasingly been the object of much criticism and rebuttals. Development, as used in this thesis, does not mean imposing a western mind-set to the world, but starting a process of mutual sharing and learning towards improved well-being of people, all people – within the limits of growth. The work presented in this thesis is hopefully a small step towards design for such type of development.

SUMMARY

Design for Development (DfD) projects aim to improve the well-being of marginalised and disadvantaged populations. Despite the objectives of DfD and the designers' best intentions, the outcomes can still fail to improve the well-being of their users. This is often the case when designers do not understand the users' context and their valued beings and doings. Obtaining a comprehensive understanding of the potential users is relevant in many design projects, but especially in DfD, as the lives of most product designers differ substantially from those of the marginalised and disadvantaged. It is therefore important for designers to be aware of their biases and assumptions regarding valued beings and doings of these users.

From the 1950s onwards, the user has increasingly been involved in the product design process. The domain of Human-Centred Design (HCD) has grown, integrating knowledge from different domains of social science. It is generally acknowledged that including the user perspective results in better accessibility, applicability, acceptance and adoption of the designed product and / or service. Furthermore, it generates design requirements, results in less frustration during decision-making, and reduces the number of design iterations. However, when involving users during the design process, product designers often limit their focus towards the product-user interaction. This is mainly due to a lack of time and other resources needed to obtain a comprehensive understanding of users' lives, lifestyle, behaviour, values, habits, needs, desires and aspirations. Existing toolkits and manuals do not specify which information or insight should be collected in order to obtain such a comprehensive understanding of users' valued beings and doings. They leave it up to the designer to think about the type of information and the insights to be collected for each project. Moreover, the design manuals and toolkits provide a method database, but no procedure to follow, and existing ethnographic approaches are not specifically tailored to the needs of designers who are often not trained to conduct ethnographic research.

The aim of this research project was, therefore, to develop a designer-friendly approach to efficiently guide product designers when comprehensively exploring the lives of potential users in DfD projects. The ultimate goal is to contribute to the design of products and services that improve the well-being of their users by addressing the valued beings and doings of these users. To develop a systemic approach to obtain comprehensive insights in people's well-being, analytic guidance was derived from Sen's 'Capability Approach' (CA). By taking people's personal characteristics and their circumstances into account, the CA provides a holistic view of well-being, making it a promising approach for use when for guiding comprehensive user context research.

The main research questions were:

1. *Which analytic guidance does the Capability Approach offer designers to understand people's well-being?*
2. *Which designer-friendly methods are available to efficiently explore people's well-being to inform Design for Development?*
3. *How can the analytic and practical guidance be integrated in a systemic approach to understand people's well-being in Design for Development projects?*

When developing the systemic approach, the intention was to base its contents on the CA and its procedures on design and rapid ethnographic practice. To answer the research questions, a Design-Based Research approach was applied, consisting of four stages: 1) preliminary research; 2) development of an intervention; 3) evaluation of the intervention; and 4) reflection. The research outcomes are practical and implementable: a thinking framework, a step-by-step procedure, guidelines, methods, techniques, tools, and a manual for product designers in order to improve the practice of user context exploration in DfD projects, as well as theoretical: design principles for product designers to advance theoretical knowledge towards conducting comprehensive field research beyond product-user interaction in a designer-friendly and effective manner.

Stage 1: Preliminary research

The outcomes of the preliminary research are described in chapters 1 to 4. In chapter 1 the need for the research is explained. From experiences in the field and from coaching design students it became clear that there is a need for methods that support designers to rapidly gain comprehensive user insight; this was confirmed by an exploratory literature study. In chapter 1 this study is summarized and the scope of the research and the research questions are presented.

After this initial exploration, in chapter 2 the results of two in-depth literature studies are presented, which were executed to explore which analytic guidance the CA can offer product designers. First, the domain of product design is investigated in relation to the goals of the study. Within the domain of HCD, specifically User-Centred Design (UCD) focuses on involving the potential user in the beginning of the design process as a subject of inquiry. Then, DfD literature provides insights about the specific circumstances and design opportunities for the marginalised and disadvantaged, and the domain of 'Rapid Ethnography' (RE) is a source of inspiration for product designers to efficiently explore the user context. Second, the CA domain was explored in detail: its background, development and characteristics are presented, as well as its influence on the domain of 'Development'. The connection between the product design domains and the CA was made, and their synergy visualised in a CA-based thinking framework. To investigate the potential of this thinking framework and further explore this synergy, chapter 2 concludes with an in-depth review of an executed DfD project, from a CA perspective. This perspective led to new insights in the

context, and the valued beings and doings of the users, demonstrating the relevance of using the CA as an inspirational source for the development of the systemic design approach. The investigation of the UCD, DfD, RE and CA domains resulted in an approach route which shows the connections between the domains, how they can be brought together and how they can supplement each other. The CA-based thinking framework and the approach route provide the answer to research question 1.

In chapter 2 the backgrounds and characteristics of the domains of UCD, DfD, RE and CA have been explored in detail. In chapter 3, four literature studies towards both the scientific and practical literature are presented, which were conducted to explore the operationalisation possibilities of the CA-based thinking framework. First, the practical application possibilities of the CA are reviewed. It became apparent that the CA can be applied in practice, but that it has not yet been specifically applied to obtain comprehensive user insights in the domain of product design. Several obstacles were detected which challenge the practical application of the CA, and several learnings were identified for its successful operationalisation. Second, three literature studies were executed towards the domains of DfD, UCD and RE to explore which practical guidance these domains can offer. A review of selected literature provided valuable information on obstacles and learnings when conducting user context research. This resulted in a selection of methods, techniques and tools suitable to obtain efficient, designer-friendly insights in the well-being of potential users. The result provides an answer to research question 2.

In chapter 4, the findings from the literature reviewed in chapter 2 and 3 is combined, resulting in a two-part conceptual framework. The first of these is theoretical, and comprises the analytic guidance from the CA: WHAT the designer should explore. The second part is more practical and includes the practical guidance from the CA, UCD, DfD and RE domains: HOW the designer should explore. It consists of activities, a list of themes (discussion topics) and questions, steps to take and prerequisites for the design team to follow. The analytic and practical guidance have been brought together, laying the foundations for a systemic approach that designers can use in DfD projects to explore their potential users' well-being. The conceptual framework forms the basis for the development of the intervention: stage 2 within the Design-Based Research approach.

Stage 2: Development of an intervention

In chapter 5 and 6, the proposed design approach and the development of the intervention are presented. In chapter 5, the 'Capability Driven Design' (CDD) approach is described, which builds on the conceptual framework developed in stage 1. The CDD approach consists of a CA-based thinking framework developed in chapter 2, prerequisites, guidelines, a set of practical methods, steps to follow and the established list of themes and questions. During its development, a distinction was made between 'essential' methods to conduct comprehensive user context research, and a set of 'add-on' methods which can be deployed when more time and resources are available, or when more research is required. It is noted that a longer stay in the field results in deeper understanding, insights and inspiration. In chapter 5 a 'basic' CDD

approach was developed, deploying the 'essential' methods. The 'basic' approach consists of the following four phases: 1) preparation; 2) obtaining informal insight by immersion, observation and informal talks; 3) deep insight by conducting individual semi-structured interviews; and 4) verifying the obtained insights by conducting focus group sessions.

In chapter 6 the development of the intervention, which was called the 'Opportunity Detection Kit' (ODK), is described. This intervention focuses on phase 3 of the CDD approach: deep insight by conducting individual semi-structured interviews. Conducting these interviews is the foremost data-collection method within the CDD approach. This method needs most guidance in the field, and the themes and questions are particularly relevant for consideration during these interviews. As the content of the CDD approach is an important part of the ODK, by developing and evaluating this kit, the CDD thinking framework, prerequisites, guidelines, themes and questions are also developed and improved upon. The kit comprises steps, interview guidelines, techniques and tools, following the prerequisites of the CDD approach and using its themes and questions.

Within stage 2, the content and procedure of the kit were developed and refined further by means of six 'formative evaluation methods' in four design iterations. Each evaluation method focused on a specific aspect of the ODK: on its content (thinking framework, prerequisites, guidelines, themes and questions) or its procedure (steps, interview guidelines, techniques and tools). The 'formative evaluation' methods used are prescribed by the Design-Based Research approach. The ODK's procedure was tested by a micro-evaluation, during which five ODK interviews were conducted in the Netherlands, and by two micro-try-outs, where 47 ODK interviews were conducted in the intended context: DfD projects in India. The ODK's content was tested by screening, a walkthrough and an expert consultation, during which research team members from the Netherlands, and 10 designers and 12 academics from a different context (the United States) critically looked at the contents. Each formative evaluation resulted in adjustments being made to the intervention, finally resulting in the 'ODK 1.0'.

Stage 3: Evaluation of the intervention

In chapter 7, the ODK 1.0 was evaluated by eight design teams, using the ODK as part of their DfD projects (its intended use), and by 53 experts from different countries and various backgrounds. The evaluations showed the relevance and effectiveness of the ODK interviews within the DfD projects, but also indicated ways to further improve its designer-friendliness and usability in the field. Thereby, improvements regarding the ODK's / CDD content (thinking framework, prerequisites, guidelines, themes and questions) were pointed out. Based on the recommendations provided by the designers and experts, both the Capability Driven Design approach and Opportunity Detection Kit were adapted, in order to provide a more easy and intuitive approach to effectively and efficiently explore the user context. The recommendations also helped to refine the approach to better detect potential users' valued beings and doings and explore their context. The resulting CDD approach and ODK can be tweaked and adjusted by the designers to fit their own preferences, the project and the

context they are working in, but within certain boundaries. The prerequisites must be met, the themes, guidelines and steps should be followed and the 'essential methods' should be deployed. The choice of 'add-on methods' and the use of the proposed questions, techniques and tools is up to the designer.

In chapter 8, the practical outcome of this research project is presented: the final CDD approach and ODK method. The approach and method are explained and described in a manual, and have also been made freely available to users on an online platform (www.design4wellbeing.info). The manual also contains a 'training module' with guidelines, tips and tricks to explain designers what rigorous qualitative research entails and provide, among others, information about appropriate ethical behaviour and attitude in the field and appropriate questioning behaviour. This 'module' is not intended to replace qualitative research and ethics training courses, but serves as a reminder to guide design teams when in the field. Chapter 8 provides an answer to research question 3. Obviously, both the approach and toolkit remain open to critique and modification, based on user experiences in the field.

Stage 4: Reflection

In chapter 9, conclusions are drawn, and a reflection on the complete research process is provided. The answers to the three main research questions are summarized, the main research findings, the theoretical and practical contributions are presented, and the project's limitations are discussed. The chapter concludes with a number of recommendations for future research and for practice.

For now, it can be concluded that the insights obtained by using this novel, systemic approach and kit provide designers with valuable support throughout the design process. Using the CDD approach, designers can better define their design challenge and make informed design decisions. The obtained insights and understanding lead to the establishment of design criteria and provide design inspiration. The added value of the kit was demonstrated in the DfD projects included in the research. For now, it can be concluded that this research project has successfully contributed to improving designers' understanding of the lives of their potential users, specifically in DfD projects, and supports designers when designing products and services in order to truly improve the well-being of the marginalised and disadvantaged.

Keywords: Design for Development, product design, user-centred design, user context research, rapid ethnography, capability approach, well-being

CHAPTER 1

Introduction

The subject of this research is best introduced by the following personal story:

Wanting to contribute to the well-being of people less well-off, during my graduation project, I decided to take up a product design challenge in Deoghar, India to see whether I could apply my knowledge and skills to empower disadvantaged and marginalised rural women. Quite unprepared I travelled in 2004 for the first time of my life outside Europe to design a Tasar silk reeling machine. For me, this was a life-changing experience. Four years after my 'deep dive', of which 18 months spent in India, the Anna Tasar Reeling Machine was patented and marketed, being a small, easy-to-carry machine for home use, improving the reelers' income, working conditions and safety. A classic success story. However, in 2010 when looking back, I realised that I had not fully captured the wickedness of the design challenge. Speaking to many reelers did not lead to fully capturing their true desires and preferences. It turned out that the smaller size of the new machine, which enables the reelers to work from home, resulted in the women being forced to work from home, whereas most prefer working together with others in a reeling centre. Thereby, some reelers indicated to prefer the previous, bigger machine for the status it provided them. Moreover, the easy-to-use new machine encourages child-labour, which represents an issue if it stops girls from going to school. If spending 18 months with potential users did not lead to a deep enough understanding, then how can these challenges be addressed when time and resources are much more limited, which usually is the case in design projects?

A well-informed design process often results in better product acceptance and offers the possibility for designers to enable their end-users to do what they want to do and be who they want to be. The aim of this research project has been to develop an approach for product designers to guide them to quickly gain comprehensive user insights, beyond the 'usual' investigation of product-user interaction. Not only people's needs and wants in relation to the to-be-developed product and / or service are relevant, but a comprehensive understanding of life, lifestyle, behaviour, values, habits, needs, desires and aspirations is required to be able to develop products and / or services that fit the local culture and circumstances and enable users to be who they want to be and do what they want to do. In this way, these products and / or services can truly improve the well-being of their users. The approach developed in the course of this research project offers designers a thinking framework, prerequisites, discussion topics, and a set of methods, techniques and tools which can be used to obtain such a comprehensive understanding. By developing this approach, this research contributes to the design of products and services that anticipate most of the unintended consequences for their users, and that truly improve their well-being. In this chapter the context for this research is provided by framing the background (§1.1 and §1.2), the problem (§1.3), the application domain (§1.4), and the potential of the Capability Approach to address the problem (§1.5). The challenges for this research project are then described (§1.6), followed by the scope and research questions (§1.7). The chapter ends with an outline of this thesis (§1.8) and a reader's guide (§1.9).

1.1 Product design comes with a responsibility

Products and services have always been designed, and they have shaped and changed our environment, our abilities and our behaviour. They support people in doing what they want to do and being who they want to be. A bicycle, for example, allows us to move around freely, a computer connects us with people and data all over the world, and a washing machine makes our lives more comfortable and provides us with time to spend freely. However, product innovations can also have unintended consequences, such as obesity, pollution, climate change and exhaustion of resources, or have consequences that intentionally limit or control individuals in their beings and doings, such as weapons or fences. Illich (2001) describes the destructive side-effects of the industrial production of products and services to the environment and to the members of society, which are turned into mere consumers rather than into people with the freedom to use their energy and imagination. Papanek (1984) therefore argues that industrial design is the second most harmful profession one can practice and Thackara (2005) claims that design is the cause of many troubling situations in our world. Margolin (2007) and Shiva (2001) warn designers not to overlook this possible 'dark side' of technologies which may cause new social problems. Manzini (2007) also notes that designers are following an unsustainable view of well-being and argues that designers should work towards more sustainable ways of living, from both an environmental as well as a social perspective. In his book 'Design for the Real World', first published in 1971, Papanek already pointed out that designers have a high social and moral responsibility for the consequences of their innovations. Designers should address the moral and ethical problems faced to prevent doing harm (Buchanan 2001) and therefore thoroughly think through the consequences of their creations (Papanek 1984; Thackara 2005), striving for positive social change and resulting in a more humane world (Margolin 2007).

Consequently, product designers, who are trained and educated to create products and / or services, have to think carefully about what they create and what the consequences of their creations are. During the process of designing, designers make many decisions that define the product's final features (Kleine 2010a). These decisions are influenced by the designer's experiences and interactions (Birkett 2010) and by their clients (Press and Cooper 2003; Adams et al. 2011). Therefore, their products, deliberately or unintentionally, carry values, norms and ideologies within them (Oosterlaken 2009; Kleine 2011). According to Birkett (2010), the issue of investigating responsibility in design is very complex. It is difficult to define what a designer's responsibility is and how far this reaches. Moreover, a designer cannot always foresee all consequences of the usage of their designs (Margolin 2007). By thoroughly thinking through the consequences of their innovations and by uncovering the values, motivations and commitments they themselves and other stakeholders bring into the design process, designers are more able to make well-considered trade-offs and deliberate design decisions during the design process. Well-informed and well thought of design decisions are more likely to result in products that induce positive change.

1.2 Relevance of user context research for product designers

The process of designing has a long tradition (Dreyfuss 2012; Simon 1996). While some innovations come from a stroke of genius, most innovations result from *"a conscious, purposeful search for innovation opportunities"* (Drucker 1998, p. 4). Likewise, Owen (1992) argues that breakthrough thinking is almost always preceded by extensive preparation. When working on complex and complicated problems, designers use a range of methodologies (Cross 2000; Diehl 2010; Badke-Schaub, Daalhuizen, and Roozenburg 2011; Roozenburg and Eekels 1998). Cross (2001, p. 53) defines design methodology as *"the study of principles, practices and procedures of design"*.

Basic structure of product design process

Although there are many different design models[1], according to Cross (2000) most of them have a basic three-phase structure: the analysis, synthesis and evaluation phase. Roozenburg and Eekels (1998) call these phases the 'strict development process', which is preceded by a product planning phase, and succeeded by a realisation phase. They explain these phases as follows:

1. Analysis: the design problem is analysed and defined, resulting in design requirements;
2. Synthesis: a draft design proposal is made, and ideas are formed. The best ideas are chosen and conceptualized. The best concept is then chosen and worked on further to produce a preliminary design;
3. Evaluation: an idea of the behaviour and characteristics of the designed product is formed by reasoning, or by building a prototype. The value or quality of the preliminary design is determined by comparing the expected properties with the desired properties.

While these design models explain and structure the design process, in practice this process is not linear. It is an iterative, spiral-like process, during which the designer goes through reductive and deductive steps and often needs to return to earlier phases to re-evaluate previous decisions (Roozenburg and Eekels 1998). In this way, the knowledge about the problem and about the design outcome increases and they co-evolve together (Cross 2000; Roozenburg and Eekels 1998). It is a process that relies on feeling, intuition and inspiration, combined with rational and analytic activities (Brown and Wyatt 2010). Figure 1-1 presents the basic design model, including its fuzzy and iterative character.

The fuzzy front-end of design

The first phase of the design process is the most fuzzy, but it is, according to Sanders and Stappers (2008, p. 7), also *"increasingly critical"* as during this phase the actual design challenge is explored and – if required - re-formulated. As Gharajedaghi (2011) explains, design failures are often caused by addressing the wrong problem. Therefore, designers need to thoroughly analyse and frame the problem, before starting the actual development of a product or service. They need to obtain insights into technological possibilities, business opportunities, the political and legal system, as well as potential users and other stakeholders.

1 *E.g., Archer (1984); Buijs (2003); Buijs and Valkenburg (2000); Ingenieure (1993); March (1984); Pahl, Beitz, and Wallace (1984); Roozenburg and Eekels (1995); Ulrich and Eppinger (1995); Unger and Eppinger (2011); Plattner, Meinel, and Leifer (2010); Wheelwright and Clark (1992)*

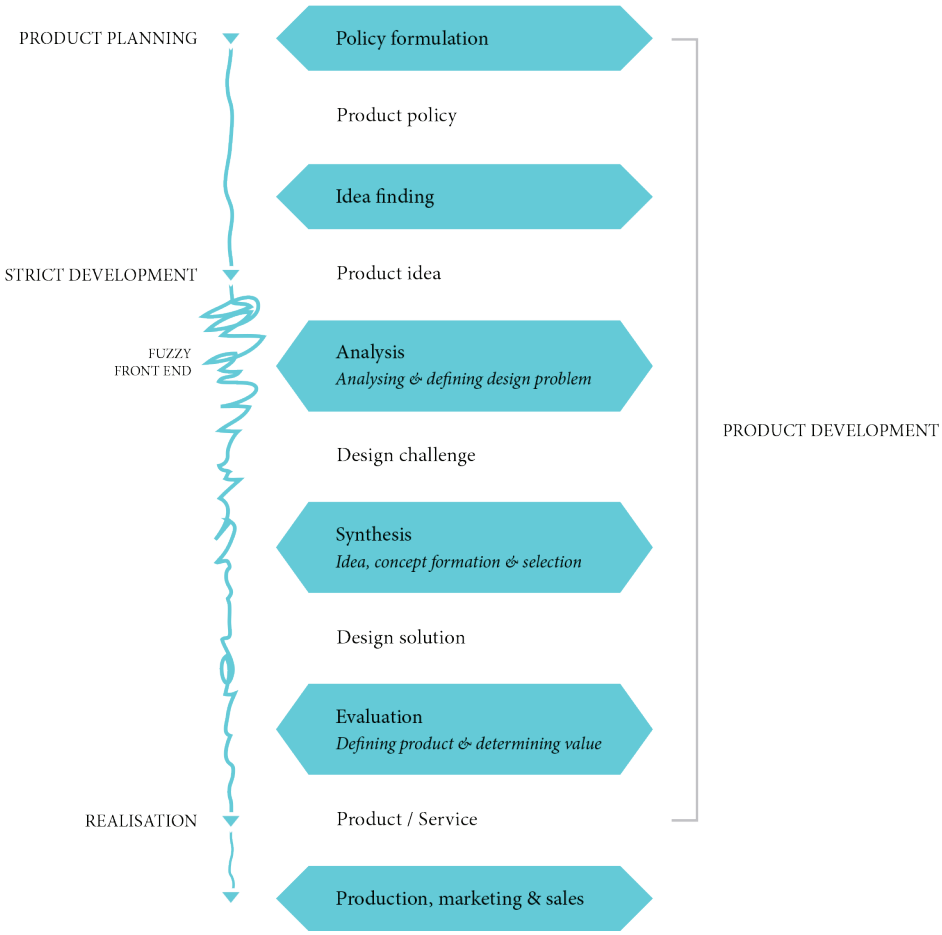


Figure 1-1: *Basic representation of the product innovation process*

The information collected in the first phase of the design process will be used to define the problem, to develop requirements and to make informed design decisions. The problem definition and requirements guide the designer throughout the design process, although they might change as new insights are gained. While technology, business, rules and regulations are all important for the investigative process, the focus in this thesis will be specifically on the potential users and their context. In the next section the choice for this focus will be explained.

User context research in the fuzzy front-end

A famous quote by the late Steve Jobs, at that time CEO of Apple, says, "*A lot of times, people don't know what they want until you show it to them*". Apple's products are often used as examples to illustrate that user insight is not required to develop successful products. Moreover, as Verganti (2008) states, product design can be driven by a firm's vision alone. Involving users does not ensure that all the relevant insights are identified (Steen 2008), it

requires time and effort (Kujala 2003), and it does not result in clear-cut decisions, because preferences and opinions differ (Sklar and Madsen 2010). However, involving potential users in the design process often does result in valuable benefits regarding the outcomes of design.

Consulting users regarding the development of products and services that influence their lives seems to make sense. Thereby, it improves the accessibility, applicability, acceptance and adoption of the designed product or service (Donaldson 2009; Nakata and Weidner 2012; Parmar 2009; Prahalad 2012; Robertson and Simonsen 2012; Wilkinson and De Angeli 2014). Integrating the user perspective leads to more flexibility and robustness in product use (Robertson and Simonsen 2012) and enhanced user satisfaction (Kujala 2003). Furthermore, Kujala (2003) mentions that consultation with potential users appears to reduce the number of design iterations and thereby the time and cost of development. It also leads to generation of design requirements and less frustration during decision-making (Kujala 2003). The insights gained from consulting users guide designers to go beyond their own assumptions (Brown and Wyatt 2010; Wilkinson and De Angeli 2014) resulting in bottom-up solutions with high-impact (Brown and Wyatt 2010). Norman and Tognazzini (2015) argue that, to be able to design products and services that help their users, it is imperative to discover people's true, underlying needs. As Stanford's Institute of Design states *"the best solutions come out of the best insights into human behavior"* (d.School 2013, p. 1); this is also increasingly recognized by global corporations (Boztepe 2007). It is valuable to enable active participation of potential users throughout the design process (Manzini 2007; Sanders and Stappers 2008; Bowman and Crews 2009; Robertson and Simonsen 2012; Wilkinson and De Angeli 2014), preferably from the early stages of the design process (Wilkinson and De Angeli 2014; Kujala 2003; Sanders and Stappers 2008). In the early stages, user involvement is most efficient and influential, because their input forms an important point of reference throughout the design process (Wilkinson and De Angeli 2014), and changes made in the beginning of the process are less costly than those made later on (Kujala 2003).

In order to gain insights into users, designers have started to co-operate with ethnographers, but they also have started to conduct fieldwork themselves (Karasti 2001). According to Donaldson (2009), Friess (2010), Kujala (2003) and Robertson and Simonsen (2012) it is best to personally engage with users and access their environments in order to learn from them about their practices and contexts. Direct engagement results in less distortion and undesirable filtering of information (Kujala 2003). Moreover, information can be gained about users' attitudes and values that they are not consciously aware of by observing their behaviour (Rosenthal and Capper 2006).

1.3 Beyond product-user interaction

Consulting potential users involves more than simply asking them what they want (Sanders and Stappers 2014; Kujala 2003). Since designers started to gain user insights themselves, their role and perspective have changed. New approaches and methods have been developed, mainly within the domain of human-centred design, to enable designers to gather and use the input from their potential users to the fullest. According to Boztepe (2007), well-known

cultural models such as Hall's and Hofstede's provide a good starting point, but for design purposes their categorizations remain too narrow and static, which might lead to unwanted assumptions and over-generalizations. Pure ethnographic research on the other hand, is too great a commitment for designers working on projects which are often quick and result-oriented with limited time and resources to obtain user insights (Handwerker 2001; Boztepe 2007; Kujala 2003; Hanington 2010). Therefore, rapid ethnographic methods, such as rapid rural appraisal (Chambers 2004; Narayanasamy 2013; Beebe 2014) and quick ethnography (Handwerker 2001; Pelto 2013), are applied by designers. Moreover, many design manuals (Van Boeijen et al. 2013; Martin and Hanington 2012; Simanis and Hart 2008; d.School 2010, 2013; Crul and Diehl 2006) and toolkits (Larsen and Flensborg 2011; IDEO 2008b, 2008a) have been developed which are an inspiration to designers going into the field.

While product designers evidently pay significant attention towards investigating the user context and integrating the users' perspective and experiences in the design process, their view is often limited to the interaction between the user and the to be designed product. Sklar and Madsen (2010) stress that to be able to truly address the needs of potential users, designers should see the world from their point of view, and should understand their motivations and aspirations. A comprehensive view of the user's world might reveal relevant aspects that, in the eyes of the designer, are not directly linked to the design assignment. For instance, the introduction of mobile phones, developed for personal use, caused privacy problems in developing regions, as family members often share a single phone (Rangaswamy and Singh 2009). Or the development of small, affordable ultrasound devices, which make healthcare more accessible in rural areas, also resulted in increased gender selection (Darnton 2010). Another example is the rejection of backscatter technology, which enables full-body scans at airports to improve safety, because of privacy problems and health concerns (Ahlers 2013) (see figures 1-2 to 1-4).

Figure 1-2: Mobile phone usage in India (Photo by Banerjee, AP 2014)
Figure 1-3: A portable ultrasound device in use (Photo by CNN 2013)
Figure 1-4: Backscatter full body scan (Photo by Scott Olson, Getty Images, 2013)

In this thesis, it is argued that, in design context research, designers need to obtain a comprehensive understanding of the context and the valued beings and doings of their potential users, to be able to develop products and services that have a higher chance of being accepted by potential users while addressing their needs and aspirations. While existing rapid ethnographic and design manuals provide methods, techniques, tools, guidelines, tips and tricks for effectively obtaining user insights, they do not specify which topics can or should be addressed when obtaining comprehensive user insight. They leave it up to the designer to

think about the type of information and the insights to be collected for each project. Moreover, ethnographic approaches are not specifically tailored to the needs of designers who are often not trained to conduct ethnographic research, and the design manuals and toolkits provide a method database, but no procedure to follow. According to Margolin (1997, p. 234), there is no *"systematic way of developing a social needs inventory to stimulate the invention of beneficial new products"*. Designers in the field, trying to understand their potential users, need analytic guidance for conducting rigorous fieldwork (Button 2000) and therefore require *"efficient tools and frameworks for conducting, analyzing, and presenting user research"* (Boztepe 2007, p. 517).

Therefore, the aim of this research is to develop an approach that offers the efficient frameworks, methods, tools, and systematic analytic guidance for conducting comprehensive user context research that Margolin (1997); Button (2000) and Boztepe (2007) find lacking, in order to help designers to obtain comprehensive user insights. These insights can be used to inspire designers to develop in a participatory manner products and services that anticipate most unintended consequences, truly contribute to people's valued beings and doings, and improve their well-being. The focus is therefore on the first phase of the design process. Figure 1-5 visualises the research scope and focus within the design process.

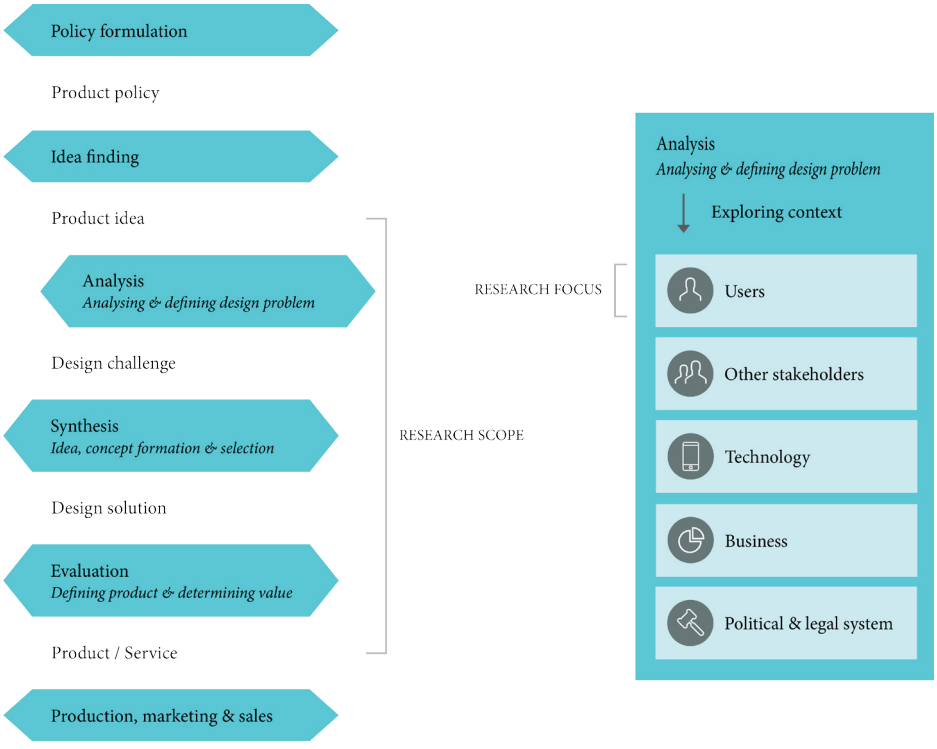


Figure 1-5: Research scope and focus within the product innovation process

1.4 Application domain: Design for Development

The application domain for this research project is 'Design for Development'[2]. Design for Development (DfD) projects aim to improve the well-being of disadvantaged and marginalised populations (Donaldson 2006, 2009)[3]. Specifically for these populations, product innovations have the potential to significantly support them in their daily lives. Papanek (1984) raised attention to DfD from the 1970s onwards, arguing that all people, being citizens of one world, have an obligation to improve the well-being of people in need. Johnstone (2007) also claims that justice urges us to first address the needs of the most deprived of opportunity. As designers are able to change *"existing situations into preferred ones"* (Simon 1996, p. 111), they can significantly impact the lives of the marginalised and disadvantaged. Thomas (2006) argues that design can increase their income and provide them with access to better goods, products and equipment. Although significant efforts have been made, there are many examples of products specifically designed for development that failed in their purpose, such as mosquito nets being used as fishing nets (Duflo 2010) or as goal post nets (see figure 1-6), toilets which are being used as a kitchen or to store cow-dung cakes (see figure 1-7) or agricultural products (Gupta 2011), and playpumps which have been abandoned (see figure 1-8), due to its complex design requiring expensive and / or unavailable parts, its dependency on children's' play, and safety issues (Nhlema 2015; Borland 2011; Unicef 2007). Considering that of all new products, a majority fail (Iyer, LaPlaca, and Sharma 2006), many of these products are unsuited to the user and / or their environment as they are either based on poorly defined needs (Donaldson 2006), or *"confuse what customers ostensibly need versus what they actually want"* (Bowman and Crews 2009, p. 38).

Figure 1-6: A mosquito net being used as a goal post net in Zambia (Photo by Moisés Mwape, AP 2014)
Figure 1-7: Toilet building used for storing cow dung cakes in India (Photo by Shantanu Gupta 2011)
Figure 1-8: Abandoned playpumps in Malawi (Photo by Mhruti Nhlema 2015)

2 *In literature, authors use different names to denote 'Design for Development' (e.g., Socially Responsible Design, Humanitarian Design, Design for Social Change, Design for Less Industrialized Economies, Frugal Innovation, Design for Social Change, Design for emerging markets, design for the Base/Bottom of the Pyramid/BoP; people living on less than $1,500 a year). Although different authors may use different terms, in this thesis the term 'Design for Development' is consistently used.*

3 *In literature, authors use different names to address the marginalised and disadvantaged (e.g., Base/Bottom of the Pyramid/BoP, underdeveloped, poor, multidimensional poor) or the regions of the world that they live in (e.g., emerging markets, the third world, less industrialized economies, developing countries, and subsistence marketplaces). Although different authors may use different terms, in this thesis the phrase 'Design for Development' is consistently used to denote design projects aimed at improving the well-being of disadvantaged and marginalised populations all over the world.*

It is always important for product designers to be sensitive to context, to relationships, and to consequences (Thackara 2005), but it is especially important when designing for populations whose lives are very different from the designer's (Brown 2008). The disadvantaged and marginalised can often not take financial risks, which makes it especially important to develop products and services that are well-engineered (Donaldson 2006) and truly address their needs (Donaldson 2002; FrogDesign 2012; IDEO 2008b; Viswanathan and Sridharan 2012) and wants (Bowman and Crews 2009; Slavova, Venter, and Baduza 2013). For designers, it is important to experience the local context (Polak 2008; Van Boeijen et al. 2013; IDEO 2008b; Simanis and Hart 2008; Donaldson 2006; FrogDesign 2012; Larsen and Flensborg 2011), in order to gain an insider's perspective and to start to understand potential users' socially constructed categories and meanings (Beebe 2014; Van Boeijen et al. 2013). As Verdu-Isachsen (2012, p. 16) argues, for sustainable change to happen in the lives of the disadvantaged and marginalised, designers need to obtain *"a deeper cultural understanding of the context than is normal in a design process"*.

1.5 The potential of the capability approach to guide the product designer

The Capability Approach (CA), as introduced and developed by economist and philosopher Amartya Sen and philosopher Martha Nussbaum, has the potential to provide the analytic guidance for performing systematic social needs inventories. The CA is a philosophical approach that focuses on what people want to do and be, or, in other words, on the real opportunities that people have reason to value themselves. The approach goes beyond income, commodities and utility, by focusing on the real opportunities ('capabilities') that people enjoy. Within the CA, development is seen "*as the expansion of human capability to lead more worthwhile and more free lives*" (Sen 1999, p. 295). Examples of valuable capabilities are, among others: the opportunity to move freely anywhere you want, the opportunity to receive education, the opportunity to participate in public debates, and the opportunity to have good health. The CA is eminently used in academia and in policy-making (Robeyns 2006), but can directly be linked to the domain of product design, as products and services have the ability to shape opportunities for their users (Johnstone 2007; Oosterlaken 2009). A bicycle for example, allows people to move further away, a water filter secures safe drinking water and therefore good health, and information and communication technologies enable their users to communicate with people far away, look up information and play games, among others. Manzini (2007) connects the domain of product design to the CA, in order to move away the attention from goods to well-being and to argue for the design of systems that enable people to fulfil their potential, by using their own personal resources and their accessible set of solutions. For several reasons, the CA seems to be a promising approach to guide designers to gather objective and comprehensive data about the lives of potential users:

- The CA takes into account all dimensions of human well-being (Robeyns 2011). It considers the whole spectrum of capabilities that people can achieve by looking at their personal characteristics and circumstances (Chiappero Martinetti 2008). The CA thus considers well-being in all its facets, its causes and effects (Chiappero Martinetti 2008);

- The CA has the potential to point out and explain human diversity (Robeyns 2005);
- By focusing on people's real opportunities, instead of on their actual achievements, the CA considers personal choice (Kleine 2011). Choice making behaviour is relevant for designers to consider as they provide their users options for choice;
- The CA places an emphasis on what people value themselves and stresses the requirement of involving the people concerned in the process of their own development (Sen 1999);
- The CA is a flexible approach that can be used for different purposes (Robeyns 2011). Slavova, Venter, and Baduza (2013) and Oosterlaken (2009) already recognized the value of the CA to inform user context research;

The CA focuses on aspects that have not only instrumental, but also intrinsic value (Alkire, Qizilbash, and Comim 2008). In other words, *"the capability approach focuses on the ends instead of the means of well-being"* (Robeyns 2008, p. 86). While products and services are also means to achieve well-being, the broader perspective of what products and services can add to people's real opportunities is important for designers to consider.

The comprehensive perspective the CA offers, taking people's personal characteristics, circumstances and choices into account and focusing on real opportunities as 'the ends of well-being', seems relevant for designers who want to develop products and services that fit their users and improve their well-being at the same time. The approach might provide the required analytic framework regarding the type of information and insights required to obtain comprehensive and holistic user insights. This insight then supports the designer in deliberate and responsible decision-making throughout the design process, stimulating the invention of products and services inducing positive change.

1.6 Challenges for this research

While the DfD domain has grown rapidly in the last few years, this has not happened in an organized way (Donaldson 2009), and until now, the literature offers little theoretical or practical knowledge (Nakata 2012; Viswanathan and Sridharan 2012). In design projects, there is not always sufficient time and resources to conduct rigorous user context research, and as Castillo, Diehl, and Brezet (2012) argue, DfD projects often require more time and resources. Currently, there is no adequate cost-efficient manner to gather user requirements in context (Kujala 2003). Moreover, a different context makes it more complicated to collect information (Castillo, Diehl, and Brezet 2012) and to identify true user needs (Chavan and Gorney 2008; Donaldson 2006; Shahnavaz 1989; Viswanathan and Sridharan 2012). This is due to accessibility, political or technical constraints (Kujala 2003; Roibás 2008), limited reactivity of the potential users (Narayanasamy 2013; Handwerker 2001; IDEO 2008b), or designers' limitations to truly understand the potential users due to their own biases, assumptions and over-generalizations (Birkett 2010; d.School 2013; IDEO 2008b; Shahnavaz 1989). Thereby, methods are often subject to built-in biases and assumptions (Chavan and Gorney 2008). It can be difficult to overcome these issues.

In that perspective, the CA seems to be a promising approach to guide designers in obtaining comprehensive insights into users, but is not directly applicable to the domain of product design. The CA is widely credited for inspiring the United Nations Human Development Index (HDI) (Anand, Krishnakumar, and Tran 2011), but its broadening beyond the HDI has been questioned (Robeyns 2006). When it comes to turning the CA into practice, the domain is underdeveloped (Wagle 2009) and it proves difficult to translate the CA to practice (Kleine 2010b; Rudra 2009; Chiappero Martinetti 2000) . Until now, no methods or guidelines have been specified on how to assess, identify, weigh, aggregate or select capabilities (Frediani 2010; Chiappero Martinetti and Roche 2009). This research takes up the challenge of translating the CA into DfD practice to guide designers in the process of gaining a comprehensive insight into their potential product users.

1.7 Research aim and research questions

The overall research aim, addressed in this thesis, is to provide product designers analytic and practical guidance to rapidly and objectively obtain comprehensive user insights, specifically for DfD practice. As the research aims to expand the theory of gaining user insights in product design, this study is labelled theory developing research. As explained in the introduction, designers require analytic guidance regarding the information and insights to be collected in order to obtain comprehensive user insights, and they need practical methods and tools to do so effectively and efficiently. Therefore, three main research questions and two sub-questions have been formulated to be answered in this thesis. These are:

RQ 1 Which analytic guidance does the Capability Approach offer designers to understand people's well-being?

RQ 1.1 Which elements of the capability approach constitute a thinking framework that designers can use to understand users' well-being?
The capability approach has been identified as a promising approach to offer designers analytic guidance in order to understand the well-being of their potential users. Which elements of the capability approach are relevant to include in a thinking framework for gaining insight into users have to be investigated. This research question will be answered in chapter 2.

RQ 1.2 Which topics constitute the well-being of a person's life?
The capability approach offers a comprehensive view on well-being, by looking not only at people's personal characteristics, but also at their external circumstances. Which topics constitute these characteristics and circumstances and therefore a person's well-being, have to be investigated to provide further analytic guidance. This research question will be answered in chapter 4.

RQ 2 Which designer-friendly methods are available to efficiently explore people's well-being to inform Design for Development?

The domains of human-centred design, design for development, and rapid ethnography offer guidelines, methods, techniques and tools to efficiently explore the user context in a designer-friendly manner. These existing practices described in the literature offer a starting point for developing a method for designers to explore users' lives, specifically for Design for Development. This research question will be answered in chapter 3.

RQ 3 How can the analytic and practical guidance be integrated in a systemic approach to understand people's well-being in Design for Development projects?

By bringing together the analytical guidance derived from the capability approach (RQ1), and the practical guidance from human-centred design, design for development, and rapid ethnography (RQ2), a systemic method can be established that designers to guide designers to explore and understand the lives of the disadvantaged and marginalised people they are designing for. This research question will be answered in chapters 5 to 8.

The framing methodology Design Inclusive Research (DIR) has been used to answer these questions. Framing methodologies offer a reasoning strategy and indicate a possible research design and research actions (Horváth 2007). DIR is an approach in which knowledge is generated and applied by employing design methods (Stappers 2007). The DIR approach consists of three phases; the explorative research phase – during which knowledge is explored, induced and deduced, the creative design phase – during which a testable prototype is developed, and the confirmative research phase – during which the outcomes are verified, validated and consolidated (Horváth 2007). These steps are visualised in figure 1-9 (overview of thesis per chapter). The research design and approach are introduced in chapter 4.

1.8 Structure of this thesis

In chapter 1, a short introduction to the research project has been provided to clarify its scope and focus. Chapter 2 presents the basic concepts and development of the domains of the CA and product design. The application domain – DfD – and the specific domains of design ethnography and contextual inquiry in design are also investigated. The knowledge gained is used to theoretically and practically explore the analytic guidance the CA can offer to obtain comprehensive user insights (RQ 1.1). In chapter 3, the focus is on the CA and product design in practice. Operationalization guidelines of the CA have been distilled from the literature, and guidelines, methods, techniques and tools for obtaining user insights have been derived from the literature on product design, DfD and applied ethnography (RQ 2). Chapter 4 presents the conceptual framework and research design based on the literature studies conducted in chapter 2 and 3 (RQ 1.2).

In chapter 5, the domains of CA and product design are brought together, resulting in the Capability Driven Design (CDD) approach. CDD consists of a thinking framework, a list of themes and questions which support the designer in thinking comprehensively, and prerequisites and steps to follow when obtaining comprehensive insight into users. In chapter 6, one specific CDD method - semi-structured, individual interviews – has been selected and developed. This resulted in the Opportunity Detection Kit (ODK). The ODK was developed based on the literature and on four iterations. Initially, a micro-evaluation (iteration 1) and a micro-try-out (iteration 2) were executed to test the ODK's procedure, and a screening (iteration 3) to test its contents. After a review within the research team, it was decided that an additional iteration was required. The ODK procedure was therefore tested by another micro-try-out and its contents by a walkthrough with novice designers and a consultation of experts, leading to additional improvements (iteration 4).

In chapter 7, the ODK was evaluated in two try-outs and by an expert appraisal. First, five novice design teams used the ODK during a full DfD project from the analysis to the evaluation phase. The results of this fieldwork provided insights into the effectiveness, efficiency and user-friendliness of the ODK's procedure and led to several improvements. To obtain more insights in the ODK's procedure, three novice design teams used the ODK more intensively during a full DfD project from the analysis to the evaluation phase. Thereby, these three teams also paid specific attention to the ODK's contents. Finally, eight focus group sessions were conducted with experts of varying backgrounds and with different affiliations. This resulted in a validation of the ODK's content and applicability. In chapter 8, a final CDD approach and ODK method are proposed, based on the literature and the data collected, presenting the practical contribution of this research (RQ 3).

Finally, chapter 9 summarizes the main research findings and provides an overview of the theoretical contributions of the research presented in this thesis. A reflection on the work presented in this thesis is given and recommendations and directions for future research are indicated.

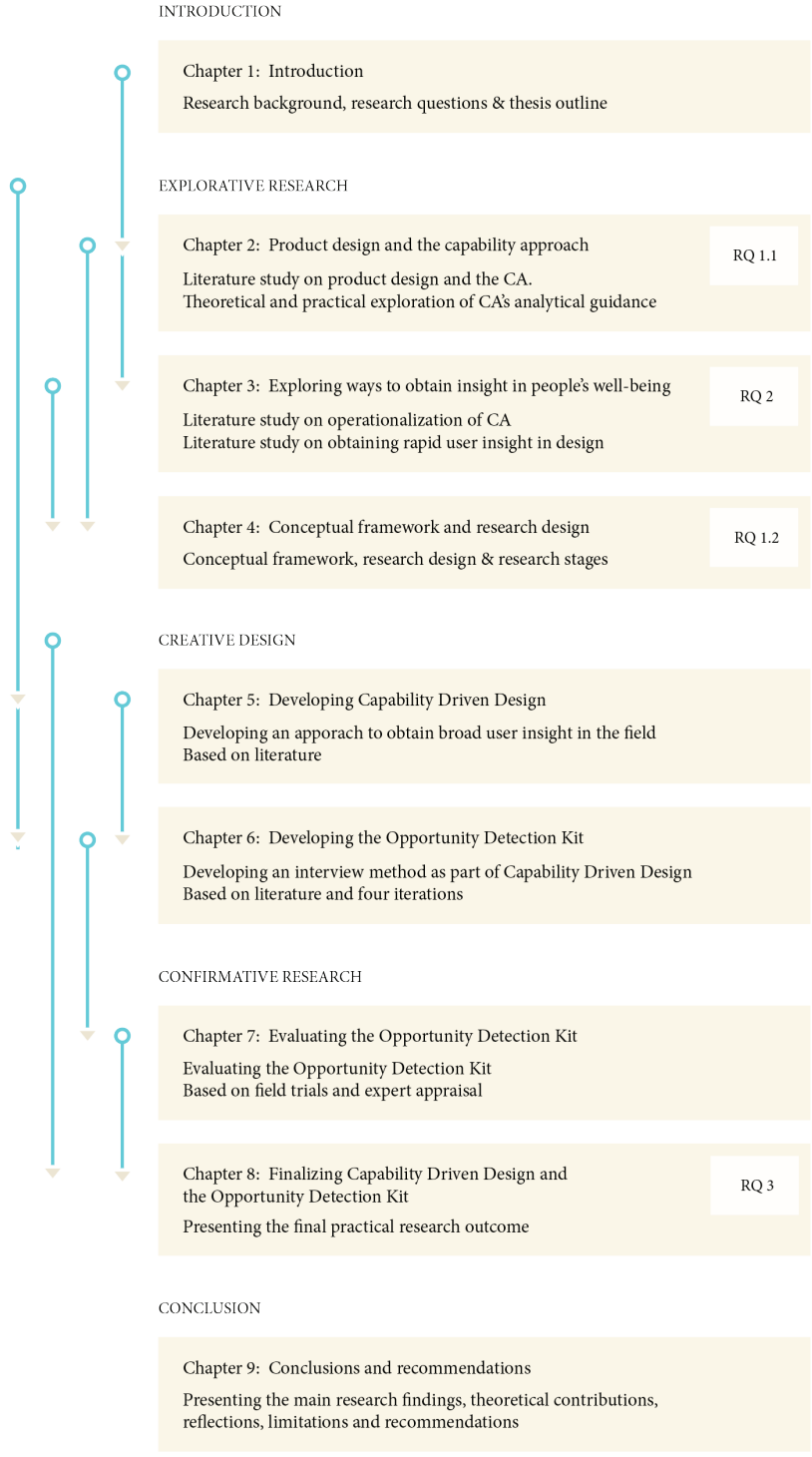


Figure 1-9: Overview of thesis per chapter

1.9 How to read this thesis

This thesis presents the study executed to provide product designers an approach and procedure to efficiently and comprehensively explore the user context. Chapter 2 and 3 provide an extensive overview of the theoretical background of the study presented in this thesis, resulting in the establishment of an initial CDD approach and ODK method. Chapter 6 and 7 provide an extensive overview of the development and evaluation of the ODK content and procedure.

For a quick glance of the theoretical background, read §2.3 and §3.3. For a quick read through the development of the ODK read §6.1 to understand the establishment of the ODK from literature, and §6.3 and §6.4.4 to learn about the changes made to the ODK as a result of the executed iterations. For a quick glance through the evaluation of the ODK, read §7.1, which presents the ODK 1.0 as a result from its development in chapter 6, and §7.5 to learn about the changes made to the ODK as a result of the executed evaluations. The 'quick read' is visualised in figure 1-10.

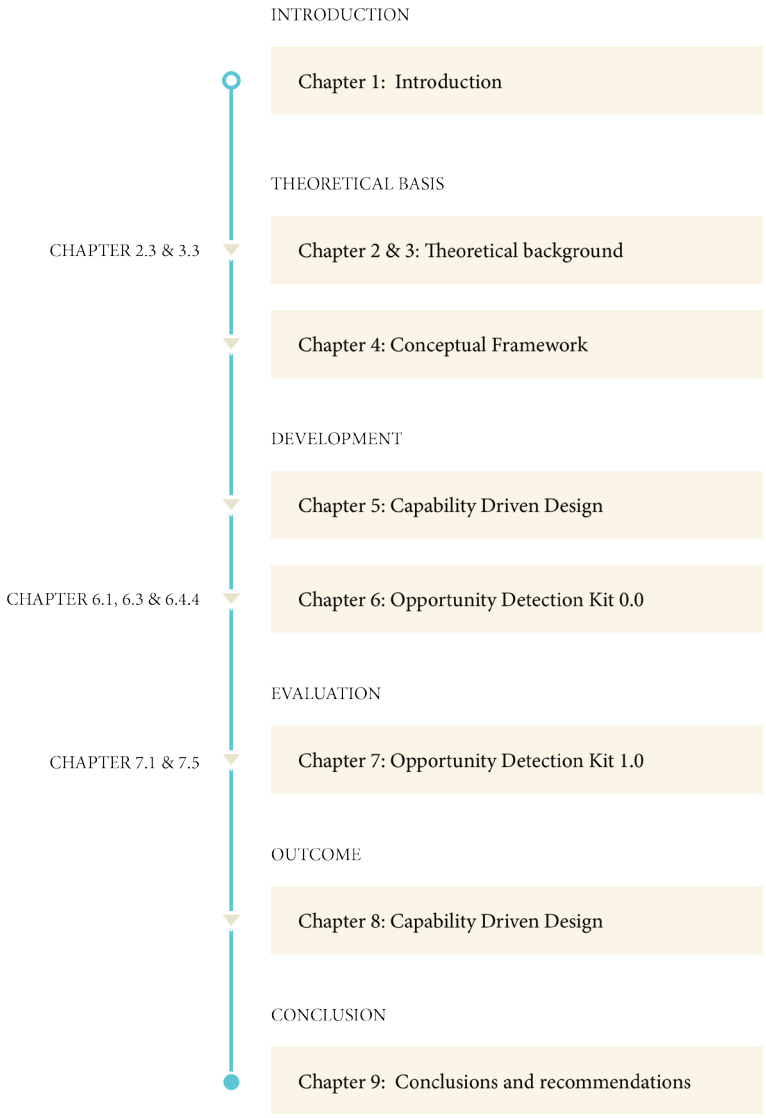


Figure 1-10: Reader's guide and possible quick read of this thesis

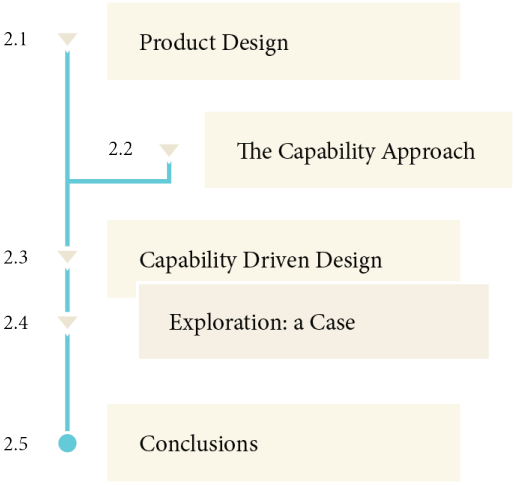
CHAPTER 2

Product Design and the Capability Approach

Large parts of this chapter are based on: Mink, A., Parmar, V. S., & Kandachar, P. V. (2014). Responsible Design and Product Innovation from a Capability Perspective. In J. Van den Hoven, N. Doorn, T. Swierstra, B.-J. Koops & H. Romijn (Eds.), Responsible Innovation 1. Innovative Solutions for Global Issues. (1 ed., Vol. 1, pp. 113-148). Dordrecht: Springer.

In the introduction, the significance of product designers obtaining comprehensive user insight, especially in Design for Development (DfD) projects, is discussed. It was also noted that the Capability Approach (CA) seems to be relevant to guiding designers to move beyond product-user interaction. However, the domains of the capability approach and product design have not yet been explored to such an extent that this relevance is indisputable. In this chapter, these domains are explained in more detail to clarify the added value of the capability approach when providing analytic guidance for exploring the user context.

In §2.1 the domain of product design is explored in general, and specifically in relation to the goals of this research project. As the focus is on the user, the domain of human-centred design is explored in detail. And as the application domain is DfD, the theoretical background of this domain is also explored. When looking at the user perspective, the domain of rapid ethnography has been an important source of inspiration, and is therefore also reviewed in §2.1. In §2.2, the basic concepts of the capability approach and the approach's influence on the world of development are clarified. Next, in §2.3 the connection between the domains of product design and capability approach is discussed and their synergy is presented in a conceptual model. To further explore this synergy, in §2.4 a DfD project executed in India is evaluated from a capability approach perspective. The chapter concludes (§2.5) by discussing the added value of the capability approach to analytically guide user context research in the domain of DfD.



2.1 The product design context

As explained in the introduction, product designers play an important role in influencing the world by creating products and services. As a profession, product design has changed greatly over the years. In this section these changes and the current state of the domain of product design are described. This serves as a background for explaining the research focus. Thereafter, product design is defined within the scope and focus of this research project: to obtain comprehensive user insight in DfD projects to develop products and services that improve the well-being of their users.

2.1.1 Product design: From a product focus to a human-centred system focus

The profession of product design has a long history; since their origin, human beings have constantly developed products and services to improve their quality of life. According to Bürdek (2005), the origins of product design can be attributed to Vitruvias' architectural handbook 'De Architectura', stemming from around 15 BC or to the work of Leonardo da Vinci (1452-1519), who was, among many other things, an inventor of objects and machines. Heskett (2001, p. 20) notes that the guilds (associations of 'arts and crafts'), formed in Europe in medieval times, can be seen as *"an early form of licensing of designers."* References to design as a creative profession have been made by Vasari (1511-1574) and by the Oxford Dictionary in 1588 (Bürdek 2005). As such, traces of product design can be found throughout our history. In this thesis, the 'Arts and Crafts' era is seen as a starting point of product design.

The work of craftsman was increasingly commercialized from the Industrial Revolution onwards (starting in 1760), resulting in industrial production by what Heskett calls "*the artist-designer*" (Heskett 2001, p. 23). Division of labour resulted in specialization of tasks (Bürdek 2005). In 1849 the first society of industrial design was established in Sweden, an example followed quickly in other European countries (Papanek 1984). The revolution of applying art to industry also had its adversaries, resulting in movements promoting Arts and Crafts, but the industrial revolution continued nonetheless (Heskett 2001; Bürdek 2005). At the time, the designers main task was to improve product aesthetics. In 1919, the Bauhaus was established with the mission of uniting art with technology, laying the groundwork for the profession of industrial design (Bürdek 2005; Papanek 1984). The term industrial design was first introduced by Stam in 1948: a profession comprising drafting, sketching and planning (Bürdek 2005).

After the Second World War, the Ulm School of Design was established and was the first to truly consider the user perspective (Bürdek 2005). That design had a strategic value was also recognized (Heskett 2001). In 1957, the International Council of Societies of Industrial Design (ICSID)[4] was established, which emphasised the professions commercial nature and its broad scope, stating that industrial designers are concerned not only with the external product features, but also with materials and mechanisms (ICSID 2015). Thereby, designers

4 *As according to the ICSID webpage in 2016: "Icsid members approved a motion at the last general assembly in October 2015 to renew the vision and mission and to change the name of the organization to World Design Organization (WDO). A new visual identity will be unveiled on 29 June for World Industrial Design Day 2016, and the new name will take effect on 1 January 2017 as we launch our 60th anniversary celebrations."*

also started to take aspects like distribution and marketing related to the designed product into account (ICSID 2015). From the late 1960s, the focus shifted from the product's form and function towards product usability, including ergonomics, psychology, sociology and anthropology, in order to make the product fit the user's body and mind (Buchanan 2001b; Bürdek 2005; Clarke 2015). Designers became increasingly involved from the early product-planning phase up and until the final stages of product development, considering technology, business and the potential users.

In the 1970s, the focus on the potential user increased even more, resulting in human-centred design (HCD) (Clarke 2015; Bødker and Pekkola 2010). HCD approaches take a broad view, by not only looking at the situation of use, but also at the experience a product provides, and the meaning of the product in people's social, cultural and natural environments (Buchanan 2001b; Stewart 2011; ICSID 2015). As Buchanan (2001a, p. 13) states: "*While form, function, materials and manner of production continue to be significant, we have an opportunity for new understanding through an investigation of what makes a product useful, usable, and desirable.*" Friess (2010) claims that HCD helped to give design to a purpose, a structure and a story to tell. Initially, the term user-centred design was coined; a mainly US-driven approach which focuses on usability and utility and treats the user as a subject to investigate (Sanders 2006a). This approach was followed by participatory design, a primarily North-European driven approach, treating the user as a partner in the design project (Sanders 2006a). The HCD approaches 'Critical Design' and 'Design and Emotion' are a recent development of the domain. 'Critical Design' is a design-led approach which treats the designer as an expert who critically reviews the prevailing situation, and 'Design and Emotion' is a fast-growing approach which combines aspects of the other approaches and focuses on an empathic understanding of the user (Sanders 2006a). While the focus of product design has shifted towards the potential user, not everyone agrees that a human-centred focus is required. Design can be user-driven, driven by the vision of a designer or firm (design-driven innovation), or by technological research (technology-push innovation) (Verganti 2008).

In the 1970s attention also focused on the ecological demands of our planet, with the 'Club of Rome' recognizing 'The Limits to Growth' (Bürdek 2005). Due to the postmodernist movement at the end of the 1970s and the Memphis group in the early 1980s, the strategic value of design started to become even more recognised, with ecological requirements moving to the background (Bürdek 2005). However, design for sustainability remained an important area of attention for designers and researchers around the world. In 2009, AIGA (the professional association for design) compiled a list of 30 approaches towards sustainability that had been developed up to then, indicating the attention paid towards this field. De Pauw (2015, p. 6) argues that, while sustainable product design has become a synonym for reducing harmful impact, it should aim at *"the development of products that are beneficial to people, planet and profit.*" And according to Manzini (2009, p. 12) design should facilitate a sustainable society where all people have the same opportunities to be and do what they want, while *"maintaining their environmental footprints in the limits of the ecosystems resilience and regenerating the quality of the physical and social commons"*. To work towards such a society, the Design for Social Innovation and Sustainability (DESIS) network is established.

In the 1990s, design started to become a holistic domain (Bürdek 2005). The scope of design shifted from material systems to human systems (Buchanan 2001a; ICSID 2015; Stewart 2011; Sanders and Stappers 2008). Besides creating things (tangible artefacts) and symbols (graphic design), designers also started to create actions (interaction design) and environments (human system design) (Buchanan 2001a). System design focuses on human systems where information, artefacts and interactions are integrated and which influence people's lives without them being able to see or experience them (Buchanan 2001a). Morelli (2003, p. 73) describes product-service systems (PSS) as *"a set of systemic solutions with a high cultural and social content"* that is marketable and fulfils the user's needs. The activity of design has become multidimensional, urging the designer to consider not only the product, but also organisational and social aspects to make the product fit the existing context and infrastructure (Sklar and Madsen 2010) and fulfil its psychological, social, economic and cultural functions (Roozenburg and Eekels 1998). For a long time, product design was viewed as a practical, 'servile' profession, taught in art schools and academies, and not as a domain of theoretical knowledge in its own right (Buchanan 2001a). However, product design is now considered as a 'profession' taught at universities, and an increasing amount of research into this domain is being conducted. The evolution of product design is visualised in figure 2-1.

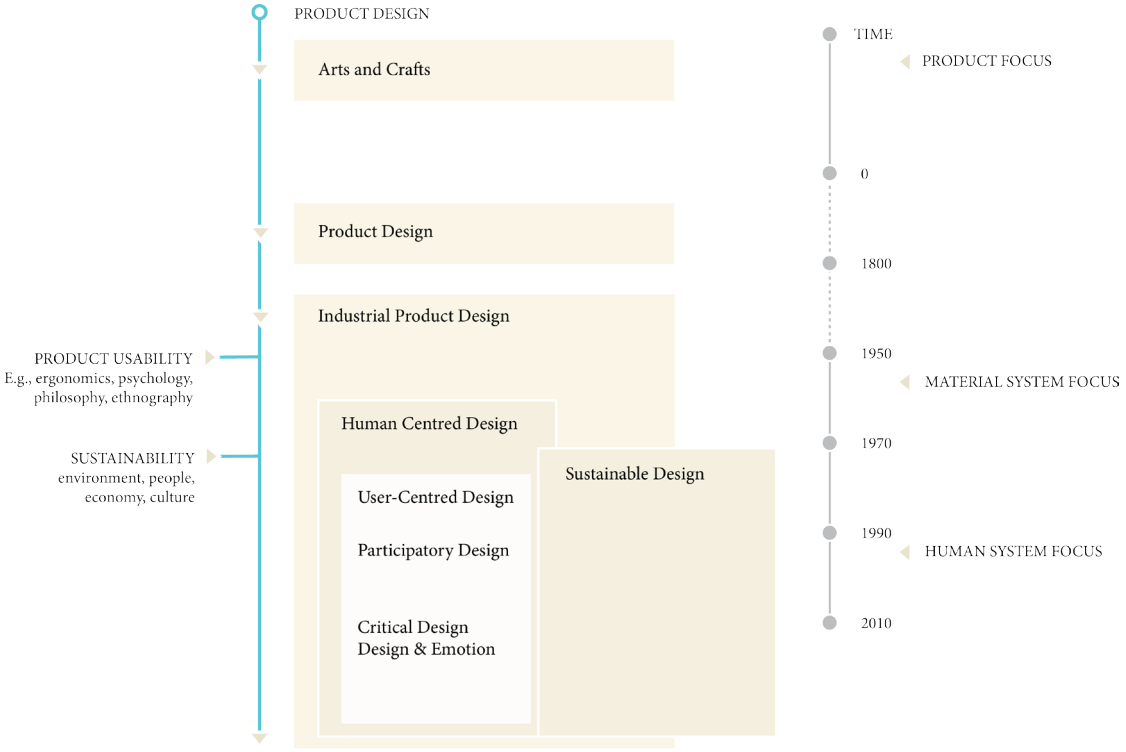


Figure 2-1: The evolution of product design

2.1.2 The current situation: Design thinking as a way to deal with wicked problems

As described in §2.1.1, the domain of product design shifted from a product focus to a system, human-centred focus. Design has evolved into a complicated subject, dealing with so-called 'wicked' and complex problems. As a result of recent developments, the way that designers think and act, and the role they have in the design process has changed. In this section the term 'wicked problems' is introduced and explained, as well as the relevance of design thinking to approaching these problems. This is followed by a review of the changed roles of designers and users.

Wicked design problems

The design profession has become more complex, combining multiple fields of expertise, involving multiple stakeholders during the process, designing complicated systems and dealing with a complex set of requirements. Designers are set the task of developing products and / or services that do not yet exist, to invent and create (Buchanan 1992) and initiate change (Stewart 2011). They need to *"connect and integrate knowledge from many specializations into productive results for individual and social life"* (Buchanan 2001a, p. 7) and handle complex, fuzzy and ill-defined problems (Kandachar 2012; Stewart 2011). Buchanan (1992) explains that most design problems are 'wicked' and 'indeterminate'. The term 'wicked problem' was first coined by Rittel and his words were written down by Churchman (1967, p. B-141):

> *"the term 'wicked problem' refer to that class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing."*

Kandachar (2012) adds that the requirements for wicked problems are incomplete, contradictory, changing and difficult to recognise. The term 'indeterminate' indicates that the limits of these problems are not definitive (Buchanan 1992). Buchanan (1992) specifically stresses the distinction between indeterminate and undetermined or under-determined. The latter two indicate the possibility to determine the design problem, whereas this possibility is not there for indeterminate problems. According to Stewart (2011), there is an urgent need for knowledge about handling these wicked problems.

Design thinking

Buchanan (2001b) claims that design thinking offers knowledge that can be used by designers to address the complex and complicated issues that human beings currently face. Designers use a holistic approach, considering aspects of human systems. According to Gharajedaghi (2011), systems thinking helps to deal with chaos and complexity and is based on five principles: (1) understanding the behaviour of systems within their context; (2) understanding why actors do what they do; (3) seeing complementary relations in opposing tendencies / creating feasible wholes with unfeasible parts; (4) understanding emergent properties and the processes that generate them. Emergent properties are the outcome of interactions among several elements, which change over time, such as success, failure, love, life and happiness; and (5) appreciating and understanding that intentions can yield counter-intuitive, opposite

results. Gharajedaghi (2011) suggests that an interactive, participative design process is an effective way of dealing with systems to re-design the future.

There is a growing interest from different fields for directly applicable design knowledge. Design thinking research has emerged as a field that helps to understand and explain how designers practice design (Cross 2001; Adams et al. 2011; Cross, Dorst, and Roozenburg 1992). Dorst (2010, p. 131) concludes that, after twenty years of research, different design thinking models have resulted in *"a rich and varied understanding of a very complicated human reality"* which other fields are eager to use. Buchanan (2001b) also indicated that design knowledge is useful for other disciplines. Nevertheless, it is difficult for designers to define and communicate their practices (Heskett 2001). Dorst (2010) stresses that there is no single version of design thinking, but many kinds with different applications and perspectives. This view is supported by Adams et al. (2011), who explain that the everyday practice of design professionals leads to variations and ambiguities in learning. Although useful when addressing global, systemic issues (Sanders and Stappers 2008), the intellectual culture of design needs to be further developed (Cross 2001; Buchanan 2001a) and a balance needs to be found between design theory, design practice and production (Buchanan 2001a).

The role of the user and the designer

As can be seen in figure 2-2 the user's role has changed in recent decades, from being merely a customer, to being a participant, or even a co-creator (Sanders 2006b).

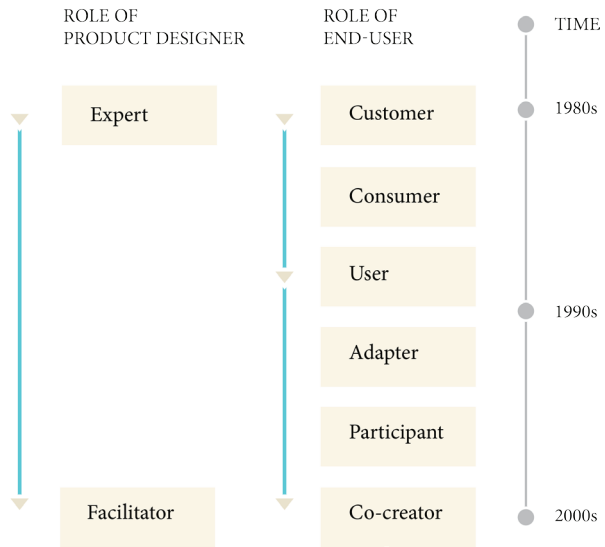


Figure 2-2: The changing roles of users and product designers (adapted from Sanders (2006b); Sanders and Stappers (2008))

Harder, Burford, and Hoover (2013) describe six different levels of participation which resemble the six different roles described by Sanders (2006b). Their participation levels range from 'denigration' - where the decision maker is superior and the subject is not involved

or even denigrated, via 'neglect', 'learning about', 'learning from' towards 'learning together' and 'learning as one' where mutually satisfactory solutions are sought together to co-create solutions. Co-creation assumes that all people are creative, and therefore people not trained in design can develop designs together with trained designers (Sanders and Stappers 2008). Manzini (2007) argues for an active role of potential users to improve their own well-being. According to him, groups of people, with or without help from designers, can design and implement new ways of being and doing, resulting in a very dynamic process, including creative, proactive, and complex co-design activities (Manzini 2014). According to Bowman and Crews (2009), co-created designs are even the most successful ones.

With the role of the potential users becoming increasingly important, the role of the designer also changes (see figure 2-2). Steen (2008) points out that more attention paid to the user results in a more limited role of the designer. However, professional designers are still vital in a co-creative design process, as their way of thinking, skills and abilities are required to address complex and ill-defined problems (Sanders and Stappers 2008), as they are especially skilled to shape and launch new design initiatives, and to actually 'make things happen' (Manzini 2014), and as they have the required knowledge, experience and anticipations (Friess 2010). Furthermore, they are able to develop tools for 'everyday people' to use, they have expert knowledge about technology, production processes and business contexts, and have domain specific skills, knowledge and methods that remain important (Sanders and Stappers 2008).

2.1.3 Defining 'Design for Well-Being'

Innovation is a broad concept that has been defined in many different ways. Schumpeter (1983, p. xix) defined innovation as *"the commercial or industrial application of something new."* Besides 'new', other keywords used in definitions on innovation are 'value', 'creation', and 'successful' (Amabile et al. 1996; Harvard Business Press 2003; Diehl 2010; Redelinghuys 2006). Berkun (2010) states that innovation seems to bring along significant positive change and Rogers (1995) adds to that, that this change not only has to concern its first use or discovery, but that an idea is an innovation if it is new to the individual. Schumpeter (1983) made a distinction between product and process innovations, while later on more types of innovation have been identified, such as market and business innovation (Diehl 2010). The focus in this thesis is on the innovation of products and / or services.

As all product innovations have at one point been designed, the profession of product design is closely linked to that of product innovation (Redelinghuys 2006; Skogstad and Leifer 2011; Veryzer 2004; Thomas 2006; OECD and Eurostat 2005). Like innovation, the term 'design' has multiple definitions. It can be used as a verb, a noun or an adjective (Birkett 2010) and many types of design can be identified. In this thesis the focus is on the action or process of designing products and services. Heskett (2005, p. 5) defined design as *"the human capacity to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives."* Besides 'needs' and 'shape', other keywords used to define design are 'creative', 'human/people', and 'change' (e.g., Papanek 1984; ICSID 2015; Simon 1996; Buchanan 2001a; Donaldson 2002; Dreyfuss 2012). Product design plays an important role in defining the characteristics of product innovations (Simon 1996).

As the title of the thesis indicates, the focus in this research is on 'Design for Well-Being'. Being part of sustainable product design, which focuses on benefits to people, planet and profit (De Pauw 2015), this research specifically focuses on people. Papanek (1984) points out that product design can be used, and that designers even have a responsibility, to improve the well-being of people. Based on these concepts, and in the context of the aims of this study, 'Design for Well-being' is defined as:

> The successful creation of *products and / or services* that induce *change* to a context in order to improve the *well-being* of its users.

According to Gasper (2007a) seven concepts of well-being can be distinguished, but a major distinction is between subjective and objective well-being. Subjective well-being measures refer to a person's feelings and / or judgement, and may include feelings of happiness, satisfaction or fulfilment (Gasper 2007b, 2007a). Objective well-being measures non-feeling dimensions which are externally assessed and approved (Gasper 2007a). According to Van De Poel (2012), in the design literature, well-being is often perceived as desire-satisfaction, but he proposes to use an objective list account of well-being: a list consisting of prudential values that together compose well-being. Gasper (2007b) notes that the CA arose from a dissatisfaction with subjective well-being measures, but that recent work considers rehabilitation of these measures. He proposes to include subjective well-being dimensions in the larger set of relevant dimensions and to add ways to measure both ability to choose and engagement in choice. As Sen specifically talks about *"the expansion of the 'capabilities' of persons to lead the kind of lives they value – and have reason to value"* (Sen 1999, p. 18) and Van De Poel (2012, p. 302) points out the importance of including people's personal *"vision of the good life"*, this research includes both subjective and objective well-being dimensions, and focuses on product design that tries to improve what its users value and have reason to value.

2.1.4 Zooming in: user-centred design activities

As explained in the introduction, the focus of this research is on comprehensively understanding potential product users in DfD projects. In this section this focus is deepened. First, the design activity (obtaining comprehensive user insight) is zoomed in on, then the application domain (DfD) is elucidated.

Activity focus: applied ethnography and contextual inquiry

As explained in §2.1.1, HCD approaches take into account the lives and role of potential users in the design process. Sanders and Stappers (2008) describe the current landscape of HCD research, stressing that this landscape will change and evolve as new landscapes are created (see figure 2-3). According to Sanders (2006a), there are different 'design zones', each with their own clusters and bubbles of activity (clusters are supported by professional organisations and represented as larger areas, bubbles are not yet supported and are represented as smaller areas). The 'User-Centred Design' (UCD) zone focuses on obtaining user needs, by activities like contextual inquiry and applied ethnography. The focus in this research is therefore on the UCD zone, with specific focus on the activities of 'Contextual Inquiry' and 'Applied Ethnography' (see figure 2-3).

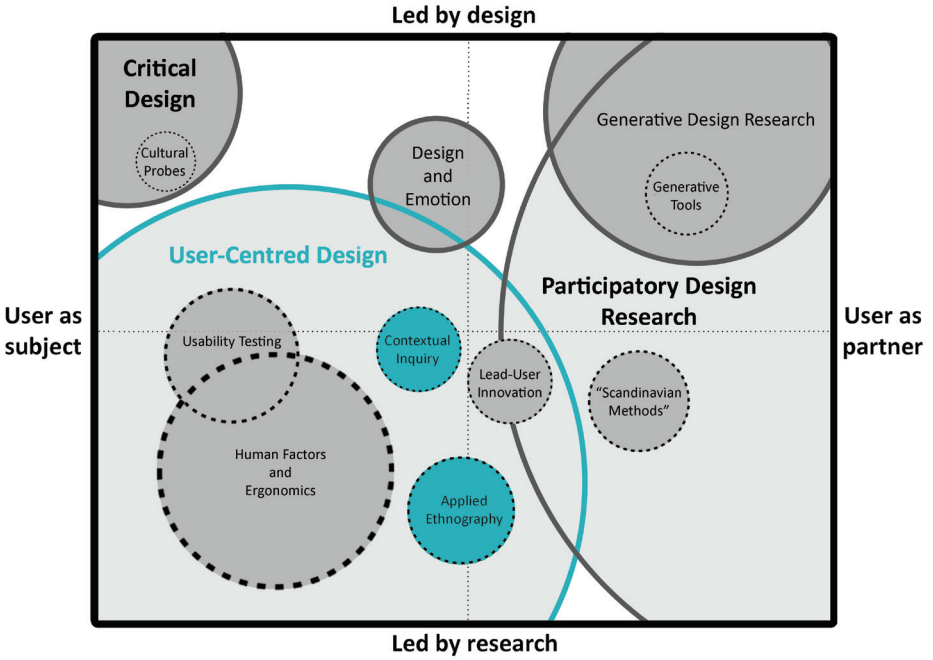


Figure 2-3: The human-centred design research landscape as adapted from Sanders (2006a); Sanders and Stappers (2008). Focus of this research indicated in blue

Contextual inquiry

Contextual inquiry is a step within contextual design that specifically aims at understanding who the potential users are and how they work (Beyer and Holtzblatt 1999). Contextual design and contextual inquiry are clearly described by Wixon, Holtzblatt, and Knox (1990). They explain that contextual inquiry is used to obtain data with users in their work environment to serve as a basis for design. This knowledge domain aids to gather insights in the field to obtain a detailed perspective on the user (Beyer and Holtzblatt 1995). Potential users are seen as partners, and the aim is to develop a shared understanding of thoughts, intentions and task orientation in a cost effective and timely way (Wixon, Holtzblatt, and Knox 1990). Although specifically aimed at interviewing and observing users at work (Beyer, Holtzblatt, and Baker 2004), contextual inquiry can also provide relevant information for obtaining insight in people's own living environments.

Applied ethnography

Ethnography encompasses the study of people and cultures, by exploring cultural phenomena from the perspective of the people being studied. Handwerker (2001, p. 17) defines culture as *"the systems of mental constructions people use to interpret and respond to themselves and the world around them."* Culture in this sense is unique to each individual, and different from cultures, which Handwerker (2001) describes as the mental constructions and behaviour of sets of people that share certain aspects of their individual culture. According

to Handwerker (2001), people participate in different cultures depending on their cognition, emotion and behaviour, which are shaped by their background and experiences. He argues for an investigation of the domains of cognition, emotion and behaviour, looking into those aspects that people share with others by detecting the labels, definitions, and intellectual and emotional associations of cultural phenomena. Handwerker (2001) stresses to identify those events, circumstances and processes that provide different sets of choices to different people. The evolution of RE is described below and visualised in figure 2-4.

Atkinson and Hammersley (1994) argue that ethnography in its modern form came into existence in the late 19th and early 20th century, when cultural anthropologists shifted to collect data first hand and, somewhat later, started to apply ethnography to their own society. However, the origins of ethnography can be traced back to the Renaissance when people were interested in the cultures of the people from the past, or, in that way, even back to Herodotus – the 'Father of History' (Atkinson and Hammersley 1994). Its origins can also be traced back to the age of discovery, which stimulated an interest in newly discovered cultures, or to 18th and 19th century German philosophy (Atkinson and Hammersley 1994). Pelto (2013) argues that Castrén, a Finnish language and ethnological researcher (1813-1852) was the first true ethnographic field researcher. Currently, ethnography is used in many disciplines, such as anthropology, sociology, and human geography (Willis and Trondman 2000).

Ethnographic researchers and research methods have been brought into design to fulfil *"the need for more informed insight into user experience"* (Stewart 2011, p. 516). Ethnography is currently used in the field of product design to discover markets and opportunities, to identify design criteria and to evaluate products and services (Handwerker 2001). As in a design process time and resources are often limited, user insight should be obtained rapidly. Traditional ethnography takes at least 12 months, preferably longer (Handwerker 2001), which is too long for design projects. Rapid assessment procedures came into existence which aimed to increase efficiency and productivity (Handwerker 2001). Applied ethnographic techniques now enable designers to obtain important insights in a feasible and cost-effective way, without the intensity of pure ethnography (Beebe 2014; Ball and Ormerod 2000). However, these techniques are more dependent on prior knowledge, and require outcome verification (Ball and Ormerod 2000). Thereby, when properly applied, they result in reliable and valid insights, but for deeper, broader, and more generalizable insights several weeks or months might be required (Handwerker 2001). Moreover, these techniques require adequate training and supervision to be able to properly use them (Beebe 2014; Chambers 2004).

In the 1980s the 'Rapid Rural Appraisal' emerged, which evolved into 'Participatory Rural Appraisal' (PRA). Robert Chambers popularized these rapid appraisal techniques (Beebe 2014). These techniques came into existence because of the dissatisfaction with existing rapid techniques like survey questionnaires, which were often developed by researchers from outside reflecting the concerns and categories of these outsiders (Chambers 2004). Chambers (2004, p. 2) describes PRA as: *"a family of approaches and methods to enable rural people to share, enhance and analyze their knowledge of life and conditions to plan and to act."* The PRA methods have been borrowed, adapted and invented based on experiences from the field, and

they continue to evolve based on practices and reflections (Chambers 2004; Narayanasamy 2013). Validity and reliability of PRA outcomes depend on following the ground rules: 1) learn from rural people; 2) learn in a rapid and progressive manner; 3) diminishing biases by being relaxed and listening; 4) optimise trade-offs between the costs and the quantity, relevance, accuracy and timeliness of the information; 5) cross-check methods, information, researchers and disciplines; 6) seek diversity; 7) facilitate participants to investigate, analyse and present themselves; 8) be self-critical and responsible by embracing errors and using own judgement; and 9) share information and ideas with the people, in the team and with organisations (Chambers 2004).

In contrast to traditional anthropological research and questionnaire surveys, PRA is more about starting a process than about gathering data (Chambers 2004). According to Chambers (2004), PRA uses a different mode of obtaining insights: open instead of closed, group focus instead of individual focus, using visuals instead of verbatim recordings, and using comparison instead of counting. He also explains that PRA involves having a different view towards the relationship between researcher and participant: instead of merely extracting information, the researcher tries to empower people. It also changed the action: building rapport and conducting fun activities instead of acting with reservation and conducting tedious fieldwork (Chambers 2004). Recently, PRA has been renamed 'Participatory Learning and Action', focusing on the role of the researcher, emphasising active participation of the people concerned, and providing a range of methods to deploy (Narayanasamy 2013). Narayanasamy (2013) stresses that participation is important as a means as well as an end of development, enhancing motivation, communication and cooperation, and leading to better decisions which are more likely to be implemented and sustained.

Beebe (2014) took inspiration from Chambers to develop the 'Rapid Assessment Process', which he later improved and labelled 'Rapid Qualitative Inquiry' (Beebe 2014). Qualitative inquiry is important for gaining an understanding of the categories and meaning that are constructed in a specific cultural context (Beebe 2014). According to Beebe (2014), a situation can be understood from the perspective of the local people in a relatively short time with sufficient rigor for public evaluation and usage by others. He argues that, on that account, the research should be done with a multidisciplinary team, should be focused on the insider's perspective, should use multiple sources and triangulation, and should develop understanding by iterative data analysis and collection of additional data. These are all requirements supported by Handwerker (2001). Handwerker (2001) propagates 'Quick Ethnography', which uses elements of research management and cultural theory. Quick ethnography provides a way of obtaining high-quality cultural data in a short time span (Handwerker 2001). While Handwerker (2001) states that experience improves questions, field notes and outcomes, he also illustrates a quick ethnographic process lasting just three days, during which researchers are unable to write an ethnographic report, but are able to produce recommendations. According to Handwerker (2001), for understanding a person's world it is necessary to (1) get to know the people, the places and the things that comprise that person's world; 2) understand the aspects of this person's environment which makes the person act in and think about the world in a specific way; and 3) be aware that recurrent

patterns of behaviour – culture- are an important aspect of people's environment, which result from social interactions with other people.

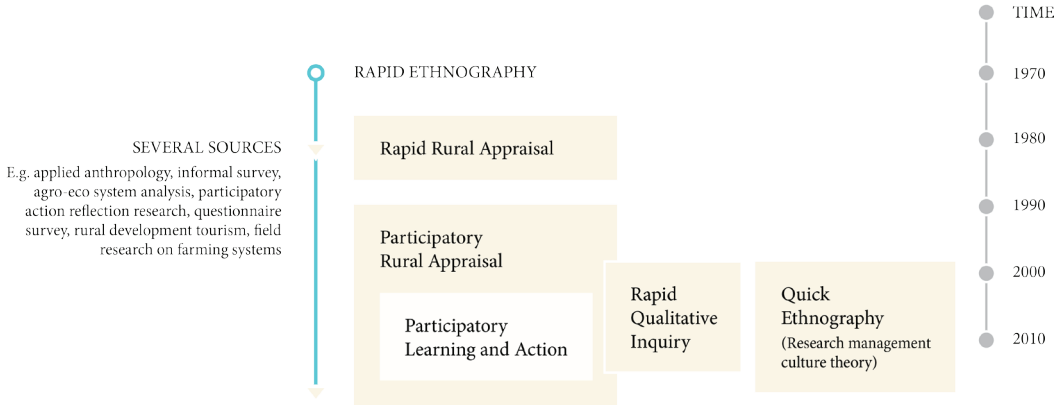


Figure 2-4: The evolution of rapid ethnography

2.1.5 The evolution of Design for Development

As explained in the introduction, the application domain of this research project is DfD. DfD is a domain established to develop products and services that improve the well-being of the disadvantaged and / or marginalised. DfD efforts have mainly focused on countries and regions considered to be the 'Third World'. In this section the evolution and current status of DfD are described. The evolution of DfD is visualised in figure 2-5.

From design for the real world to inclusive design

According to Donaldson (2009), DfD can be traced back to the Marshall Plan, where the United States financially aided Western Europe to stimulate its recovery after the Second World War ('reconstruction'). Margolin (2007) states that DfD has its origins in the 1960s, where the 'First World' provided aid and technical assistance to the 'Third World'. The approach was mainly top-down, aimed at economic advancement. As a response to bringing this Third World technologies that they could not accommodate, Schumacher co-founded the 'Intermediate Technology Development Group' (also known as the appropriate technology movement and now known as Practical Action) in 1966, with the aim of bringing technologies to developing regions that would fit their needs and skills (PracticalAction 2015). The focus of this movement is on low cost, appropriate, small-scale, locally relevant and environmentally sensitive solutions that aim to provide people the opportunity to help themselves (PracticalAction 2015).

In the 1970s the perspective started to change from economic to human development. An anthropological perspective was used to understand and interpret the 'needs of the poor' (Clarke 2015). Papanek's book 'Design for the real world', first published in 1971, calls for improving the well-being of people and the environment, following a bottom-up human needs approach. However, Papanek was, like other designers working in the field of DfD, also

accused of neo-colonial exploitation and interventionism. He was blamed to design products and services from a Western mind-set, not matching indigenous practices and ignorant of local power relations (Clarke 2015). arguing forNonetheless, since his book was published, designers and researchers have been paying more attention to DfD in their work (Amir 2004; Donaldson 2002; Margolin 2007).

In 1973, the United Nations Industrial Development Organization (UNIDO) started to discuss the domain of DfD (Brown 2014), and in 1977, UNIDO and ICSID joined forces to promote industrial design in developing countries and to speed up DfD activities to address the needs of the poor (ICSID, UNIDO, and NID 1979). In 1979, a meeting between industrial design thought leaders was held at the Indian National Institute of Design (NID) in Ahmedabad, organised in collaboration with ICSID, UNIDO and the Indian Institute of Technology Mumbai, which led to the Ahmedabad Declaration on Industrial Design and Development (ICSID, UNIDO, and NID 1979; Clarke 2015; Margolin 2007). ICSID, being criticised for their focus on 'developed regions', started to pay more attention to the potential of industrial design in 'developing regions', as well as to the view that design can improve quality of life (Clarke 2015). Attention was also raised towards the duality of preserving authenticity and culture versus expansionism and design for export (Clarke 2015; Margolin 2007). Furthermore, the meeting resulted in complementing the mainly community-oriented development ideas with a link to industry, science and technology (Margolin 2007).

At the start of the 20th century, Prahalad and Hart (2002) generated attention to the need to address the world's poor by considering their business potential. They noted that the 'Bottom of the Pyramid' (BoP, people living on less than $1,500 dollar per year) constitutes a consumer market of 4 billion people. In their article titled 'The Fortune at the Bottom of the Pyramid' and Prahalad's book published in 2004 under the same name, they argue that when addressing the poor with products, a small profit-margin can still result in high profits when sold to many (Prahalad 2005; Prahalad and Hart 2002). Prahalad (2005) furthermore suggests that the Bottom of the Pyramid (later changed to: 'Base of the Pyramid') should be recognised as resilient and creative entrepreneurs and value-conscious consumers. He suggests an approach to *"achieve sustainable win-win scenarios where the poor are actively engaged, and, at the same time, the companies providing products and services to them are profitable"* (Prahalad 2005, p. 27-8). Prahalad is praised for his approach, as well as criticised for his imperialist mind-set. Thereby, Karnani (2007) argues that Prahalad's promise is in fact a mirage as the BoP market is small and unlikely to be profitable for multinationals.

Recently, the DfD focus has shifted towards inclusive innovation. The Organisation for Economic Co-operation and Development (OECD) started a project on 'Innovation for Inclusive Growth' recognizing that innovation can serve inclusive development (OECD 2015). The World Bank defines inclusive innovation as *"knowledge creation and absorption efforts most relevant for the poor"* (Dutz 2007, p. 2). According to Joshi (2010), innovations should address sustainability and inclusivity in order to succeed. The 'Centre of Excellence for Sustainable Development' (CESD) describes the following characteristics of sustainable and inclusive innovations:

"Add value to the life of the people much beyond the immediate use of the product or service. Create a product or service of an uncompromising quality at a price that is affordable. Address the challenge of resource use efficiency to manage drastically low cost structures. Scalable and replicable to suit requirements of local circumstances and complexities" (Joshi 2013, p. 19)

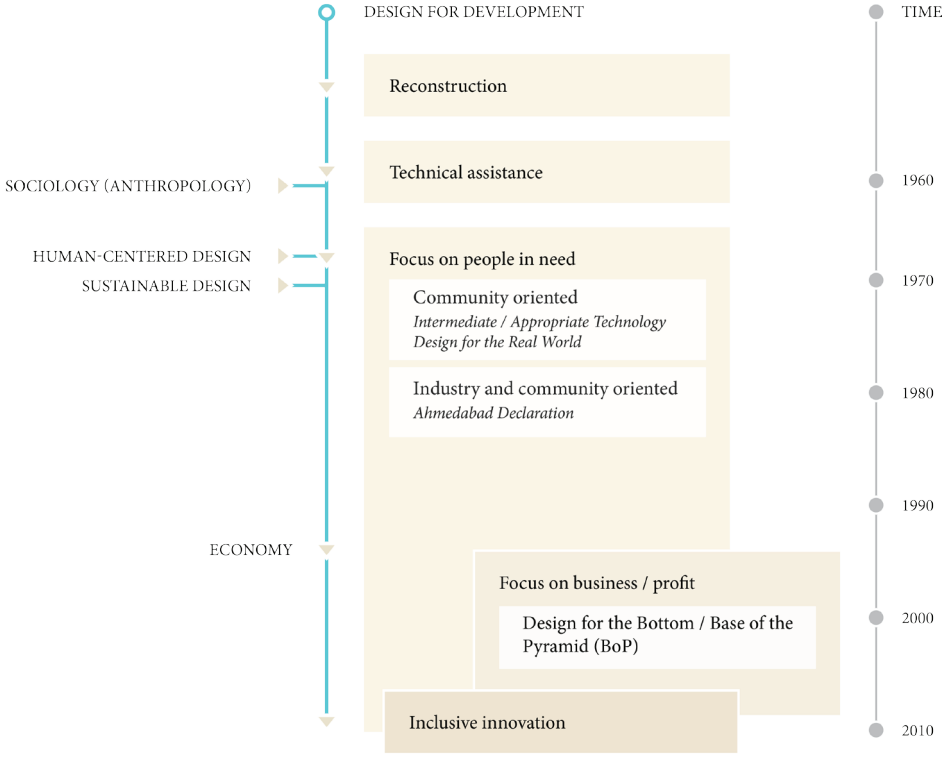


Figure 2-5: The evolution of Design for Development

Current status of Design for Development

Papanek and Schumacher are both considered as DfD thought-leaders (Donaldson 2009), but until now DfD has not received mainstream attention (Thomas 2006) and little seems to have changed in terms of reducing poverty (Escobar in Clarke 2015; Er 1997). This has mainly resulted in low-level technological projects addressing local needs (Margolin 2007) with often poorly engineered technologies (Donaldson 2006). Multinationals that manufacture their products in developing countries make little use of designers in those countries, and national development agencies still do not include much design in their aid programmes (Margolin 2007). The domain of DfD has grown quickly based on good intentions, however this growth has been haphazard (Donaldson 2009). Many authors agree that significant efforts are still required (Amir 2004; Donaldson 2002; Margolin and Margolin 2002).

According to Banu (2009), Donaldson (2006), Margolin (2007) and Shahnavaz (1989), DfD should no longer be based on benevolence, but on self-sufficiency. Prahalad and Lieberthal (2003) argue that companies addressing the disadvantaged and marginalised should rid themselves of their imperialist mind-set: they should stop thinking that exporting their existing products to consumers in emerging markets without adaptations, following their existing business models will boost their profits. Instead, Prahalad and Lieberthal (2003) stress that, if companies truly want to participate effectively in those markets and achieve global competitiveness, they have to stop targeting the affluent buyers who most resemble the western consumer, start understanding the markets and their people, start collaborating with them and start changing their businesses and business models. Karnani (2007) calls for a focus on the poor not as consumers, but as producers. Brown (2014) argues that the BoP mind-set should be capitalised, but in a way that is not disempowering, offensive or relying on stereotypes. According to Donaldson (2009), Iyer, LaPlaca, and Sharma (2006) and Ray and Ray (2011), for successful DfD projects, designers should obtain an understanding of the characteristics of the potential users and their context and consider product appropriateness. Coming from a radically different context, it is not an easy task to identify the valued beings and doings of the disadvantaged and marginalised, and to predict the consequences of developed products and services. Donaldson (2009) argues for a user-centric approach with a broad scope aimed at establishing partnerships and building local capacity.

2.2 Theoretical perspective: the capability approach

The capability approach (CA) is identified to be a promising approach to guide the designer in obtaining comprehensive user insight (see §1.5). In the following sections, the evolution of development is explained and the role of the CA in the domain of development is introduced, after which the CA itself is explained in more detail.

2.2.1 The evolution of development

In this section the evolution and current status of development are described. The evolution of development is visualised in figure 2-6.

From economic development to inclusive development

Although during the colonial period traces of community development can be found, the concept of development as we currently know it was created after the Second World War (Escobar 2015). Sachs (2010a) argues that the era of development began when president Truman of the United States of America delivered his inauguration speech in 1949. According to Esteva (2010) and Sachs (2010a), Truman changed the meaning of development and gave the global South officially the label 'underdeveloped'. The powerful in the world embraced this view, also shown by the fact that experts of the United Nations wrote a report on the dream of economic development of the underdeveloped (Escobar 2011). For long the focus of development has been on economic improvement, where the 'First World' provided loans and started social projects to support the 'Third World' (Margolin 2007).

In the 1960s social development started being included in the concept of development, and in 1963, the United Nations Research Institute for Social Development (UNRISD) came into existence (Esteva 2010). However, the main focus was still on economic growth and social aspects were considered separate from the economical ones (Esteva 2010). It was not until the 1970s that the focus shifted towards human development, i.e. development intended to improve people's well-being (Margolin 2007; Clarke 2015; PracticalAction 2015; Esteva 2010). The 'basic needs approach' came into existence in 1976, propagated a standard of living which all human-beings are entitled to (Esteva 2010). In the 1980s, the United Nations changed the definition of development and included the ability to create human well-being (Margolin 2007). In 1987 the Brundtland Commission introduced the term 'sustainable development' (Margolin 2007). A concern for future generations has led to attention being paid to the needs of the world's poor, and to the effects of technology and social organisation on the environment (WCED 1987). As Sachs (2010b, p. xi) argues, it is not possible for the world at large to follow *"the Euro-Atlantic model of wealth"*, as the required resources would be *"too expensive, too vast, too expensive and too damaging for the local ecosystems and biosphere"*.

In 1990, the first Human Development report was published by the United Nations, focusing on people and their opportunities and choices (UNDP 2015a). This human development approach was developed by economist Mahbub ul Haq in collaboration with several other development economists and is based upon Amartya Sen's work on the capability approach (UNDP 2015a). In 1995, the World Commission on Culture and Development (WCCD) published a report paying attention to social and cultural needs in the context of development, and proposing an agenda for exploration and clarification of key issues concerning culture and development (WCCD 1995). In the report, culture is not only viewed as a way of living together, but also as an end of development, stressing that human beings should be able to follow a way of life they choose themselves (WCCD 1995). The aim is *"to allow all individuals to lead a life that is decent, dignified and wise, without losing their identity and sense of community, and without betraying their heritage"* (WCCD 1995, p. 18).

In September 2000, the Millennium World Summit was held in New York, and attended by a large number of world leaders. It led to the adoption of the UN Millennium Declaration and a set of eight quantified basic human rights goals (MillenniumProject 2000). The declaration and the Millennium Development Goals (MDGs) were set to reduce extreme poverty (MillenniumProject 2000). A review of the MDGs in 2010 showed that poverty reduction is most effective when the benefits of development are shared by everyone, and people are involved and participate in creating opportunities and in decision-making (UNDP 2011, 2015b). The United Nations Development Programme's (UNDP) focus shifted towards inclusive development, an approach that follows the human development approach but focuses specifically on inclusion in order to enhance equality and development (UNDP 2015b).

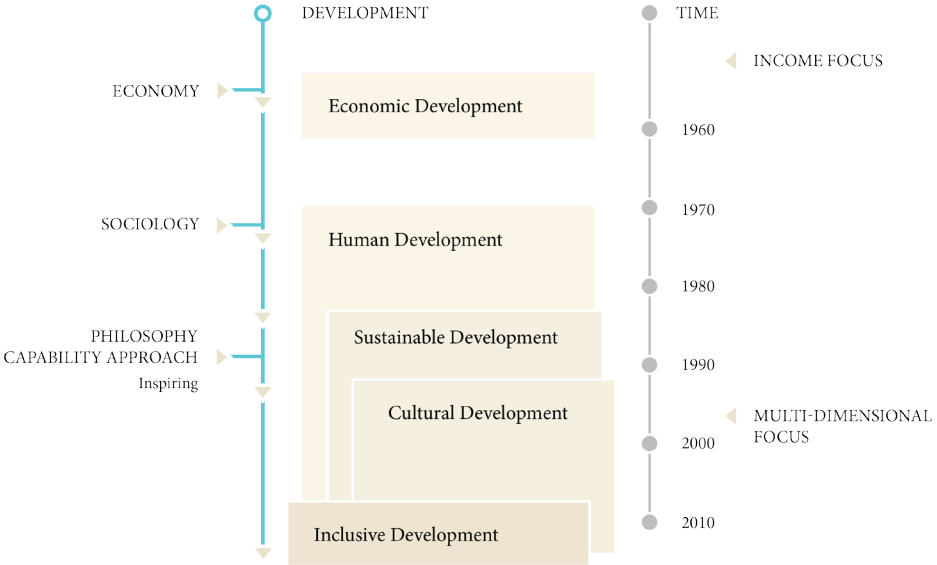


Figure 2-6: The shift from economic to human and inclusive development

Current status of development

In the 1960s already 'development' was being criticised for being the cause of dependency of 'underdeveloped' areas on the 'developed' areas and exploitation of the 'poor' by the 'rich' within the countries (Escobar 2015). In the 1980s the very idea of development started being criticised for being a Western discourse (Escobar 2015). A discourse that, from an environmental perspective, cannot be followed by the whole world (Sachs 2010b). According to Sachs (2010a), Truman's words formed the basis for ethnocentric intervention from the North and self-pity in the South, leading to bigger inequalities and loss of diversity due to standardization of desires and dreams following the Western mind-set. Esteva 2010 notes that development represents a path towards a desirable goal to some, but that this positive meaning does not hold for the 'underdeveloped', who are in this undignified and undesirable position. He argues that the word 'underdeveloped' is belittling, undignified and homogenizes a diverse group of people. Sachs (2010a) also acknowledges that the word development does offer a common ground, a higher goal and unites people all over the world, but argues that its conceptual foundations and language should be changed. Escobar (2011) specifically connects anthropology to development and argues that anthropological practices are shaped from a Western mind-set and that anthropologists should make sure to represent the interests of the people they study and describe.

2.2.2 Comprehensive and holistic view of human well-being

The CA aims to take into account all dimensions of human well-being (Chiappero Martinetti 2008; Robeyns 2005). However, the CA does not present a specific comprehensive doctrine, forcing a particular way of living onto a person, instead it focuses on the opportunities which allow for freedom to choose a way of living (Sen 1990). The CA advocates viewing the well-

being dimensions in a holistic way: it is important to look at all the sets of capabilities that are open to a person, thus the combination of capabilities that a person can achieve without having to choose between them (Robeyns 2011).

The CA does not only focus on individuals, but places people's well-being in a broader context. Sen (1999, p. 17) stresses that the approach considers *"both the processes that allow freedom of actions and decisions, and the actual opportunities that people have, given their personal and social circumstances"*. It is not only important to consider a person's history, values and characteristics, but also a person's access to resources and the available conversion factors that play a role in achieving desired opportunities. If the resources are available and the conversion factors are in place, the user possesses certain 'capability sets', which he / she can choose to achieve, which turns them into a 'functioning set'. The concepts of capability, functioning, choice, resources and conversion factors are explained in the following sections.

As argued in §1.5, the CA is identified to be a promising approach to guide designers in collecting comprehensive user insight. However, the CA is also being critiqued for, among others, being difficult to operationalise (Frediani 2010; Clark 2005; Robeyns 2011), too complex Chiappero Martinetti (2008), underspecified Robeyns (2006, 2008), too abstract (Clark 2005; Gasper 2007b), too much focused on the individual (Frediani 2010), localised in nature (Frediani 2010), and also for endorsing a specific comprehensive moral view (Robeyns 2011), not sufficiently considering negative freedoms (Clark 2005), and an insufficient focus on the means of freedom (Clark 2005). Not all this criticism is examined further in this thesis, but chapter 3 elaborates on the obstacles for using the CA in practice and on how these obstacles can be dealt with for the purpose of obtaining comprehensive user insight.

2.2.3 Capability approach elements in the scope of this research

The CA is an extensive approach that can be used in many ways. As the focus in this research is on the CA's practical application to obtain comprehensive user insight in the domain of product design, the focus is especially on those elements that constitute the opportunities and actual achievements of potential users. These elements are explained below and visualised in a descriptive model.

Capabilities, functionings and choice

The CA makes a clear distinction between what people are free to do to improve their well-being ('capabilities') and what they actually choose to do ('functionings'). As the word 'choose' already indicates, the difference between capabilities and functionings lies in the concept of choice.

Capabilities and their characteristics

Human capabilities are the valuable 'beings and doings' that a person can achieve. Within the approach, the definition of capability differs from its use in everyday language. Gasper (2007b) explains that within the Capability Approach (CA) capabilities refer to attainable outcomes and are consequently hypothetical, while in daily language, capability is mainly used in the sense of inborn or trained potentials (skills, abilities and aptitudes). The focus

in the CA is on these opportunities that enable people to do what they want to do and to be who they want to be (Robeyns 2005); the real opportunities that people have (Alkire 2005). The goal is to expand people's capabilities to enable them to choose the lives they want to live and have reason to value (Sen 1999). However, the CA does not specify which capabilities are valuable, as that is up to the people themselves to decide (Nussbaum 2003). The CA sees capabilities as the ends of processes aimed at achieving well-being and development (Robeyns 2005). Within the CA it is, however, recognised that capabilities can also be a means to an end, and in this way, in addition to being of intrinsic importance, capabilities can also have an instrumental role (Robeyns 2005). For example, sufficient nutritional intake is an end in itself, but is also a means to have good health. In turn, good health is a means to have the capability of participation in work.

Capabilities are opportunities that a person can choose from, and are therefore not directly observable (Sen 1995), and difficult to identify (Gasper 2007b; Kleine 2011). They are often interdependent, in the sense that one improved capability can lead to improvement of other, otherwise inaccessible, capabilities (Krishnakumar and Ballon 2008) and not all available opportunities can always be realized at the same time (Robeyns 2006). Thereby, capabilities differ per person and context, depending on available resources and conversion factors (Frediani 2010; Wagle 2009) and change over time (Wagle 2009; Burchardt and Vizard 2011). Lastly, some have argued that capabilities are incommensurable (Robeyns 2011), which means that different capabilities have no common standard of measurement and therefore cannot be evaluated and compared by the same standards.

Functionings

A person who has certain capabilities has *"the freedom to achieve various lifestyles"* (Sen 1999, p. 75). A person can choose to achieve a certain capability or a capability combination, or not. When a person achieves a certain capability set, the capability set is turned into a set of functionings (Sen 1999). This set of functionings might differ for people with the exact same capability set. For example, a person can choose to use a computer for playing games or for educational purposes. In the first case the capability to enjoy leisurely activities is achieved, in the latter the capability to be educated. As Robeyns (2005) explains, people have different ideas of what comprises the good life, and thus make different choices.

Personal choice and adaptive preferences

Kleine (2011) developed the 'Choice Framework' as an attempt to operationalise the CA. In this framework she describes four dimensions of choice: the existence, the sense, the use, and the achievement of choice (see figure 2-7). If different capabilities exist and people sense their availability, a person can make a choice which results in a specific outcome. Kleine (2011, p. 123) notes that choice does not only has an instrumental role, but also intrinsic value, as *"being able to pursue one's own choices is part of being fully human."*

The transformation of a capability into a functioning specifically depends on people's sense and use of choice. People's sense of choice relates to people's imagination and is influenced by several aspects, such as educational resources and discourses (Kleine 2010; Kleine, Light, and

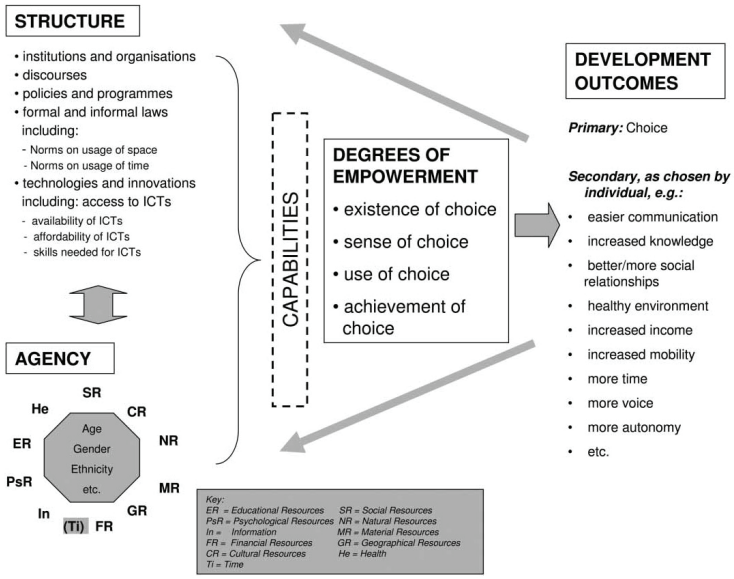


Figure 2-7: The Choice Framework (Source: Kleine 2012)

Montero 2012). The use of choice depends not only on people's preferences and conception of the good life, but also on people's ability to choose, which can be influenced by age and mental ability, and on outside influences, for example social pressure (Robeyns 2005). Both the sense and use of choice can be influenced by adaptive preferences. This phenomenon is described by Sen (1999, p. 63) as *"the adjustment of people's desires and expectations to what they unambitiously see as feasible due to their deprivation."* According to Clark (2009), adaptive preferences come into existence for several reasons: (1) the malleability of people's aspirations and desires to the circumstances in which they live; (2) the social conditioning or cultural and religious indoctrination; and (3) people's own limitations to make informed judgments and rational choices.

Resources and conversion factors

The capabilities that people have are formed by a set of resources. People's ability to transform these resources into capabilities is influenced by conversion factors (Frediani 2010). Both concepts of resources and conversion factors are elucidated below.

Resources

Kleine, Light, and Montero (2012) describe eleven resources which comprise an asset portfolio that can be converted into capabilities. These resources are listed in table 2-1, where they are divided into internal and external resources.

Table 2-1: List of resources (Adapted from Kleine, Light, and Montero 2012)

Resource	Description
Internal	
Health	Physical and mental health of a person.
Educational resources	Education and skills acquired through formal and informal means.
Psychological resources	May include capability to envision, self-confidence, tenacity, optimism, creativity and resilience. Spirituality or religious beliefs can strengthen or weaken them.
External	
Material resources	The material objects owned. They are also essential inputs in the production process.
Financial resources	Financial capital in all its forms (such as cash, savings, shares).
Cultural resources	The habitus a particular person lives in, objects (such as paintings, instruments and monuments which only the initiated can use or appreciate) and prestige attached to things (for example to academic titles or leadership roles).
Social resources	Network of relationships of mutual acquaintance and recognition, or in other words membership of a group (can be defined by kinship, friendship, shared ethnicity or class, or informal commonality ties).
Natural resources	Geomorphologic and climatic conditions and related aspects (such as soil quality, naturally available resources, access to water, the attractiveness of the surrounding nature).
Geographical resources	The practical implications and intangible qualities of location and relative distances
Information	Access to information and the process of filtering and transforming information into meaningful knowledge.
Self-governed time	The available time a person has control over.

Conversion factors

Conversion factors say something about the circumstances in which a person lives and are defined as *"the degree in which a person can transform a resource into a functioning"* (Robeyns 2011, p. 13). Kleine, Light, and Montero (2012) describe conversion factors as the 'opportunity structure' of a person. Robeyns (2011) divides conversion factors into three sources: personal, social and environmental. These factors are described below, and Robeyns (2011) example of a bicycle is used to illustrate how these factors work. Figure 2-8 shows Robeyns' representation of the conversion process from means to functionings.

- Personal conversion factors: Factors internal to a person, such as metabolism, physical condition, gender, reading skills, or intelligence. A bicycle provides the opportunity for a person to move further, but not if a person misses both legs, is ill, or does not know how to cycle.
- Social conversion factors: Factors from the society in which one lives, such as public policies, social norms, practices that unfairly discriminate, societal hierarchies, or power relations related to class, gender, ethnicity or caste. Kleine (2011) notes the importance of structure in her Choice Framework; social structures consisting of laws, policies, programmes, institutions, organisations and processes. These elements can be considered to be part of the social conversion factors. In the case of a bicycle a person owns, if a

person is prohibited by his or her spouse or community to use that bicycle it does not add to opportunity expansion.

- Environmental conversion factors: Factors that emerge from the physical or built environment in which a person lives. Aspects regarding geographical location are, for example; climate, pollution, the proneness to earthquakes, and the presence or absence of seas and oceans. Aspects regarding the built environment are, for example; the stability of buildings, roads, and bridges, and the means of transportation and communication. Returning to the example of the bicycle: a bicycle is difficult to use in a desert without roads, or if it is too hot to exercise.

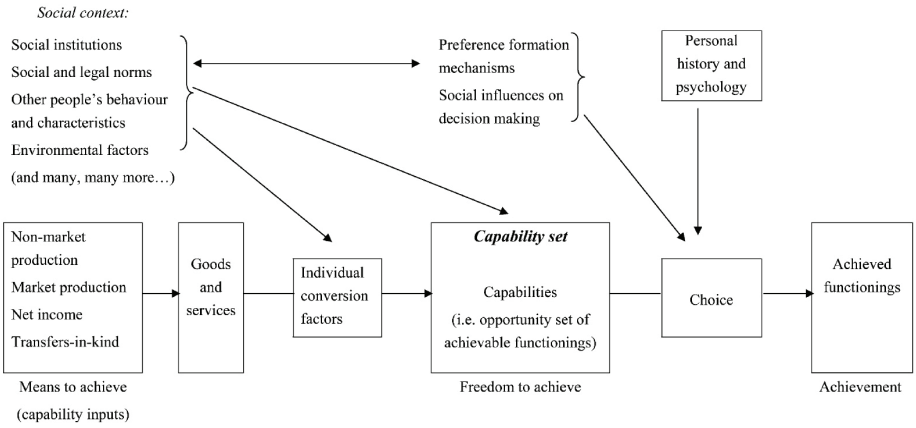


Figure 2-8: Representation of the conversion process from means to functionings (Source: Robeyns 2005)

Distinction between resources and conversion factors.

In the above descriptions of resources and conversion factors, there seems to be an overlap between resources and conversion factors. However, resources comprise a person's asset portfolio, where conversion factors form the opportunity structure that influences the transformation of those assets into opportunities. Internal resources comprise, for example, a person's nutritional intake, self-confidence and acquired skills, while examples of personal conversion factors are a person's intellect, gender or ethnicity. Likewise, social and cultural resources include membership of a group or certain objects, while social conversion factors can include policies and power relations. Lastly, natural and geographical resources can include relative distances and access to water, where environmental conversion factors can be related to climate and the availability of roads and seas, amongst others.

A model of capability approach elements

A model of capability elements has been established (see figure 2-9). This model visualises the above discussed capability concepts and their interrelations. Kleine's Choice Framework (see figure 2-7) and Robeyn's visualisation of the process of turning means into capabilities (see figure 2-8) have been the inspirational sources for developing this model.

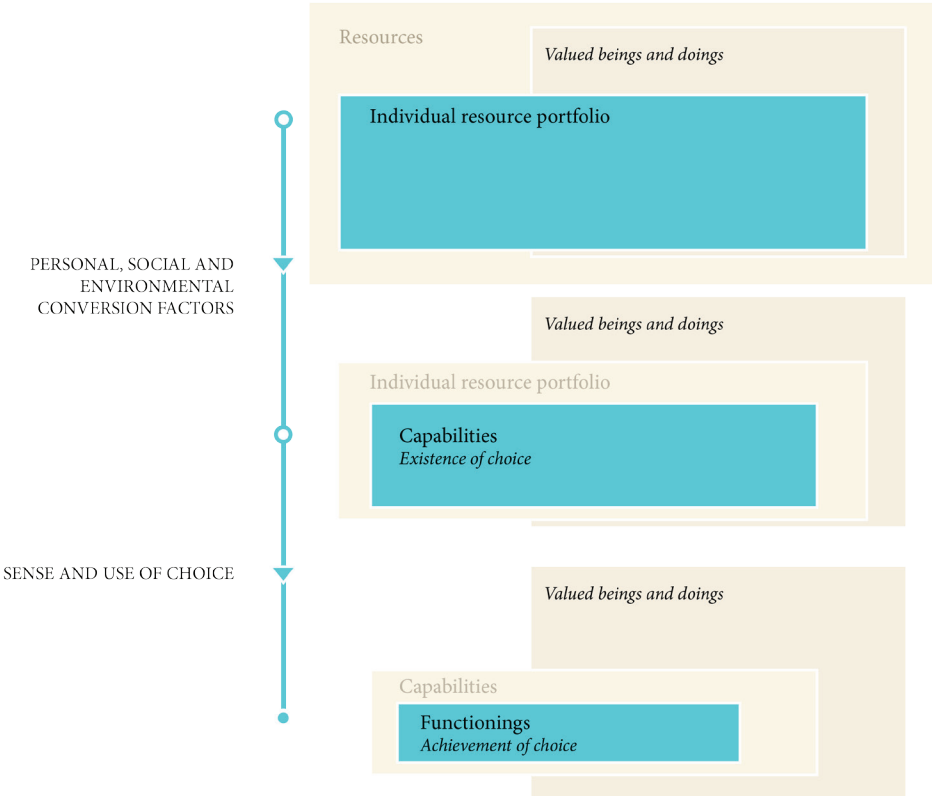


Figure 2-9: Model of capability approach elements

Of the set of all resources, an individual has an individual resource portfolio. When the personal, social and environmental conversion factors allow resources to become real opportunities, capabilities arise. Some of these capabilities coincide with an individual's valued beings and doings, others do not. When a person has a sense of this existing choice, this person can use this choice and transform the opportunity into a functioning, depending on preferences, social influences and personal history and psychology.

To illustrate this transformation: a person might be able to own a mobile phone (individual resource), but only has the capability of distant communication when this person is allowed to use it (social conversion factor), is able to use it (personal conversion factor) and has, for example, a power supply (environmental conversion factor). Whether this person actually achieves the capability for communication depends on the awareness of the phone's ability for distant communication (sense of choice), and the availability of other valuable options (such as playing a game on the phone, or going out and enjoy time with friends) which the person might prefer over communication through the phone (use of choice). If this person actually uses the mobile phone, this capability turns into a functioning.

2.3 Capability Driven Design

Connecting the CA with product design seems relevant as designed products and / or services can expand people's real opportunities (Johnstone 2007; Oosterlaken 2009; Kleine, Light, and Montero 2012), which is already illustrated by the above examples of the bicycle and mobile phone. In this section, the common ground between the two domains is described and presented in a conceptual model.

2.3.1 Common ground between product design and the capability approach

The domains of the CA and product design have several aspects in common; these are described below.

Complementary theories

Robeyns (2006) states that, in many cases, the CA does not replace other approaches, but provides complementary insights to them. Consequently, the CA is used by researchers from different disciplines (Anand et al. 2009). In Kleine's Choice Framework for example, the CA is used to provide complementary insights into the field of Information and Communication Technologies for Development (ICT4D). The CA offers a comprehensive and flexible framework suitable for multiple purposes (Robeyns 2011). Product design is a multidisciplinary profession which uses several additional bodies of knowledge, for example ergonomics, psychology, sociology and anthropology (Buchanan 2001b), but also marketing and business. It therefore seems plausible that the CA can serve as a complementary approach towards the domain of product design as well.

Holistic view

The CA not only looks at individuals, but also at their context. By taking conversion factors and personal choice into account, the CA has the potential to offer a holistic and comprehensive approach (see §2.2). Due to the transition in the domain of product design from designing products towards designing human systems, designers have broadened their perspective, considering not only the product, but also the user and the product's place in the environment (§2.1). The comprehensive view the CA offers therefore seems relevant to support the product design process.

Participation is key

Sen (1999) argued that the involvement of the people concerned is a requirement when enhancing capabilities. He also stated that capability selection is not a task for outsiders, but it needs to be a participatory, democratic process. The CA focuses on what people have reason to value themselves. Oosterlaken (2009) therefore connects the CA to participatory design. In §2.1, the different participatory design zones and the different levels of participation are described. Especially in DfD projects, aimed at the marginalised and disadvantaged, an interactive and co-creative design process is required to effectively come up with design solutions that fit the potential users. By co-creating solutions together with potential users, these users are also empowered to start designing themselves. Getting to know the user

is therefore only a first step in the design process. Following the CA, a high level of user involvement throughout the product design process is recommended.

Concern for human diversity

The CA takes human diversity into account by focusing on the plurality of functionings and capabilities as the evaluative space and by taking conversion factors into account (Robeyns 2005). This broad view causes a focus on *"things that really matter" and avoids "the neglect of crucially important subjects"* (Sen 1999, p. 34). Oosterlaken (2009) and Toboso (2011) therefore relate the CA to universal design. Universal design is the development of products and services that are accessible to, and usable by, as many people as reasonably possible (Keates and Clarkson 2004). However, every solution for a design problem means compromising between contradictory criteria (Roozenburg and Eekels 1998) as no one system can meet everyone's need (Nieusma 2004). Taking into account human diversity is therefore relevant during the design process.

Balance between individual and collective beings and doings

There is an on-going debate between CA researchers about a focus on individual and/or collective capabilities (Robeyns 2006). The CA measures well-being in terms of an individual ability, while some capabilities belong to societies or groups more than they do to individuals (Gore in Frediani 2010). Therefore, it might be useful to take both into account. A focus on collective capabilities, however, can complicate the process of agreeing on a capability set (Kleine 2010) and in this process there are obstacles such as overruling individual values by the majority (Clark 2009). A focus on individual capabilities raises the question of how far individual preferences must be respected and can be justified (Robeyns 2006). Designers face similar issues. They need to identify individual, community, and stakeholder needs and balance these (Sklar and Madsen 2010). Appropriate choices need to be made to satisfy the priorities of the people involved (Sklar and Madsen 2010).

Focus on personal choice

The CA focuses on people's ability to choose the lives they have reason to value (Sen 1999). Of all the available choices, only those between opportunities that people value are relevant (Johnstone 2007). Different people value different opportunities and they therefore make different choices. Users' personal choice is also relevant for designers. Designed products and services can enhance people's choices (Gharajedaghi 2011). A designer develops products and services that provide the existence of choice that a user can sense, use and achieve. Kleine (2011) states that the designer can limit the user's choices by making decisions before the user gets this choice. In this way, a designer can also steer towards certain behaviour. Persuasive design can be used as a strategy for changing people's attitudes (Parmar 2009). However, there is only a thin line separating persuasive design from paternalism. Suber (1999, p. 632) describes paternalism as *"to act for the good of another person without that person's consent."* The design decisions the designer makes during the development of products and services largely define the choices provided to its users.

Aim for development

The CA focuses on the opportunities that people have to do what they want to do and to be who they want to be. Sen (1999) describes development as freedom, and sees these freedoms (or: opportunities) as the ends of well-being. Product design aims at creating products and services that provide people a choice and improve their quality of life, and DfD specifically aims at development. However, as stated above, the concept of development is mainly created by a Western mind-set. Therefore, in the process of development it is important to truly represent the interests and activities of the people under study, as it is their valued beings and doings that need to be improved, not the designers'. However, no designer can be free of bias, assumptions and pre-conceptions.

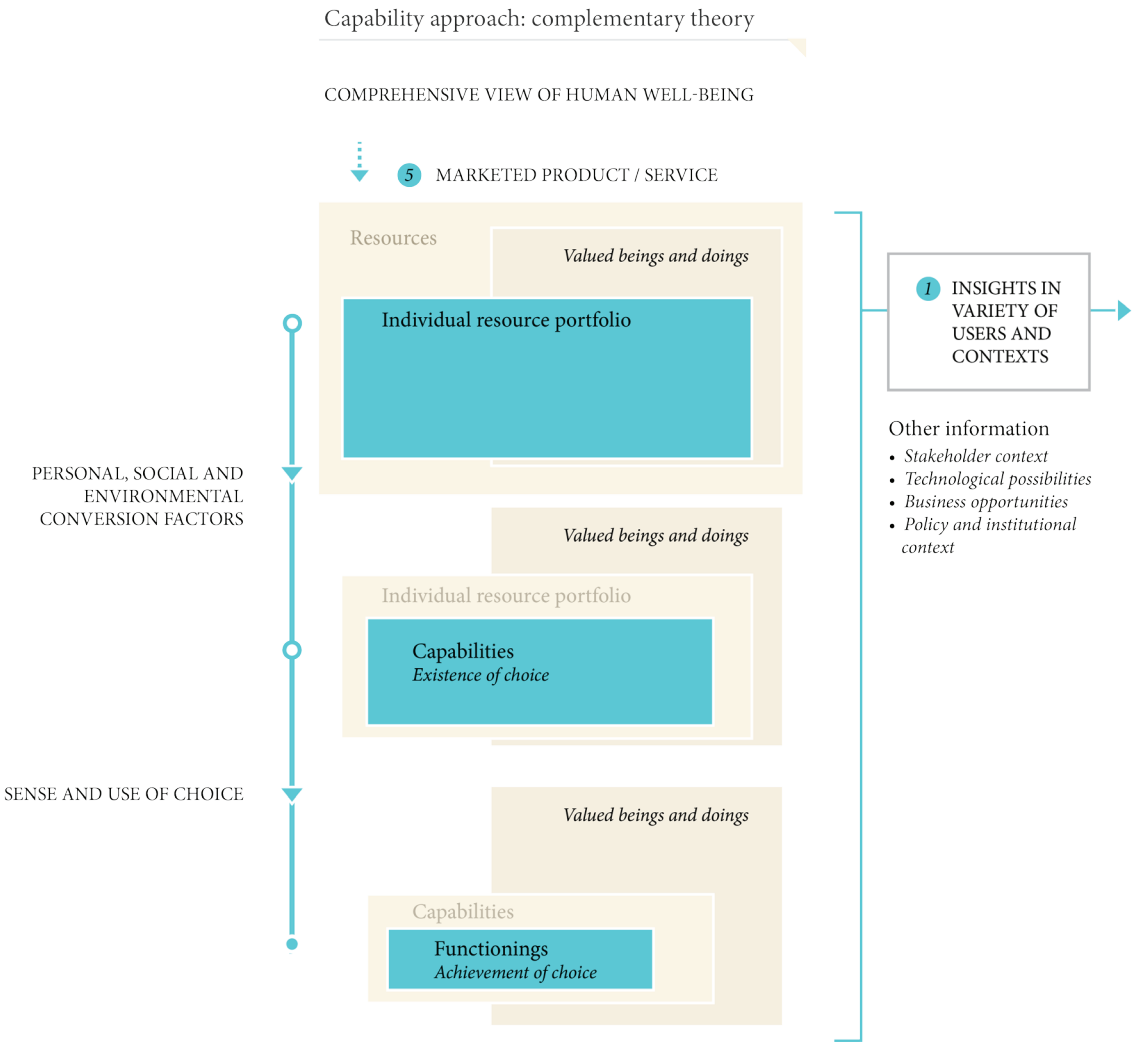
2.3.2 The capability approach informing the product design process

The CA potentially provides the designer with information to explore the context, to inform design decisions during the creative process, to evaluate ideas and concepts, and to analyse the impact of the final marketed product. The comprehensive view the CA offers has the potential to assist designers to objectively approach potential users in their context, to obtain an insider's perspective in order to make well-informed and deliberate trade-offs and decisions with minimal exclusion of users, which leads to the development of desired, usable and useful products and services. Therefore, the use of Sen's CA may inspire product designers to enhance socially responsible product design and innovation.

Based on theory from the domains of the CA and product design, a conceptual model has been developed to visualise the role the CA can play as a complementary theory in the product design process (see figure 2-10). The model brings together the product design process (as presented in fig. 1-1 in §1.2) and the model of CA elements (as presented in fig. 2-9 at the end of §2.2).

2.3.3 Conclusions

The common ground between the CA and product design illustrates the relevance and the possibility of connecting both domains. Following the common ground between product design and the CA, the CA can serve as a complementary theory for design, in order to provide analytic guidance to obtain comprehensive insights into the valued beings and doings of a variety of potential users and their contexts. Applying the CA in the domain of product design does not necessarily require a change of the design process, it merely offers designers a grip on what to explore. By considering people's valued beings and doings during the design process and during design decisions, the resulting products and services are more likely to offer valuable choices for its users.



The numbers in figure 2-10 present a process taking place:

1. By identifying potential users' opportunity space (resources, capabilities, functionings, preferences, needs, conversion factors and choice making behaviour), designers can obtain comprehensive user insight.
2. The insights inform the design process, aiding in defining the problem and developing design requirements.
3. The insights are considered throughout the product development process, enabling designers to make deliberate design decisions, keeping the potential users involved.

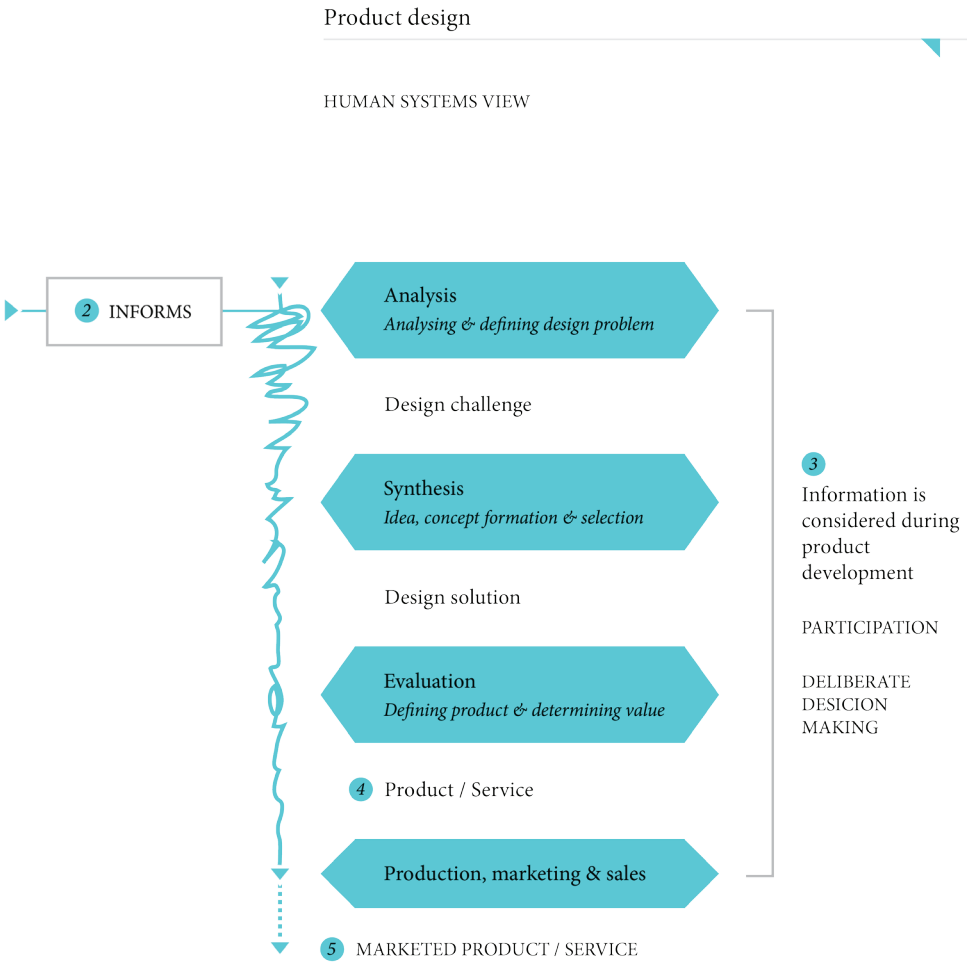


Figure 2-10: Conceptual model of using the capability approach as a complementary theory in product design

4. To enhance people's real opportunities, product designers can develop products and services that provide users with choices they value.
5. When the choice is made to use the product and/or service, it impacts the life of its user. The new opportunity space can be evaluated and again used to inform a new design process.

2.4 Exploring capability driven design: A case

To explore the relevance of using the CA for the domain of product design, and particularly for DfD, a DfD project was analysed from a capability perspective, based on the model represented in figure 2-10. This project concerns the development of a silk reeling machine for rural women in Eastern India: the Anna Tasar Reeling Machine (ATRM). This machine processes Tasar silk cocoons into yarn by means of a reeling process. The author developed this reeling machine for Tasar silk for her Master's graduation project at the faculty of Industrial Design Engineering of Delft University of Technology in 2006. The outcome of this project has been implemented in rural eastern India. In this section the development and the outcome of this project are critically investigated based on a list of capabilities.

2.4.1 A list of capabilities

Although the use of a list of capabilities is highly debated within the CA (see §3.4), for this study a general list of 'beings and doings' has been developed based on the CA literature. As Sen (1999) argues, capabilities are context-specific and in need of public deliberation, which the list of beings and doings developed for this evaluative exercise does not live up to. The reason behind this is that this exercise was not executed to establish a method for using the CA in the domain of product design or to prove its relevance, but to obtain insights into what a CA perspective offers the domain of product design. It is an exploration of the CA's relevance for product designers. Furthermore, it must be noted that the CA perspective is used here to evaluate this case after its development and implementation, and not prior to. The users of the machine were not involved in this study; the input is gathered from the Non-Governmental Organisation (NGO) involved.

Alkire identified 37 lists that all contain poverty-related dimensions based on existing data, normative assumptions, public consensus, ongoing deliberative participation, and / or empirical analyses (Alkire 2007). Among these lists are Chambers dimensions of deprivation, Max-Neef's axiological categories, Narayan's voices of the poor, and Maslow's instinctive and universal needs (Alkire 2007, 2008). For an overview of all lists see Appendix A1. For this exercise, all the dimensions of Alkire's lists were classified according to the seven aspects of well-being identified by Williamson and Robinson (2006): biological, mental, emotional, material, social, cultural and spiritual well-being. The full list containing all dimensions and their descriptions, is presented in table 2-2.

The listed beings and doings are described in general terms, for example being literate or speaking up in public. Robeyns (2011) explains that the focus of the CA is on these general capabilities and that the way people translate these capabilities (for example reading a street sign or publicly supporting a political party) is up to them. The design project of the silk reeling machine was analysed by going through this list of general beings and doings in order to extract more specific capabilities. This analysis is based on what Alkire (2008, 2007) describes as 'informed guesses from the researchers'.

Table 2-2: List of general beings and doings and their descriptions

Biological aspects of well-being	
Life / Physical survival	Being able to live to the end of a human life of normal length
Nutrition	To be adequately nourished
Health	Being able to have good bodily and mental health
Reproduction	Being able to have good reproductive health
Healthcare	Being able to receive good healthcare
Shelter	Having adequate shelter
Sanitation	Having adequate water, sanitation and hygiene
Rest and exercise	Having adequate periodic rest, and adequate physical activity
Physical security	To be secure against harassment, pain, anxiety and violent assault, and being able to have pleasurable experiences, safety, harmony and stability
Mental aspects of well-being	
Education	Being able to receive education, to experience and appreciate beauty, and to develop curiosity, learning, and understanding
Practical reason	Being able to form a conception of the good and to engage in critical reflection about the planning of one's life
Identity and individuality	Having a sense of the aspects that makes one unique
Morality	A sense of goodness, righteousness, duty, and obligation
Freedom of sexual activity	Having the opportunities for sexual satisfaction and choice in matters of reproduction
Freedom of movement	Being able to move freely from place to place
Freedom of residence	Being able to reside where one wants
Meaningful work	Being able to choose one's work, and to work as a human, to exercise practical reason, and to enter into meaningful relationships of mutual recognition with other workers
Leisure	Being able to laugh, to play, to enjoy recreational activities
Political liberty	Having the right of political participation, protections of free speech and association
Emotional aspects of well-being	
Freedom of mind	Having the freedom of thought, imagination, opinion
Freedom of experiencing and expressing emotions	Having the freedom to experience emotions and express oneself, not having one's emotional development blighted by fear and anxiety.
Happiness	Being able to lead a happy, enjoyable life
Love, longing, and grieve	Being able to experience and to give love and affection
Worry-free	Having a prosperous life, without worries and with confidence in the future
Self-respect	Having the social bases of self-respect and non-humiliation
Aspirations and self-actualization	Being able to express and activate all one's aspirations and capacities
Achievement	Being able to accomplish one's aspirations, to demonstrate competence and make a lasting contribution
Equality	Being able to be treated as a dignified being whose worth is equal to that of others
Recognition	Being recognised and having status
Having power	Having social status and prestige, and having control within the household and the more general social system (includes decision-responsibility)
Acceptance and self-adjustment	Being able to adjust to circumstances
Self-acceptance	Being able to accept oneself and one's circumstances

Material aspects of well-being	
Goods	Being able to hold property / to have sufficient assets, control over material environment
Services	Having access to services i.e. mobility and media services
Housing	Being able to have a place to stay
Economic security	Being economically secure at present and in the future
Settings of interaction	Having places to meet others for educational, spiritual or creative purposes
Social aspects of well-being	
Significant relationships	Being able to form attachments to people and things outside ourselves, to recognise and show concern for other humans, to engage in various forms of social interaction; to be able to imagine the situation of another
Family	Being able to care for, bring up, marry, settle and raise children
Friends	Being able to form friendships and to enjoy companionship
Community	Being able to live in and participate in a community
Other species	Being able to live with and have concern for animals, plants, and the world of nature
Social security	Living in an open, just, and secure environment
Privacy	Being able to seclude oneself or information about oneself
Cultural aspects of well-being	
Cultural identity	Having respect for the customs and ideas of one's culture or religion, and being able to choose to reject or accept those customs and ideas
Spiritual aspects of well-being	
Peace of mind	Being able to find meaning, inner harmony and inner peace
A spiritual life	Being able to find meaning and value, and being free to believe or not believe in a greater than human source

2.4.2 The project: The Anna Tasar Reeling Machine

The development of the ATRM project was part of the larger 'Tasar Silk' project of the Indian non-governmental organisation (NGO) PRADAN. This NGO organizes poor rural village women in so-called Self-Help-Groups (SHGs) and engages them in independent livelihood activities. Tasar silk reeling is one of these activities, deployed in the states of Bihar, Jharkhand, and Chhattisgarh. In this section some background information about PRADAN's reeling project, the development of the ATRM, and its implementation is provided.

The Tasar Silk Reeling Project

The Tasar silk reeling activity has traditionally been a low-paid activity in the states of Jharkhand, Bihar and Chhattisgarh, carried out by poor rural women in their spare time. Silk reeling is done mainly by women in weaver families (without any remuneration), or as an uncertain, low paid type of wage labour. PRADAN separated the yarn production from the weaving activity and promoted it as an independent, separate, and viable enterprise. They introduced existing machinery (a reeling and a re-reeling machine, see figures 2-11 and 2-12) to replace the primitive and rudimentary technology of palm or thigh reeling (see figure 2-13). They organised women from different SHG's into reeling groups who work together in a reeling centre. The reeling centre was specially built for this activity in the centre of several villages to allow women from many villages to join the activity. The women who

engage in reeling generate income in a dignified way which enables them to better fulfil their basic needs, gain more confidence, and become more self-sufficient and independent. It also reduces the need for the husband to migrate to the city for work.

Figure 2-11 and 2-12: The Tasar silk reeling and re-reeling machines as introduced by PRADAN
Figure 2-13: Thigh reeling, a traditional method of Tasar yarn reeling (picture by PRADAN)

PRADAN makes use of government subsidies to help the women purchase the machine as the women cannot afford to buy a machine themselves. PRADAN also provides reeling and entrepreneurial training, they help out with cocoon buying and storage, and in the sales of the yarn. They also employ technicians for repairs of the machines. Moreover, they opened up new markets for Tasar silk. Because the activity flourished well, PRADAN organised the women in their own producers' company called MASUTA.

The Development of the Anna Tasar Reeling Machine

The reeling machine that PRADAN introduced greatly improved the working circumstances of the women, but the machinery suffered from several problems (e.g., energy-loss, failing materials, safety issues, physical problems due to running the machine by pedalling, and yarn quality problems). With help from one of their subsidiaries (ICCO, a Dutch NGO) the first author was appointed to re-design this machine (Mink 2006). This effort led to a significantly improved machine and was named 'Anna Tasar Reeling Machine'. Up-scaling started leading to large scale utilization. In November 2012, 219 machines were running in several villages. For a thorough description of the development of the ATRM and the outcomes of the project, see TEXTBOX I.

TEXTBOX I - The Development of the Anna Tasar Reeling Machine

The re-design of the ATRM was executed following the design methodology described by Roozenburg and Eekels (1998). During the analysis phase, all stakeholders were interviewed to identify the design requirements. Reelers, PRADAN staff (field workers, technicians, yarn graders, and team leaders), and the managing director of MASUTA were all interviewed about the use of the existing machine, the quality and characteristics of the reeled yarn, and about their preferences for a new machine. The full process from cocoon rearing up to yarn making, weaving, and fabric marketing was analysed to obtain a good view of this process and its related requirements. The reelers were also observed during their work on the machine, during SHG meetings, and during daily activities. Some of them were also interviewed about their lives, and because no anthropometric data was available of rural North-Indian women, measurements were taken of 24 women. From a technical point of view, the existing machine was fully analysed, as well as other silk reeling machines which are in use in India, and the production possibilities in India were explored. During this analysis phase, many requirements were identified, mainly concerning the technical and economic function of the machine, and concerning the user comfort during the reeling activity.

Due to the high technological character of the machine development, the reelers were not involved in the synthesis phase of machine development. They were neither involved in idea generation, nor in choosing between several ideas and concepts. For this phase, mainly technical knowledge of the reeling process and of machines was required, therefore only PRADAN and MASUTA staff were involved. The preliminary design was manufactured in 2006 in Nagpur, and thereafter the machine was extensively tested by reelers, in which they could suggest changes. During further adjustments, reelers were continuously involved by testing the machines (see figure 2-14). Their feedback together with technical optimisations led to the final machine design, which was ready for up-scaling in 2010. Currently, the machine is continuously being optimised, with help from MASUTA's own technicians, the reelers, and the Central Silk Board of India.

Figure 2-14 (a-h): Several prototypes of the Anna Tasar Reeling Machine (pictures c-h by MASUTA)

Results after implementation

The impact of the ATRM was evaluated after implementation, and it turned out that this machine further improved reeling activity, ensuring a higher yield and a higher quality yarn, while the cost of the reeling machine is approximately the same as of the old machine (around INR 25,000). The reelers are able to extract more yarn from one cocoon, which according to MASUTA's managing director, is probably because the reelers have more time to concentrate on extracting the yarn, and because there is less yarn breakage. Therefore, the reelers' income increased, compared to

the income they earned with the old machine. This is shown in the data from Danidih village in Jharkhand (Table 2-3)[5]. This additional income enables the women to better fulfil their basic needs, and to gain even more confidence, by becoming more self-sufficient and independent.

Table 2-3: Improvements for reelers of reeling centre in Danidih (Godda district, Jharkhand), due to ATRM

	Old Machine	**ATRM**
*Yarn quality ratio (grade A:B:C)**	64 : 36 : 0	92 : 8 : 0
Reeled yarn per working day (gram)	127	171
*Profit earned per working day (Indian Rupees)***	30	56

* *A-grade yarn is the best quality, C-grade yarn is unsuitable for selling.*

** *For heavy physical labour, women are paid 10 to 20 Rupees per full working day (8 hours), this income is earned during the 4-6 hours that a reeler spends on average in yarn production per day.*

The ATRM is also more comfortable and easier to use, is more energy efficient and user-safety has improved. Additionally, the ATRM thereby introduces the opportunity to produce a new type of yarn, which ensures better sales, as there is a big demand on the market for untwisted yarn. This type of yarn is called untwisted yarn[6], and was, until now, only produced by women in traditional weaving pockets using the traditional methods. Solar panels are now used to supply energy to the machines, and therefore pedalling is no longer required.

Some aspects concerning the machine were adjusted during prototype testing. Initially the machine was placed on the floor (as can be seen in figure 2-14d). Sitting on the floor follows Indian culture, however, it worsened the working position of the women instead of improving it. Therefore, the reeling machines are now placed on a platform (figure 2-14e and f). Secondly, the machine was designed to have four spindles, but due to the increased speed of the spindles, the women were only able to use one or two. Therefore, the ATRM was downsized, and currently only contains two spindles.

The ATRM also had some undesirable effects; it is more difficult to mend the ends of the yarn after breakage because the yarn gets more entangled on the bobbin. This is a challenge that still needs to be overcome during further optimisation. Secondly, the covering of rotating parts makes the machine safer to use, but also makes maintenance more difficult. This was, however, a deliberate choice. Thirdly, the ATRM is easier to use, which is beneficial for the reeler, but might also encourage child labour. PRADAN keeps a close eye on keeping children from working fulltime in yarn production. The children do sometimes help their mothers during reeling, but mostly they do not reel themselves, as yarn reeled by occasional reelers is of low quality with low recovery. In some villages, grown-up girls who stopped going to school (due to the distance to high school, girls are not always sent there) start reeling as a full time business before their marriage. Lastly, PRADAN requested a small and light-weight machine that could be taken home to be used there. For several reasons, PRADAN has now started promoting individual home-based reeling for new reeling villages[7]. Reeling at home enables the reelers to work on the machine when it suits them, it does not require dependence on a reeling centre manager, and the reeling activity no longer suffers from closure of the centre due to community disputes. It therefore turned out that, where the ATRM was designed to give the reelers the choice to work in a reeling centre or at home, new reelers are not actually given this choice. However, if reelers are given the choice, it can be questioned to what extent they will be able to exercise this choice.

5 *For each reeler, data are kept to capture their performance and to be able to calculate the reeler's payment.*

6 *The warp of a fabric requires twisted yarn for strength. For the weft untwisted yarn can be used for a softer feel.*

7 *Obtained from email-contact with Mr. M. Ray in 2011, at that time director of MASUTA Producer's Company Ltd.*

2.4.3 A capability perspective with hindsight

In this section, a capability perspective to the ATRM case is applied using hindsight, in order to capture a more comprehensive view of the impact of the ATRM on the lives of its users. The analysis of the ATRM from a capability perspective was achieved by using the list of general beings and doings (§2.4.1). The input for the analysis was based on the knowledge of PRADAN employees and of the author. The capability parameters identified were validated by consulting the Producer's Company MASUTA[8] in Jharkhand, India. No quantitative statements are provided, as in this research project no method was decided on to measure the identified capabilities. As Sen (1995, p. 46) states:

> *"Having more of each relevant functioning or capability is a clear improvement, and this is decidable without waiting to get agreement on the relative weights to be attached to the different functionings and capabilities."*

Therefore, this investigation only aimed to detect an increase or decrease in capabilities and functionings. All the detected beings and doings, relevant to this project, and their enhanced and decreased capabilities due to the usage of the ATRM are summarised in table 2-4. The remainder of this section clarifies these relevant beings and doings.

Table 2-4: Overview of enhanced (+), decreased (-) and unchanged (o) capabilities due to design of the Anna Tasar Reeling Machine. Concerning two aspects the effects are unclear (/).

Biological aspects of well-being	
Health	
+	Enhanced: Due to covering of the machine, the safety for the reelers and their children improved / When the machine is placed on a table, the ergonomic posture of the reeler improved
-	Decreased: When the machine is placed on the floor, the ergonomic posture of the reeler decreased
Mental aspects of well-being	
Freedom of movement	
+	Enhanced: Due to promotion of home based reeling, the solar panel attached to the roof enables children to study in the evening
-	Decreased: Due to promotion of home-based reeling, the reeler is restricted from moving around freely.
Meaningful work	
o	Unchanged: The machine still enables the women to work in a dignified manner
-	Decreased: Due to promotion of home based reeling, the reeler has less possibility to enter into meaningful relationships with other workers
Emotional aspects of well-being	
Happiness	
+	Enhanced: Additional income and / or time improve the reeler's ability to lead a happier, more enjoyable life / A better ergonomic posture increases the reelers health, which enhances their happiness
Love	
+	Enhanced: Affection towards daughters may be enhanced when daughters run the machines for their mothers to ensure economic security
Worry-free	
+	Enhanced: Additional income and/or time improve the reeler's ability to lead a more prosperous life

8 *The information is gathered through email contact with Mr. M. Ray in 2011, at that time MASUTA's director being in close contact with the implementing non-governmental organisation PRADAN.*

Self-respect

+ Enhanced: Additional income increases self-respect
o Unchanged: Self-respect due to owning and using the machine by themselves
- Decreased: Due to covering the rotating parts, the women themselves have more difficulty to maintain the machine. This reduces their confidence and self-respect

Achievement

+ Enhanced: The additional income gives the reeler a greater sense of achievement

Equality

o Unchanged: Reeling enables the reeler to be treated as a dignified being who is equal to others

Recognition

+ Enhanced: The additional income increases the recognition and status of the reeler

Having power

+ Enhanced: The additional income increases the dominant position of the reeler within the household

Material aspects of well-being

Goods

+ Enhanced: The machine is easier to use which gives the reeler more control over their material environment
o Unchanged: Control over their material environment due to local repair possibilities
- Decreased: The machine is more difficult to maintain and therefore reduces the reeler's control over her environment

Economic security

+ Enhanced: Additional income gives economic security / Children can run the machine if the reeler herself is not able to, which increases the economic security of the family
/ Unclear: Does the reeler earn more income when she works at home (reel whenever she has time and use of light), or when she works in a reeling centre (away from household chores and children)?

Settings of interaction

- Decreased: Due to promotion of home based reeling, the reeling centre is no longer a setting of social interaction

Social aspects of well-being

Significant relationships

- Decreased: Due to promotion of home-based reeling, attachments to friends decreased / Due to promotion of home-based reeling, engaged in various forms of social interaction decreased
/ Unclear: Not much attention was paid to the attachment of the reelers to the machine (shape, size, color), unclear if the machine's characteristics influence this

Family

+ Enhanced: Due to promotion of home-based reeling, the additional time and the availability of light in the house increases the time to care for family

Friends

- Decreased: Due to promotion of home-based reeling, the possibility to form friendships decreased / Due to promotion of home based reeling, enjoyment of companionship decreased

Community

- Decreased: Due to promotion of home based reeling, participation in the community decreased

Cultural aspects of well-being

Cultural identity

+ Enhanced: When the machine is placed on the floor: working according to culture is enhanced by sitting on the floor / Due to promotion of home-based reeling, living according to culture increased
o Unchanged: Reeling is a job which matches the culture more than heavy physical labour
- Decreased: When the machine is placed on a table: working according to culture is decreased

Instrumental role of capabilities and resources	
Multiple aspects of well-being can be enhanced / decreased by using capabilities, income or time	
+	Enhanced: Income is instrumentally important, the reeler family can choose which opportunities they want to enhance. For instance bodily health, or education / Time is instrumentally important, the reeler can use this extra time for different purposes. For instance to enjoy leisure, time with her family, or additional time for her religion. / Capabilities itself can also be instrumentally important, for example: good bodily health due to a good ergonomic posture might enhance income, and increase a reeler's happiness with her work, and control over her environment
-	Decreased: Time is instrumentally important. If a child has to run her mother's machine, she has less time for homework, or to play

Using the machine

The ATRM is owned and used by the reeler, and can be repaired by local technicians, just like the machine it replaced. Owning and using the machine gives the reeler self-respect, and the possibility for repair at a local level gives the reeler control over her own environment. In this sense, not much has changed for the reeler. What has changed is that the ATRM is covered to shield the rotating parts, which makes maintenance by the reeler herself more difficult, and therefore slightly reduces the reeler's ability to have control over her own material environment. Because operating the machine has been made easier and lighter, and the machine ensures a good ergonomic posture - when placed on a platform, and the safety of the women and their children has been improved by shielding the rotating parts, their capability to have good bodily health improved. Although placing the machine on the floor is more in accordance with culture, the reelers themselves prefer to place the machine on a platform. The reelers' daughters do sometimes work in the reeling centre to help their mothers, but mainly after school. When their mother is not able to use the machine for some time, due to pregnancy, illness, or other causes, the family income declines. By letting their daughter reel during these periods, a reeler family can secure their income. It is not unusual in these areas that children contribute to the household in some way, which adds to the basic survival capabilities of their families. And by helping their mothers, or by working on the reeling machine themselves, this might be a better working opportunity for these girls than heavy physical labour. The daughters might like to reel on the machine out of affection for their family, and this might also enhance the affection of their family for them. However, a decrease in the capabilities of the daughters also occurs as they have less time to pursue other goals like study or leisure. In this case, it is not clear what the daughters see as their most valuable capability: the ability to perform meaningful work, or the ability to study, play or spend their time otherwise. All these considerations illustrate that 'child labour' comprises much more than is visible at a first glance.

Working at home or in the reeling centre?

The ATRM was meant to give the reelers the choice to work in a reeling centre or to work at home. Both workplaces have certain advantages and disadvantages, which all became clear due to this analysis. The advantages of working in a reeling centre are that this allows the reeler to move around more freely, and to better focus on her work (as she is away from her household chores). It also allows her to socially interact with other reelers and form

attachments and create friendships, to enjoy companionship, to engage in various forms of social interaction, to participate in her community, and to enter into meaningful relationships with other workers. Thereby, from a community point of view, the reeling centre itself can be viewed as a setting of social interaction. Working at home, on the other side, is more in accordance with culture, and gives the reeler the opportunity to combine household chores with reeling work, and work on the machine when it suits her. This might however lead to women spending every spare moment to earn additional income to serve the family, diminishing her capabilities to rest or enjoy leisure time. Not having to walk to the reeling centre also saves the reeler time which she can spend otherwise. In addition, individual, home-based reeling gives the reeler the advantage of a solar panel being installed on the roof. This solar panel provides sufficient energy to bring light to the home which s enables the reeler to work at night, but also to gather with the family, and to enable the children to study in the evening. From this exercise, it remains, however, unclear which working environment gives the women most time to reel yarn of good quality, and thus earn most. As can be concluded from above, both working environments enhance certain capabilities. Developing a machine that can be used at home, as well as in the reeling centre, did not lead to a choice for new reelers where to work, because PRADAN, due to several reasons, started introducing home-based reeling only in new reeling villages. During validation, MASUTA's director indicated that the reelers themselves mostly preferred to work in a reeling centre (being away from the household chores is a relief for them), whereas the family wanted the woman to work at home. Therefore, if the reeler had been given a choice by PRADAN, her personal preference could still be restricted by her family.

A dignified way of generating income

The reeling machine enables the women to have a job that is more in accordance with culture, as they no longer have to engage in types of heavy physical labour with low status, which is looked down upon. They are able to work as a human, and are treated as a dignified being, equal to others. However, these capabilities had already been improved following the introduction of the old machine. The ATRM only enhances the reeler's opportunity to live according to culture, as it enables the reeler to work at home. This last opportunity is debatable, as it became clear that the reelers prefer to work in a reeling centre, but are only given the option to work at home.

Appearance of the machine

Not much consideration was paid to the appearance of the ATRM during its development. According to PRADAN's field staff[9], new reelers are not used to machinery; they are often scared to use machines. Involving the users in giving a product the right shape, size, and colour can improve the attachment of the users to the product. However, in this design process, the users were not involved in decisions concerning the appearance of the machine. The design of the machine was mainly based on covering all the machine's parts, and making the machine as small as possible. The machine did go through a change of colour (from green to brown to blue to brown), however, MASUTA's director indicated that the change of colour

9 *The information is obtained from field staff of PRADAN in 2006, in Deoghar district, Jharkhand state, India.*

was not to enhance the reeler's attachment to the machine. The machine was painted blue for the manufacturer's convenience, and was changed to brown on request of PRADAN to enhance the contrast of the yarn colour with its background. During field trials, the reelers could have indicated their preference for the machine's colour in this respect, but they were never specifically asked about it.

Additional income and / or time

Earning an income increases the reeler's self-respect, and gives her recognition and status, as well as a more dominant position within the household. Moreover, the additional income gives the reeler a greater sense of achievement. The additional income also gives the reeler's family economic security, and the possibility to lead a happier, more enjoyable, and more prosperous life. However, most of these capabilities had already improved after the implementation of the old machine. The ATRM slightly enhanced these capabilities, because the reeler's productivity per working hour increased. Thereby, theoretically, home-based reeling provides the reeler the opportunity to reel in the evenings and during every moment of free time, and the reelers no longer have to spend time walking to the reeling centre. Therefore, theoretically, the total of working hours increases. It is, however, not yet clear if the women actually use this extra time for reeling. The reelers can also choose to reel less because in fewer hours they can earn the same income as prior to the ATM's installation, which gives them more time to pursue other goals, such as spending time with their family, working on the fields, or taking rest. However, the ATRM might actually reduce the time that daughters can spend on doings valued by them. If their daughters help their mothers during reeling, or work on the machine themselves, they have less time to spend on, for example, study, play, or performing other work.

Instrumental Role of Capabilities and Resources

As stated, capabilities can have instrumental importance. In this case this instrumental role was also detected. For example, due to good bodily health resulting from a good ergonomic posture, a reeler can better concentrate on her work and can continue for a longer time. This gives her the ability to enhance her economic security. The good ergonomic posture also enhances the reeler's happiness with her job. The additional income that the reeler generates by using the ATRM is also instrumentally important. This resource can be used to achieve several opportunities; for instance it can be spent to improve bodily health, or on the educational level of the children. Lastly, time is also an instrumentally important resource. The reeler can choose how to spend her extra time. For example, she can enjoy leisure, spend more time with her family, or spend more time on religion or cultural practices. As stated above, the reelers have more money and/or more time to spend, and can therefore increase several opportunities.

2.4.4 Evaluation and conclusion

The development of the ATRM has been evaluated according to the identified common ground (§2.3) between product design literature and the CA literature. This case is then used to reflect on the usability of a capability perspective in DfD projects.

Reflection on common ground between product design and the capability approach

The usage of the CA to offer a more comprehensive view of the lives of product users is reflected on below.

Complementary theories

During the design process of the ATRM, no additional theories were used. The analysis made it clear that not all aspirations and motivations of the reelers and their families were considered during the design process. By using additional theories such as the CA or design ethnography, a broader view could have been captured.

Holistic view

During the design process, the view taken was not as broad as could have been. The focus of the project was mainly on the use and the technical and economic function of the machine, and less on its psychological, social, and cultural functions. Also the built environment was not considered, such as infrastructure, the reeling centre and the means of transportation. A broader view could have captured these aspects to lead to the design of the whole system instead of only focusing on the machine.

Participation is key

The reelers and other stakeholders were involved in the development of the machine, but mainly in the analysis, the simulation and evaluation phase, and only in relation to the product to be designed. In the analysis phase, the participatory methods used were not as elaborate as those used in design ethnography or participatory design toolkits. In the synthesis phase, participatory design was not practiced, mainly due to the high technological character of the design. The reelers did look forward to the new machine, but mainly because they trusted the NGO PRADAN. If the potential users had been more involved, this could have caused a higher personal attachment to the ATRM.

Concern for human diversity

During the design process, not all valued opportunities and not all conversion factors were identified, and no specific concern was paid towards consulting a varying spectrum of users. During this analysis, several conversion factors were detected which are relevant to this case. First, PRADAN only provides the machine to women, and only to women who have sufficient yarn-reeling skills. The implementing NGO thus excludes men from reeling, and personal skills might prohibit a woman from using the machine[10]. Thereby, a reeler with a better physical condition, intelligence and skills is more likely to enhance her opportunities than a reeler with less skills (e.g., self-confidence, economic security, friendship, and status). Second, the social norm for women is to work at home, and to perform household work. If they are involved in income generation, this job should be a dignified job in the eyes of the community. The reeling activity can thus be available, but if the household work is too

10 *It must be noted that, if a woman does not have sufficient reeling skills, PRADAN will engage her in another livelihood activity.*

demanding, or if the community rejects the reeling activity, a woman will still not be able to reel yarn. Third, the climate in Bihar, Jharkhand and Chhattisgarh is suitable for the tree on which the Tasar silk worm lives. Therefore, this area is suited for promoting the livelihood of Tasar silk reeling. If a poor rural woman lives in another area, and is able to purchase a reeling machine, it might still be difficult for her to obtain cocoons which she can reel. The walking distance to a reeling centre is another factor that might prohibit a reeler from working in reeling. The ATRM makes it easier for women to join the reeling activity, as this machine can be used at home. Also, the inclusion or exclusion of children was not considered during the development of the ATRM. If a broader variety of needs and aspirations had been captured and considered during the design process, this might have resulted in different design decisions.

Balance between individual and collective beings and doings

During the analysis phase, only the reelers themselves were interviewed, not their families. Therefore individual needs were identified, not those of the family and/or community. The reeling activity does not only change the reeler's life, it affects her family and the community as well. Making the machine suitable for everyone to use, and making the machine suitable for home-based reeling were more delicate issues than anticipated during the design of this machine. This exercise points out that capabilities of the individual and of the community are all relevant and should be considered. By doing so, these capabilities can be properly weighed, before making a design decision.

Focus on personal choice

In this case, poor rural women in Bihar, Jharkhand and Chhattisgarh have the choice of working in the activity of Tasar silk reeling because of the presence of the Tasar silk worm in these areas, the presence of PRADAN and MASUTA, and the availability of reeling machines. The sense of choice is generated by PRADAN which makes the poorest families in communities aware of the opportunity to participate in the activity of Tasar silk reeling. This sense is improved when the women gain confidence of being allowed and able to use the ATRM. Whether a woman actually uses this choice depends on her preference, she can also choose to engage in another livelihood activity, as well as on her husband and family as they have to allow the woman to work as a reeler, either in a reeling centre or at home. The effectiveness of achieving this choice depends on how well the use of the ATRM helps the women to achieve their desired outcomes.

Two adaptive preferences have been identified as a result of the development of the ATRM. If PRADAN gives new reelers the choice of working in a reeling centre or at home, reelers will probably not be able to use and achieve their choice to work in a reeling centre; due to social conditioning or cultural indoctrination, the new reelers will probably work at home. Moreover, at home they can work at the machine whenever they have time, and family pressure or the adapted preference to serve the family might result in women working non-stop, which decreases the reelers' capabilities to rest or enjoy leisure activities. These adaptive preferences were not detected by the designer. However, when detected, it must be noted that cultural aspects are not easy to influence or change without being paternalistic. If the machine was made in a way that it could only be used in a reeling centre, or in a way which excludes

children from using it, this design decision goes beyond persuasion as the choice of working at home will be ruled out. Social change is a process and it already started in most reeler families: the women gained confidence and respect and were more involved in decision-making. For this design project a better consideration of the actual choice provided to the female users could have led to different design decisions.

Aim for development

In the design process the aim has been to improve the Tasar silk reeling machine to further empower women, enhance their income and improve their working posture. To a certain extent, the new machine resulted into such a development. However, not all valued beings and doings of the reelers are properly taken into account or satisfied.

Use of a capability approach perspective

This exercise was used to map how the valued capabilities of the reelers and their families changed because of the ATRM. Mainly beings and doings achieved by the reelers were detected, i.e. functionings rather than capabilities. It turned out to be easier to identify the choices that people made than the choices that people can make, something Sen (1995) acknowledges. However, some capabilities were detected, such as the choice to work at home or in a reeling centre, though there may be other relevant capabilities which were not detected by this exercise.

It further became clear that cultural practices, choices of others, the absence of specific conversion factors or resources can all prohibit the reelers from actually fulfilling the opportunities that they value. However, as the reelers themselves were not consulted, it is not clear how many reelers value which opportunities and to what extent, and how many reelers are prohibited from fulfilling their preferences due to personal, social or environmental conversion factors, or due to interdependency of different capabilities. For now, it is not clear how satisfied the reelers are with this job, how much they experience a sense of achievement by using the ATRM, how the machine's appearance enhances or decreases their attachment to it, or their preferences for other job opportunities. It might be possible that some individual reelers prefer to work at home instead of working in a reeling centre, or prefer the old machine to the new one. Capabilities might indeed differ per person and per context, and no assessment of capabilities and preferences of different women was made. Therefore, involvement of the users is highly relevant to these evaluative exercises.

Limitations

The insights obtained through this evaluative exercise could have influenced the decision making process if they had been known beforehand. It can, however, not be verified whether these insights would have led to different design decisions. This evaluation provides deeper insights into the project, but to be able to properly identify what the different reelers themselves perceive as their most valuable opportunities, how they perceive their change in capabilities, and to what extent they experience this change, the reelers themselves must be consulted. It must also be said that not all consequences of product innovations can be predicted, and thus the full impact of the ATRM cannot yet be determined. For example,

in which workplace does the reeler earn most? And what is the effect on the opportunities of reeler families if children are involved in reeling? These are questions that may become clearer over time, when information is available about both situations.

Conclusion of evaluation

From this project it became clear that designers have the power to influence which incommensurable capabilities their target-users will be entitled to, and which ones not. In this DfD project, trade-offs had to be made because not all capabilities could be provided at the same time. The machine is designed to be easy to use in the reelers' homes. These choices enhance some of the reeler's capabilities, but unfortunately put other capabilities out of reach. The common ground between the CA and product design suggests that product designers already include many relevant perspectives in their design process. Still, the CA added new insights to the case of the ATRM by identifying aspects that were overlooked before. By using the list of beings and doings and examining the design process, the impact of the ATRM on the lives of its users, their families and their communities, has been placed in a different perspective. There are other approaches that could have brought about these aspects, but the holistic view the CA offers, taking into account all well-being dimensions, seems to work well and seems to fit the design perspective. Therefore, it seems to be relevant for designers to consider real opportunities, resources, conversion factors, needs, aspirations, and the instrumental role of capabilities during the design process, to be able to make deliberate design decisions.

2.5 Conclusions

In this chapter more background information is provided on the development of the domains of product design and the CA. This theoretical exploration provides insights into the relevance of connecting those domains. This relevance was further explored by analysing a DfD project. In this final section, conclusions on this relevance are drawn and the next steps to explore how the CA can be used as a complementary theory in the domain of product design are explained.

The relevance of using a capability perspective

Reverting back to innovation as significant positive change; product designers have the opportunity to influence the change that disadvantaged and marginalised populations need in their societies and in their lives to uplift themselves, socially and economically. By taking the theoretical aspects of the CA in the design process into account, a holistic and comprehensive view of potential users and their context can be obtained which can improve the decision making process that leads to a product and/or service. From the evaluative exercise of the ATRM project, it became clear that the CA does not inform designers which design decisions need to be made, but the approach helps designers make more deliberate and responsible decisions during the design process. This potentially reduces unintended consequences of product innovations and can enhance the innovative value of the design outcome for the target-user. The CA can potentially add a new body of knowledge to the domain of product

design and to DfD in particular. The CA is not the only approach that offers this body of knowledge, but it appears to be particularly useful for giving designers the insights they require to advance socially responsible design, resulting in products and / or services that fit the needs and aspirations of most of their users.

Approach route: integrating product design and the capability approach

In this chapter the domains of 'Development', 'Product Design', 'DfD' and 'RE' are explored. This resulted in insights into the connections between these different domains and their potential contribution to a 'Capability Driven Design' framework. The list of general beings and doings and the common ground between the CA and DfD literature form a start for developing this type of framework. However, more insights into the practical application of the CA and DfD, UCD and RE are required. Therefore, in the next chapter, the practical application efforts of the CA are investigated, and design methods, tools and best practices from UCD, RE and DfD are explored. This approach route is visualised in figure 2-15.

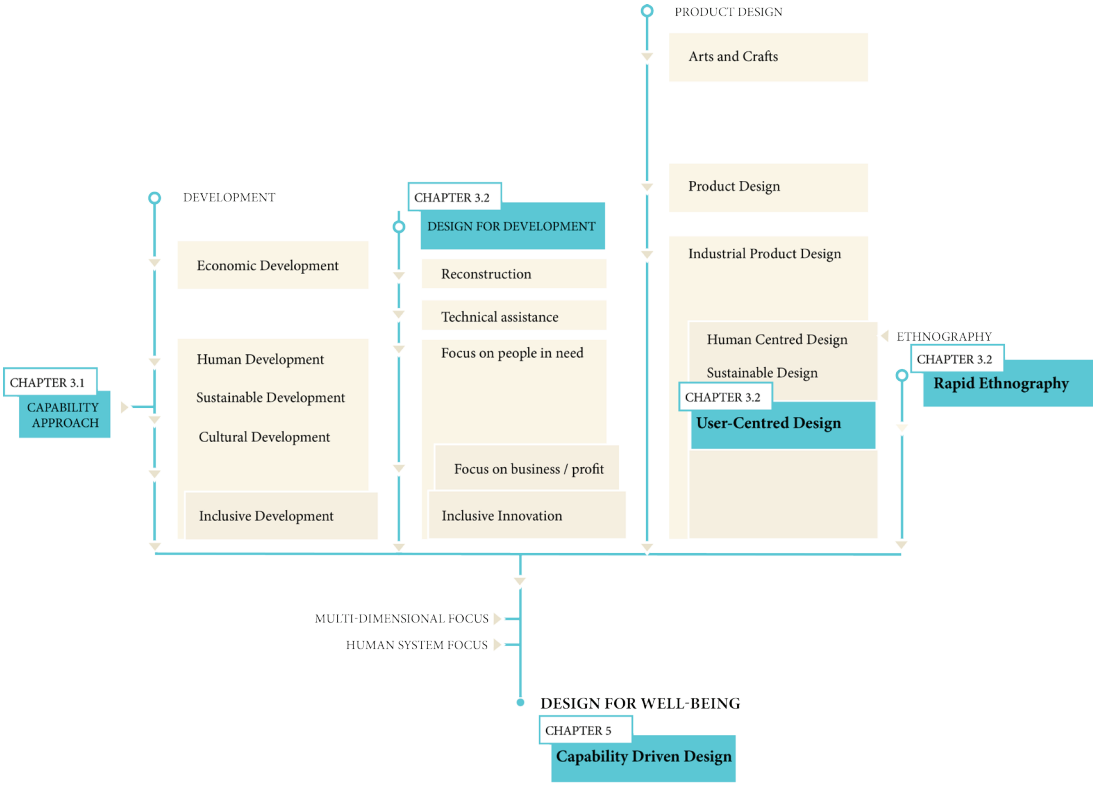
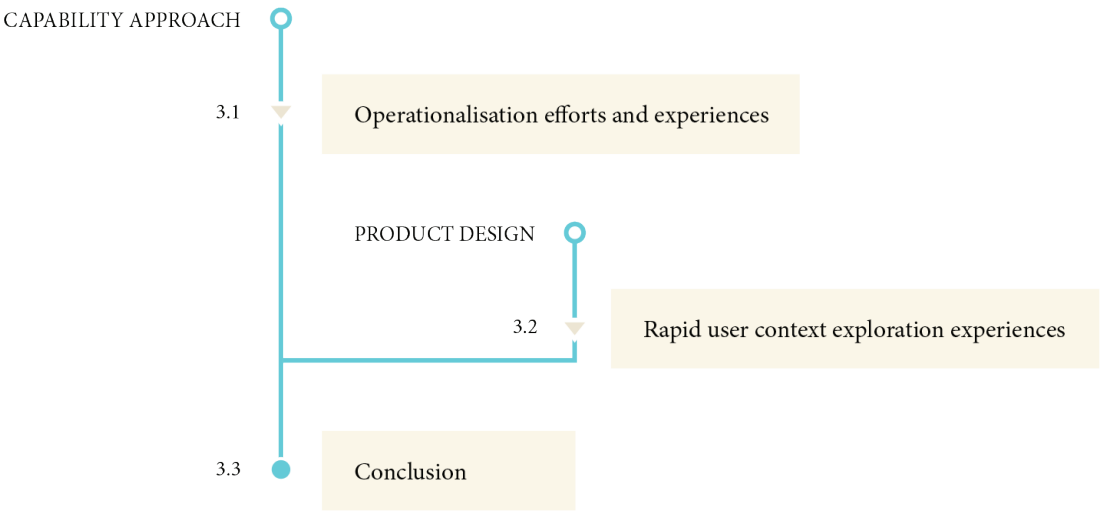


Figure 2-15: Approach route for Capability Driven Design

CHAPTER 3

Exploring Ways to Obtain Comprehensive User Insights

In chapter 2, the domains of the capability approach (CA) and product design have been explored in detail to determine the relevance of the CA to guide designers in obtaining comprehensive user insights. However, it is not discussed how the CA can be practically applied in product design practice, and which designer-friendly methods help designers to efficiently explore people's well-being to inform Design for Development (DfD). As indicated in chapter 1, current ethnographic approaches are not specifically tailored to the needs of designers, design manuals and toolkits lack a systematic way to conduct user context-research, and both of them do not specify which topics can or should be addressed when obtaining comprehensive user insight. Therefore, in this chapter the practical application efforts of the CA and the rapid user context exploration efforts in product design are explored, to form the basis of a designer-friendly, comprehensive, and efficient 'Capability Driven Design' (CDD) approach which provides information about the type of information and insights that need to be collected for comprehensive user context research and a procedure, methods, techniques and tools to conduct this type of research. In §3.1, the obstacles and learnings from previous operationalisation efforts of the CA are derived from the literature. In §3.2, the obstacles, learnings, methods, techniques and tools for rapid user context exploration from the literature are reviewed. As the focus of this thesis is on the domain of product design, and more specifically on user-centred design (UCD) and DfD, the reviewed literature includes both these sub-domains. Thereby, literature from the sub-domain of rapid ethnography (RE) is also reviewed, as this is one of the inspirational sources for obtaining user insight in the domain of product design. Section 3.3 concludes by combining the literature of both the CA and product design. The literature review described in this chapter will be used in chapter 4, 5 and 6 to build the CDD approach.



3.1 Prospective applications of the Capability Approach

As the CA offers a comprehensive view of well-being, and this is lacking in current design and rapid ethnographic approaches, the CA thinking and its comprehensive view of well-being and will therefore be integrated in a to be developed CDD approach. As the CDD approach will be used in a prospective manner – to inform projects and processes – the prospective application of the CA in practice is the subject of this section's systematic literature study. This resulted in a list of obstacles and practical learnings for prospective CA operationalisation. The information presented in this section will be used to establish the analytical guidance of the envisioned CDD approach, which helps designers to understand people's well-being and to obtain comprehensive user insights in the domain of DfD.

3.1.1 Practical application efforts

The CA has been applied in practice in a number of ways. Most of these are evaluative or descriptive by nature, but the CA is also used in a prospective manner - to inform projects and processes. The best known practical application of the CA is the Human Development Index (HDI). Inspired by the CA, the HDI takes a broader view on human development than traditional measures of economic growth (UNDP 2012a). The HDI focuses on three dimensions: standard of living, living a long and healthy life and being knowledgeable (UNDP 2012a). The Multidimensional Poverty Index (MPI) is also inspired by the CA, and includes the same three dimensions as the HDI. This measurement index, however, also identifies the number of people suffering from multiple deprivations at the same time (UNDP 2012b). Besides being an inspirational source for the HDI and the MPI, the CA has been discussed and adopted by scholars from different fields of expertise. Sen distinguishes between three ways of using the CA: the CA can be used to directly focus on capabilities, to supplement traditional approaches, or to adjust traditional approaches (Alkire, Qizilbash, and Comim 2008). Robeyns (2006) made a classification of all the CA applications up to 2006. She points out that the CA has been used to:

- Assess human development in a country;
- Assess development projects;
- Assess the human development of groups of people (e.g., disabled, gender inequalities);
- Identify poverty and well-being in economies;
- Analyse policies;
- Critique social norms, practices and discourses; and
- As a concept in descriptive research.

These applications are mainly evaluative or descriptive in nature. Increasingly, the CA is used prospectively. As Alkire (2008) explains, this entails that capabilities are considered before generating policies, recommendations and conducting activities, instead of merely analysing the effects afterwards. When reviewing the literature, many examples were found of prospective CA applications, for example to identify relevant capabilities for a specific target group, or within a specific domain or project, such as ICT, education, design or health (e.g., Babic, Germes Castro, and Graf 2009; Dong 2008; Kleine 2011; Coeckelbergh 2010; Ruger 2006; Bonvin and Farvaque 2006; Oosterlaken 2009; Tikly and Barrett 2011; Zheng 2009).

In this research project the aim has been to prospectively operationalise the CA in order to inform product designers working on DfD projects. This entails finding a way to support designers at the start of their project to identify all relevant information that guides them to develop products and / or services that enhance people's capabilities and well-being when they use the design. According to Alkire (2008, p. 41), there are several ways to prospectively put the CA into practice, depending on *"discipline, level of analysis, policy audience, region and context"*. However, to date, the CA has not explicitly specified a methodology for prospective analysis (Alkire 2008), and, according to Johnstone (2007), the CA offers ample material to do so. Rudra (2009) indicates that current capability measurements do not frame all problems of deprivation, do not accurately reflect the priorities of the 'poor', and do not help governments to establish a hierarchy of reforms. Thereby, limited research has been conducted to investigate the link between product design and the CA. Oosterlaken (2009, p. 94) noted that *"philosophers working on the capability approach so far do not seem to have sufficiently realized the relevance of technology, engineering, and design for capability expansion."* To explore the practical application possibilities of the CA for product designers, a literature study was conducted of prospective operationalisation efforts. The selected literature pointed out possible ways to achieve this and what to be aware of. These insights provide the theoretical basis for applying the CA to DfD practice and are presented below.

3.1.2 Literature study 1: operationalisation efforts of the capability approach

To find the relevant literature about putting the CA into practice, two databases were reviewed: the ISI Web of Knowledge's Web of Science database (WoS), and the Scopus Abstract and Citation database. The search keys used are 'capabilit* approach' in combination with 'operational*' and/or 'practice' and/or 'prospective' in titles, keywords, or abstracts. The search was limited to English language journal articles, reviews and editorials. This resulted in 61 articles from Scopus and 24 articles from WoS. Comparing both databases, there were 19 double hits. Of the 66 unique documents the abstracts, and in some cases the full paper, were studied in order to obtain a clear understanding of the work reported. Articles that referred to another CA than Sen's CA, and articles that used the term 'practice' or 'prospective' but not in the sense of applying the CA into practice, were excluded. Eventually, 15 articles were selected that provide information on the CA and how to put the CA into practice. These fifteen articles are: Anand, Krishnakumar, and Tran (2011); Anand and van Hees (2006); Burchardt and Vizard (2011); Frediani (2010); Gasper (2007); Kerstenetzky and Santos (2009); Kleine (2010, 2011); Krishnakumar and Ballon (2008); Robeyns (2006); Rudra (2009); Wagle (2009); Walker (2006); Walker et al. (2009); Zimmermann (2006). These articles have been analysed in detail. In addition the book of Comim, Qizilbash, and Alkire (2008) was included in this literature study, as their book specifically describes CA applications.

The relevant literature was scrutinized, looking for obstacles and learnings for putting the CA into practice. All relevant information was colour-coded and for the obstacles as well as the learnings the information was grouped together according to identified patterns. These groups were re-grouped after being discussed within the research team. This process resulted in 11 obstacles and 14 learnings for operationalising the CA in a prospective way. These obstacles and learnings are presented in the next sections.

3.1.3 Obstacles for operationalisation

From the selected literature, eleven obstacles were identified that challenge the CA's operationalisation. These challenges are discussed below.

a) The approach is complex

According to Chiappero Martinetti (2008) and Rudra (2009), the CA is an intrinsically complex approach. Chiappero Martinetti (2008) argues that this is a strength at the conceptual level, but a challenge at the methodological level. For practical purposes the CA needs simplification (Burchardt and Vizard 2011), but it is difficult to find a balance between the CA's conceptual richness and its practical applicability (Kleine 2010).

b) The approach is abstract

Frediani (2010) argues that the CA fails to unpack the concept of capability, resulting in unresolved debates about specific elements. These debates are, for example, whether the focus should be on agency or well-being (Frediani 2010; Gasper 2007), on individual or collective capabilities (Robeyns 2006; Frediani 2010), and on universal or local capabilities (Frediani 2010). Another debate is about the use of basic capabilities i.e. those capabilities essential for survival or dignity (Gasper 2007), and about whether to use a list of capabilities or not (Robeyns 2006; Frediani 2010). Wagle (2009) claims that the CA's idealistic and abstract character hinders its operationalisation. Gasper (2007) argues that the CA needs to be refined, as due to its vagueness and flexibility different users select different features, leading to multiple versions of the CA being in use.

c) The approach is underspecified

Robeyns (2006, 2008) states that the CA is radically underspecified and that the lacunae can be filled in different ways. The CA often needs to be supplemented with other social theories, resulting in different assessments depending on which theory is used (Robeyns 2006).

d) The approach has a localised nature

According to Frediani (2010) the CA has a localised nature. He also argues that participatory methods, which the CA considers to be of great importance, propose local solutions to global problems. Burchardt and Vizard (2011) noted that capabilities identified through local, participatory processes might conflict with established, universal human rights.

e) The approach has an individualistic nature

The CA has an individualistic nature (Frediani 2010), while for prospective analysis in particular, groups and social structures are relevant (Alkire 2008). Robeyns (2008); Alkire (2008) and Deneulin (2008), however, argue that the CA includes social structures, properties and their effect on individual well-being.

f) Ambiguity about the meaning of 'capability'

Gasper (2007) criticises Sen for not clarifying the meaning of 'capability' and for not relating his concept of capability to the vocabulary in other fields. Within the CA, the meaning of capability diverges from its use in everyday language: in the CA 'capability' refers to attainable outcomes, taking its meaning beyond a person's abilities (Gasper 2007).

g) Capabilities are hypothetical concepts

Capabilities concern hypothetical achievements, referring to what 'could be' (Gasper 2007) i.e. capabilities depend on the choices people make. These choices depend on preferences, skills and social supports (Gasper 2007; Zimmermann 2006; Robeyns 2006) and might be influenced and adapted by specific circumstances (Frediani 2010; Walker 2006; Gasper 2007). Thereby, a person's capabilities might not all be achieved at the same time (Robeyns 2006). The choices people make can never be fully predicted (Kleine 2011), and therefore capabilities are difficult to identify (Gasper 2007; Kleine 2011; Zimmermann 2006) and to measure (Burchardt and Vizard 2011; Krishnakumar and Ballon 2008; Wagle 2009). Consequently, development processes focusing on capabilities remain dynamic and open-ended, without measurable targets or impact predictions (Kleine 2011). By focusing on capabilities to determine a person's well-being, people are held responsible for their own choices (Robeyns 2006), but in practice even Sen acknowledges that practitioners often have to settle for identifying achieved functionings (Zimmermann 2006).

h) Capabilities vary per person and per context

The broad variety of dimensions included in the CA are influenced by a person's situation, corporeity and sociality (Zimmermann 2006) and therefore they differ per person and per context (Frediani 2010; Robeyns 2006; Wagle 2009; Gasper 2007; Rudra 2009; Chiappero Martinetti 2008). It remains a challenge to find a balance between individual and group perspectives (Frediani 2010), to determine a hierarchy of needs (Rudra 2009), to prioritise different relevant capabilities in a democratic process (Robeyns 2006), and to decide which capabilities are justified in which context (Robeyns 2006). A risk of making trade-offs is that by improving one capability, another might be restricted (Walker et al. 2009). It is therefore often not possible to identify one best way to select and prioritise capabilities (Alkire 2008).

i) Capabilities are interdependent and change over time

Capabilities shape and influence each other (Krishnakumar and Ballon 2008; Frediani 2010) and change over time (Burchardt and Vizard 2011; Wagle 2009; Zimmermann 2006; Alkire, Qizilbash, and Comim 2008). Therefore, all capabilities should be identified at one point in time in order to capture all linkages and details (Chiappero Martinetti 2008; Krishnakumar and Ballon 2008).

j) Difficult to achieve democratic deliberation

The CA propagates democratic deliberation with the people concerned (Kleine 2010; Robeyns 2006). However, in practice, it might be difficult to reach those people (Rudra 2009), for example due to resource constraints (Burchardt and Vizard 2011). And, even when they are reached, it might be challenging to get them to actually participate (Rudra 2009). Democratic deliberation can furthermore be limited by issues like domination by the majority (Robeyns 2006), underlying power structures, and / or conditioned expectations (Burchardt and Vizard 2011).

k) No clear practical guidelines

The CA does not offer practitioners or researchers clear practical guidelines on how to identify or assess different dimensions (Frediani 2010). It is unclear how to:

- identify and measure capabilities (Robeyns 2006);
- select capabilities (Robeyns 2006);
- measure capabilities (Wagle 2009; Robeyns 2006);
- weigh and aggregate capabilities (Wagle 2009; Robeyns 2006; Alkire 2008);
- evaluate and compare people's lives (Walker et al. 2009).

3.1.4 Learnings from theory and practice

When using the CA in practice, the selected literature notes 14 relevant 'learnings' from theory and practice. These learnings can be joined together in four steps: 1) adapt the approach to the purpose; 2) choose a focus and a mechanism; 3) identify dimensions; and 4) select and prioritize between these dimensions. These four steps are discussed in more detail below.

Step 1: Adapt the approach for the purpose

As the CA is a complex, abstract and underspecified approach, it can be adapted to support practical application in a specific domain.

a) Simplify

For practical utilisation of the complex CA, simplifying assumptions need to be made (Burchardt and Vizard 2011). These simplifications must, however, be consistent with the CA's conceptual richness and rationale (Gasper 2007; Kleine 2011, 2010).

b) Refine – to a certain extent

Frediani (2010) states that a CA-based conceptual framework needs clear components, while remaining open and not imposing universal values. Gasper (2007) argues the need to develop and refine the CA, but not to over-refine the approach into something mysterious and distant for practitioners.

c) Supplement - if required

Depending on its application, the CA may need to be supplemented with other social theories in order to specify certain views (Robeyns 2006).

d) Specify the meaning of 'capability'

Gasper (2007) advises relating the meaning of 'capability' to the vocabulary used in the field of application. Kleine (2010), for example, distinguishes between 'capabilities' and 'skills' to avoid confusion, and Zimmermann (2006) uses Gasper's distinction between 'skills capabilities' and 'opportunities capabilities'.

Step 2: Choose a focus and a mechanism

Before identifying capability dimensions, it is important to focus on what has to be detected, from whom, and how this can best be done for the specific project or purpose at hand.

a) Choosing a focus on capabilities or functionings

As it is difficult to identify capabilities, Sen proposes to either focus on functionings and note the alternatives, or to focus on functionings and include choice as one of the relevant functionings (Robeyns 2006). Zimmermann (2006) proposes to start with functionings

and use them to derive choices, or to focus on the lack of capabilities. Until now, most CA applications have focused on functionings rather than on capabilities (Robeyns 2006; Anand and van Hees 2006). Robeyns (2006, p. 355) states that the choice for focusing on capabilities, functionings or both, depends on *"the kind and context of the application, on certain normative choices, and (if applicable) on the data-availability."*

b) Focus on the individual, but consider groups, structure and context

Deneulin (2008, p. 111) advocates the importance of considering 'structures of living together' which she defines as *"structures which belong to a particular historical community, which provide the conditions for individual lives to flourish, and which are irreducible to interpersonal relations and yet bound up with these"*. (Kleine 2011) also specifically argues for considering social structures consisting of laws, policies, programmes, institutions, organisations and processes. Within the CA, these elements can be considered to be part of the social conversion factors. As structure might constrain free choice, both individual freedom and collective freedoms should be considered (Deneulin 2008).

c) Choose a mechanism to identify poverty dimensions

Alkire argues that the process of specifying a list should be collaborative, visible, defensible and revisable (Walker et al. 2009). She recognises five mechanisms to identify capabilities and poverty dimensions (Frediani 2010):

- Using existing data or conventions that are taken to be authoritative, such as the human development index;
- Using informed guesses of researchers, or transparent and justified use of normative assumptions such as Nussbaum's list of human capabilities and Maslow's hierarchy of needs;
- Using legitimate consensus-building processes, examples are human rights or the Millennium Development Goals;
- Using people's values captured through group discussions and participatory analysis;
- Using expert analysis of people's values from empirical data.

Sen and Nussbaum, the leading CA authors, are divided on the matter of establishing a standard list of capabilities. While Sen refrains from doing so, Nussbaum has developed a list of ten 'central human capabilities' (Robeyns 2006). Wagle (2009) notes that Sen also acknowledges that a comprehensive list of indicators would be required for systematic analysis and measurement of capability deprivation. Frediani (2010) notes that all five mechanisms mentioned by Alkire are relevant to different purposes and in different contexts, but he stresses the relevance of the fourth mechanism, which he himself applied in earlier work. Lelli (2008) uses data from the Panel Study of Belgian Households, Alkire compares existing data from different multidimensional approaches to human well-being (Chiappero Martinetti 2008), Rudra (2009) proposes triangulation to balance standardisation and complexity by identifying universal human development goals, identifying basic needs, and applying participatory poverty assessments. Burchardt and Vizard (2011) derived a human rights-based capability list and supplemented this list with local capabilities obtained by public deliberation. Walker et al. (2009) applied all five mechanisms by following them as steps when choosing dimensions.

d) Decide whether measurement/aggregation is required

According to Robeyns (2006), whether capabilities need to be measured and / or aggregated depends on the type of application of the CA. Different authors focus on measurement of capabilities, such as Wagle (2009) who proposes a framework for capability measurement and states that, to measure capability deprivation, it is critical to use a specified deprivation cut off or threshold. Anand, Krishnakumar, and Tran (2011) and Anand and van Hees (2006) propose a survey instrument for quantitative measurement of capabilities. Robeyns (2006) stated that the main measurement techniques explored so far are descriptive statistics of single indicators, scaling of functionings (used for calculating the HDI), fuzzy sets theory, factor analysis, principle component analysis, and structural equation modelling.

Step 3: Identify dimensions

To identify a set of capability dimensions, several authors have developed criteria to which this set has to comply, and provide guidelines for obtaining these dimensions.

a) Criteria for a list of dimensions

A list of dimensions should be:

- philosophically and theoretically meaningful in relation to a life of full human dignity (Nussbaum in Walker et al. 2009);
- not over-specified or derived from a particular metaphysical worldview (Nussbaum in Walker et al. 2009);
- made explicit, discussed and defended (Robeyns 2006);
- clarified, scrutinised and defended for methodological justification (Robeyns 2006);
- contain different levels of generality, from ideal theory to pragmatic (Robeyns 2006);
- exhaustive and not reduced, thus include all important capabilities (Robeyns 2006);
- short, but covering all issues related to agency and well-being goals (Anand and van Hees 2006).

b) Involve the people concerned

Sen stresses the importance of democratic deliberation and participation (Walker 2006). Frediani (2010) points out that participatory methods are required to identify people's aspirations and capabilities. Kleine (2011) also argues for consultation of the people involved. She highlights that involvement of the people concerned not only seems morally right, it might also reduce the rate of failure, increase local agreement, enhance recognition of benefits, lead to more effective social change, and lead to a better reflection of the diverse things people value (Kleine 2010). Zimmermann (2006) therefore advises immersion in the life-worlds of the actors for an ethnographic moment and a 'naturalistic' approach, and if this is not feasible, to at least couple interviews with ethnographic observations on specific aspects or cases. She furthermore argues that qualitative inquiry can be used to provide the deep insights required for designing quantitative surveys. Porter and de Wet (2009) mention Alkire's focus-group methodology in which participants are given the space to recognise, define, and choose instances which help or hinder them.

c) Include dimensions of choice

As capabilities are hypothetical concepts, Kleine (2011, 2010) allocates a prominent place in her conceptual Choice Framework for the concept of 'choice' (see figure 2-7, §2.2). She distinguishes between existence, sense, use and achievement of choice. Gasper (2007) stresses that not only the possibility, but also the probability of achieving a set of capabilities is an important consideration. Subjective well-being is, according to Gasper (2007), not a good measure of well-being for public purposes, due to preference adaptations. He does, however, propose including subjective well-being dimensions in the larger set of relevant dimensions while looking at people's ability to and actual engagement in making choices to investigate the level of adaptation. Frediani (2010) advises focussing on the choice, ability, and opportunity that people have to transform resources into achieved functionings.

d) Obtain an overall picture at the same moment in time

According to Chiappero Martinetti (2008), an overall picture of peoples opportunities is required to be able to capture all linkages and details. Krishnakumar and Ballon (2008) argue that it is important to determine all capabilities at the same moment in time, as capabilities change over time. When assessing all capabilities at different moments in time, the dynamics of capability formation can also be taken into account (Burchardt and Vizard 2011; Porter and de Wet 2009; Alkire, Qizilbash, and Comim 2008).

e) Link local outcomes to global perspectives

Burchardt and Vizard (2011) link a 'global' human rights-based list with a 'local' publicly deliberated list of capabilities. They compared both lists and in case of conflicts, they considered the human rights-based list leading.

Step 4: Select and prioritise

According to Robeyns (2006), after identifying capabilities, a selection has to be made. The literature suggests to do so in a participatory manner.

a) By public debate and democratic decision

As there is often not one best way, and therefore *"from the set of possible 'better' options, an informed value judgement will need to be made between the alternatives"*, which *"should be open to public scrutiny and debate"* (Alkire 2008, p. 30). Rudra (2009), Frediani (2010) and Gasper (2007) also indicate that the best way of ranking capabilities and/or functionings and identifying thresholds is through public debate and democratic decision. Robeyns (2006) indicates that some studies have used qualitative empirical techniques such as participatory methods and interviews to select functionings and to determine their relative weights.

3.1.5 Conclusions

The CA can be applied in practice, however it has not yet been specifically applied to obtaining user insights in the domain of product design. Eleven barriers have been detected that challenge the practical application of the CA. Several CA researchers and practitioners are working on these operationalisation issues, and have identified four steps for successful

operationalisation. Although the CA has the potential to offer product designers a thinking framework and a practical approach to obtain broad user insight, operationalising the CA to obtain comprehensive user insight in DfD remains a complex task.

3.2 Rapid user context exploration

In UCD, the user is treated as the subject, in this project the user is more specifically defined as being a subject of inquiry. The time allowed for gaining user insights is often limited time in design projects, while in DfD projects it is especially relevant for designers to get to know their potential users in order to be able to develop products and / or services that fit their needs, aspirations, desires and context. The domain of RE has been an inspirational source for designers with regard to rapidly conducting fieldwork activities. In this section, therefore, a systematic literature study has been conducted on rapid user context exploration regarding the three domains of UCD, DfD and RE. This resulted in a list of obstacles and learnings from practice and a range of methods, techniques and tools, which are presented below. The information presented in this section will be used to establish the practical guidance of the envisioned CDD approach, by presenting a possible procedure, and a selection of methods, techniques and tools, which form the basis of a designer-friendly and efficient CDD approach that can be used to obtain comprehensive user insights in the domain of DfD.

3.2.1 Obtaining rapid user insight in product design

As the goal of this theoretical exploration is to identify which practical guidance the domains of UCD, DfD and RE offer for obtaining comprehensive user insights, specific attention has been paid to the methods, techniques and tools to achieve this. In the domain of product design, methods have been developed for each phase of the design process which support the designer during that phase. According to Roozenburg and Eekels (1998, p. 40), a method is *"the consciously applied diachronous structure of an action process."* They explain that a method refers to an intervening action where the elements are consciously applied in a certain time order. According to Martin and Hanington (2012, p. 6): the design methods and techniques in their book provide *"an opportunity to structure conversations that can help to better understand and empathize with people, and as a result build more meaningful products."* Methods thus support designers, but are not a recipe for success (Van Boeijen et al. 2013) and should not restrain individual design thinking (Wallace 1992). Cross (2000) argues that design methods can be any procedures, techniques, aids or tools, such as brainstorming, context mapping, use of checklists or process trees. In this thesis a distinction is made between 'methods', 'techniques' and 'tools':

- Methods indicate the procedure that controls the way in which user insight is generated. Examples of methods are interviewing or observation;
- Techniques indicate specific ways of obtaining user insight that can be used within a method to increase the outcomes, for example, questioning techniques or mapping during interviews;
- Tools indicate tangible elements that can be used to support techniques, for example, a map of the area people live in can support the mapping technique.

3.2.2 Literature study 2, 3 and 4: Rapid user insight

In this section, the second literature study conducted on all three sub-domains is described.

Literature study 2: Obtaining user insight in user-centred design

The sub-domain of UCD, as described by Sanders (2006), comprises two activities that specifically focus on obtaining user insight. These are 'contextual inquiry' and 'applied ethnography'. To find relevant scientific literature about contextual inquiry and applied ethnography in the field of human-centred design, a literature study was conducted using two databases: the ISI Web of Knowledge's Web of Science database (WoS), and the Scopus Abstract and Citation database. However, a wider search scope was chosen than the specific focus of this research project, as in the domain of product design, the words human-centred, user-centred and participatory design are often used interchangeably. Thereby, variations for contextual inquiry and applied ethnography are included, and also the phrases co-creation and co-design, to detect all product design literature involves potential users. The search keys used were: "human cent* design", "user cent* design", "participatory design", co-creation, and co-design. The search keys for the design activity were "contextual inquiry", "contextual design", and ethnograph*. A search in the title, keywords, or abstract of the papers in both databases used combinations of one or more of the synonyms / alternative words for the design zones with one or more of the synonyms / alternative words for the design activities. The search was limited to English language journal articles, reviews and editorials.

This search resulted in 80 documents in Scopus and 53 documents in ISI WoK. A comparison of both databases resulted in 93 unique documents. Of these, the abstracts were analysed to identify their relevance to this study. Many papers discuss the application of human-centred design in a different field than product design or on a single case only, while the aim of this literature search was to obtain knowledge about obstacles, learnings, methods, techniques and tools in the sub-domain of human-centred design. The full text of 34 articles was studied to obtain a better understanding of the work reported. Eventually, 27 articles were identified that provided information on the aspects of human-centred design relevant to the purpose of study. This is the resulting list of articles that were analysed in detail: Barab et al. (2004); Boztepe (2007); Beyer and Holtzblatt (1995); Diggins and Tolmie (2003); Beyer, Holtzblatt, and Baker (2004); Steen (2011); Friess (2010); Gielen (2008); Hanington (2010); Iivari and Iivari (2011); Johansson and Linde (2005); Johansson and Messeter (2005); Kensing, Simonsen, and Bødker (1998); Kies, Williges, and Rosson (1998); Kujala (2003); Lebbon, Davies, and Shippen (2011); Liedtka (2011); Nesset and Large (2004); Newell et al. (2011); Oulasvirta, Kurvinen, and Kankainen (2003); Park (2011); Roibás (2008); Smart and Whiting (2001, 2002); Sperschneider and Bagger (2003); Van der Veer (2008); Viitanen (2011).

As design is a practical science, documents not included in scientific databases were also considered relevant to the study. Books and toolkits provide relevant input concerning obstacles, learnings and methods, techniques and tools used in human-centred and user-centred design. Therefore, these were included by conducting a 'google-search' literature study using the same criteria as that of the 'scientific database-search', aimed at identifying relevant books and toolkits that provide methods, techniques and tools for obtaining user

insight. The following documents were selected:

- The book 'Universal Methods of Design' of Martin and Hanington (2012), which contains 100 methods for human-centred design;
- Stanford University D.school's 'Bootcamp bootleg', which provides tools for the human-centred design process (d.School 2013, 2010);
- Frog Design's 'Collective Action Toolkit', which provides resources and methods to enable collective action in communities (FrogDesign 2012).

Literature study 3: Obtaining user insight in Design for Development

A third literature study was conducted to find relevant literature about DfD practice, using two databases: the ISI Web of Knowledge's Web of Science database (WoS), and the Scopus Abstract and Citation database. In the sub-domain of DfD a range of terms are used to indicate the same or a similar activity. Therefore, for retrieving documents on DfD, several search keys were used. Of the terms used, both 'design' and 'development' are broad and general terms; a combination of these resulted in more than 5 million hits. The databases were searched using the following synonyms and alternative words for design: 'Industrial Design', 'Design Engineering', 'Industrial Design Engineering', 'Product Design', 'Design Thinking', 'Product Innovation', 'Social Design', 'Social Innovation', 'Design for Development' and 'Product Development'. For development, the following synonyms / alternative words were used: 'Emerging Markets', 'Base of the Pyramid', 'Bottom of the Pyramid', BoP, 'Industrialised Economies', 'Developing Countr*' and 'Third World'. The search in the title, keywords, or abstract of the papers in both databases were combinations of one or more of the synonyms/alternative words for design with one or more of the synonyms/alternative words for development. The search was limited to English language journal articles, reviews and editorials.

This search resulted in 106 documents in Scopus and 139 documents in ISI WoK. After comparing both databases, 207 unique documents were found. The abstracts were reviewed to identify the relevance of the articles to the study. This resulted in 33 articles which were fully studied to obtain a better understanding of the work reported. Many papers discuss factors that impact a firm's innovative efforts or innovation in the field of medicine – mainly concerning vaccines. All the articles that focused on a different type of design than product design or DfD were excluded. Eventually 22 articles were identified that provided information on DfD. The following articles on (DfD) were analysed in detail: Banu (2009); Burrage (1997); Chavan and Gorney (2008); Donaldson (2006); Er (1997); Gardner, Acharya, and Yach (2007); González, Quesada, and Bahill (2003); Guimaraes, Penny, and Moody (1996); Iyer, LaPlaca, and Sharma (2006); James (2011); Jiehui and Kandachar (2008); Krishnan and Prabhu (1999); Margolin (2007); McNeill and Westby (1999); Prahalad and Lieberthal (2003); Ray and Ray (2011); Shahnavaz (1989); Sklar and Madsen (2010); Souiden, Pons, and Mayrand (2011); Viswanathan and Sridharan (2012); Viswanathan, Yassine, and Clarke (2011); Waeyenberg and Hens (2008).

Several universities[11], organisations[12], and companies / consultancies[13] are active in the domain of DfD and several of them have developed processes, methods, techniques and tools to better address the needs of the disadvantaged and marginalised. The resulting manuals and toolkits were also included in this literature study, as these practical guides also provide relevant input concerning obstacles, learnings, methods, techniques and tools for obtaining user insight. The following manuals and toolkits were included:

- The 'Delft Design Guide' by the faculty of Industrial Design Engineering of Delft University of Technology which describes the 'Base of the Pyramid and Emerging Markets' approach, as well as design methods that can be applied within this approach (Van Boeijen et al. 2013);
- The 'Base of the Pyramid Protocol: Toward Next Generation BoP Strategy, 2nd edition' by the Center for Sustainable Global Enterprise, Johnson School of Management of Cornell University, which advocates a BoP approach of co-invention and business co-creation where businesses partner with BoP communities (Simanis and Hart 2008);
- The 'Market Creation Toolbox' by DI Business Development and the BoP Learning Lab, which guides companies to develop business projects for developing markets by providing advice and activities to get started (Larsen and Flensborg 2011);
- The 'Design for Sustainability (D4S) manual' by the United Nations Environment Program in collaboration with Delft University of Technology. The manual provides information for small- and medium enterprises that want to do business in developing economies (Crul and Diehl 2006);
- The report 'Engineering Solutions for the Base of the Pyramid' by the American Society of Mechanical Engineers (ASME), which includes four critical business strategies, as well as five design principles for engineers who want to improve the lives of the world's poor (Bowman and Crews 2009);
- The 'Human Centered Design Toolkit' (HCD) by IDEO, developed in 2009 after a request from the Bill and Melinda Gates Foundation. This toolkit provides a human-centred design approach adapted for communities in need. It offers techniques, methods, tips and worksheets to guide people through the design process for these communities;

11 Among others: Centre of Sustainable Technologies of the Indian Institute of Science in Bangalore, India; D-Lab, Massachusetts Institute of Technology, Boston, United States of America; Design for Extreme Affordability course, Hasso Plattner Institute of Design, Stanford University, Stanford, United States of America; Center for Sustainable Global Enterprise, Johnson School of Management, Cornell University, Ithaca, New York; the Institute of Design from IIT Chicago in the USA; Aalto University in Finland (BoP Network); University of Colorado-Boulder (Engineering for Developing Communities (EDC) program); Ateneo School of Government, Philippines (Science and Technology Innovations for the Base of the Pyramid in Southeast Asia program -iBoP Asia – an initiative of the William Davidson Institute of the University of Michigan); William Davidson Institute of the University of Michigan (mainly focusing on business development and impact assessment); Design for Social Innovation at Carnegie Mellon's School of Design (not specifically focused on design for development, but focused on addressing social needs and quality of life issues).

12 Among others: DI Business Development/BoP Learning Lab; the United Nations Environment Program; the American Society of Mechanical Engineers; Design without Borders; Practical Action; Kickstart; International Development Enterprises, Technoserve, EnterpriseWorksWorldWide.

13 Among others: IDEO, Windhorse International, D-Rev, International Development Enterprises, IICD, Design for Development Society and Laerdal

- The 12 principles for designing affordable technology with decentralized supply chains which intend to benefit 'bottom billion customers' by Paul Polak, who founded D-Rev, International Development Enterprises and Windhorse International, and wrote the book 'Out of Poverty' (Polak 2015);
- The book 'Design without Borders – Creating Change' by the independent foundation Design without Borders. The book illustrates several DfD projects developed by Design without Borders, as well as short articles by several professionals in the domains of design, development and policy making (Verdu-Isachsen and Ramberg 2012).

Literature study 4: Obtaining user insight in rapid ethnography

Sources of applied, rapid ethnography[14] include Participatory Rural Appraisal (PRA) developed by Chambers (1994, 2004), Rapid Qualitative Inquiry (RQI) developed by Beebe (2014), and Quick Ethnography (QE) developed by Handwerker (2001). As PRA, RQI and QE comprise the main sources for RE, and within this domain, sharing of experiences is propagated, for this domain books and practical manuals regarding these three main sources were selected. Regarding PRA the following literature was reviewed:

- Rural Appraisal: Rapid, Relaxed and Participatory (Chambers 2004);
- Participatory Rural Appraisal: Principles, Methods and Application (Narayanasamy 2013);
- Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA): A Manual for CRS Field Workers and Partners (Freudenberger 1999).

Regarding RQI the following literature has been studied:

- Rapid Qualitative Inquiry: A Field Guide to Team-Based Assessment by (Beebe 2014);
- The book: Applied Ethnography: Guidelines for Field Research (Pelto 2013); mainly chapter 16, entitled: Qualitative Research Guidelines: RAP, PRA, RRA, FES and Others, which specifically focuses on rapid qualitative inquiry.
- Regarding QE the following literature has been studied:
- Quick Ethnography (Handwerker 2001).

Data analysis

The relevant literature has been scrutinized, looking for obstacles, learnings, tips & tricks, and methods, techniques and tools for obtaining rapid user insights in DfD projects. All relevant information has been colour-coded and have been grouped together as obstacles, learnings and methods, according to identified patterns. The groups have been discussed within the research team and have accordingly been re-grouped to result in 34 obstacles, 39 learnings, 9 methods, 19 techniques and 3 tools relevant to obtaining rapid and comprehensive user insights in DfD projects. The outcomes of these literature studies are presented in the next sections.

14 Throughout this thesis, the phrase 'Rapid Ethnography (RE) will consistently be used, although different authors may use different terms when referring to this sub-domain.

3.2.3 Obstacles in rapid user context exploration

The selected articles, books, manuals and toolkits were extensively reviewed and several obstacles in obtaining user insight have been detected. These can be grouped together in six categories: 1) obstacles regarding the data collection process; 2) obstacles regarding designers[15] ability to obtain user insights; 3) obstacles regarding participants ability to provide the required insight; 4) obstacles of data collection activities to detect user insight; 5) obstacles regarding the obtained data; and 6) obstacles regarding the usage of the data in the design process. In total 34 obstacles were identified; these are discussed below.

Obstacles regarding data collection process

In this section, six obstacles to obtaining rapid user insights are described, which resulted from the literature review.

a) Lack of motivation to obtain user insight in context

Obtaining insight in the natural setting is not always considered to be part of the product development process, and it can be difficult to convince the design team and / or organisation of its value (Kujala 2003). User context studies can be considered as being too time, labour, and attention intensive (Kujala 2003), which may prevent design teams from going into the field to meet 'real' users (Newell et al. 2011; Sperschneider and Bagger 2003; Viitanen 2011). Technological or economic concerns may prevail over users' concerns (Steen 2011). If the team and / or organisation does not support the idea of fieldwork, it is difficult to pursue (Kujala 2003).

b) Dealing with multiple stakeholders

According to Van Boeijen et al. (2013), DfD projects often involve multiple stakeholders with varying backgrounds and interests, such as companies, governmental and non-governmental organisations, aid foundations, and knowledge institutes. The design team needs to establish and maintain relationships with all these different stakeholders and consider their goals and interests during the design process in order to obtain access to potential users and keep all the stakeholders satisfied.

c) Limited time and resources

Field research is a complex activity that takes time to plan and execute, and that requires material and people (Kies, Williges, and Rosson 1998; Martin and Hanington 2012; Narayanasamy 2013). More time is often required for DfD projects due to lengthy travel times and infrastructure challenges (Van Boeijen et al. 2013), a longer commitment to establishing trust (Van Boeijen et al. 2013), and the need for a translator (Larsen and Flensborg 2011). Designers, unlike ethnographers, often do not have sufficient time and resources to immerse themselves for longer periods of time (Hanington 2010; Martin and Hanington 2012; Kujala 2003; Newell et al. 2011; Sperschneider and Bagger 2003; Viitanen 2011; Pelto 2013), and therefore, there is a need for gathering user needs with greater efficiency and higher

15 *Throughout this thesis, the person who conducts user context research will be called 'designer', although different authors use different terms when referring to this person, e.g., 'researcher', 'design researcher' or 'field worker'.*

productivity (Martin and Hanington 2012; Kujala 2003; Sperschneider and Bagger 2003; Handwerker 2001), while maintaining rigor (Martin and Hanington 2012).

d) Changing plans

Despite good preparation beforehand, real life in the field can be very different than expected, resulting in changes of suppositions and plans (Handwerker 2001). According to Handwerker (2001), much time in the field is spent on adapting the plans to 'field realities'. Possible obstacles which result in changes to plans are: when permissions are not granted (Handwerker 2001), the designer and the potential users cannot get along (Handwerker 2001), or when participants turn out to be difficult to reach (Beebe 2014; Chambers 2004; Narayanasamy 2013).

e) Obstacles in accessing potential users

In some projects it is difficult to identify potential users, to gain access to them and / or to actually catch them performing the tasks of interest (Kujala 2003). Potential users might be difficult to access due to private, technical, or legal issues (Roibás 2008), or because they are busy (Kujala 2003; Viitanen 2011). Restricted access or sensitive situations might limit direct contact with users (Martin and Hanington 2012) and travelling to meet potential users can also be an issue (Van Boeijen et al. 2013).

f) Open-ended, iterative process

Obtaining user insight is an open-ended, ongoing process (Johansson and Messeter 2005; Sperschneider and Bagger 2003). It is often unclear when enough information has been collected, and the view of potential users that is constructed may change during the design process once more information has been gathered (Johansson and Messeter 2005). Therefore, this process usually ends when resources are depleted (Johansson and Messeter 2005; Kies, Williges, and Rosson 1998).

Obstacles regarding designers' ability in obtaining insight

The literature review identified the following five obstacles to designers obtaining rapid user insight.

a) People's limited ability to understand a different cultural context

Barab et al. (2004) question the extent to which a different cultural context can be understood. It is difficult to move into a different world with its own knowledges and practices (Steen 2011), where people have different conditions, desires (Prahalad and Lieberthal 2003) and criteria of acceptance (Banu 2009). The needs of the marginalised and disadvantaged are often *"shaped by life experiences of chronic resource, literacy, psychological, and social barriers"* (Viswanathan and Sridharan 2012, p. 52). Conducting fieldwork in a radically different culture can be an overwhelming experience, which can be distracting and possibly influence team members' objectivity (Sklar and Madsen 2010).

b) Influence of designer's goals and agenda

The design team enters the field with its own agenda and perspectives, which can influence interaction with the participants (Barab et al. 2004; Beyer and Holtzblatt 1995). This might

result in a too focused process (Beyer and Holtzblatt 1995) and outcomes that might not match the users' agenda (Barab et al. 2004). According to Barab et al. (2004, p. 262), it is not wrong to have an agenda, as long as the design team does not let these perspectives or social commitments influence the data collection and interpretation, as it *"can undermine local knowledge, people, and power, possibly contributing to mistrust, inappropriate interventions, and undesirable outcomes."*

c) Influence of designer's personal lens

Human beings cannot escape subjectivity (Handwerker 2001), and therefore field data *"can never be free from value and interpretation"* (Johansson and Linde 2005, p. 11). Mental frames, categories and worldviews of designers might not match those of local communities (Narayanasamy 2013). Designers' backgrounds, education, political standpoints, experiences, knowledge and world views can result in mental constructs leading to biases, assumptions, and rationalisations that influence their relationships with potential users, and therefore the information collection and interpretation (Barab et al. 2004; Birkett 2010; d.School 2010; Handwerker 2001; IDEO 2008b; Johansson and Messeter 2005; Kies, Williges, and Rosson 1998; Martin and Hanington 2012; Smart and Whiting 2001; Von der Lippe 2012; Narayanasamy 2013). The formulation of questions and the execution of activities are based on the designers' understanding and assumptions, which might result in errors (Handwerker 2001; Johansson and Messeter 2005). During data analysis, perceptual errors and electronic file coding errors can occur (Handwerker 2001). Thereby, inquiry has an interpretative nature (Beebe, 2014), which allows influences caused by the personal lens of the designer (Beyer and Holtzblatt 1995): the designer documents, interprets and fills in missing information, data can be omitted or distorted, and irrelevant data can be included (Oulasvirta, Kurvinen, and Kankainen 2003).

d) Influence of designer's skills, knowledge, behaviour and attitude

A designer is often not educated to conduct ethnographic fieldwork (Johansson and Linde 2005; Nesset and Large 2004), while the quality of data collection and interpretation in ethnographic studies highly depend on the executers' skills and expertise (Barab et al. 2004; Chambers 2004; Kies, Williges, and Rosson 1998; Nesset and Large 2004; Van Boeijen et al. 2013) as well as on their behaviour and attitude (Larsen and Flensborg 2011; Chambers 2004; Narayanasamy 2013). Narayanasamy (2013) notes that the quality, validity and authenticity of data obtained by a research activity largely depends on the quality of the designer and how the designer conducts the activity. The amount of empathy and active engagement with participants, the ability to speak the same language, and the way of questioning all influence the data being collected (Handwerker 2001). According to Chambers (2004), habits and routines are a threat to good field research. Steen (2011) also warns that when designers often involve potential users in their projects, they can become prejudiced. Chambers (2004) therefore argues for continuous experimentation with appraisal methods in order to improve them, instead of constantly repeating the same steps. After data collection, designers should fully use the richness and value of ethnographic investigations (Steen 2011), but this process is a challenging task for design teams (Martin and Hanington 2012). There is no guarantee that designers will interpret the data correctly (Friess 2010; Nesset and Large 2004), and that

they will use the knowledge resulting from the user instead of the knowledge gained about the user (Steen 2011).

e) Influence of sampling errors

According to Handwerker (2001), the sample of participants selected can be a source of error, which due to random sampling or systematic selection biases (Handwerker, 2001). Certain biases can tempt designers to make brief visits which do not result in data that truly represents problems and realities (Beebe 2014; Chambers 2004; Narayanasamy 2013). These biases can be related to: space (visiting easy to reach locations), project (visiting locations where activities already take place), person (meeting easily accessible groups of people based on for example gender and status), season (visiting when the climate conditions are convenient), diplomacy (being afraid to offend the community when requesting visits to specific groups, for example the poor or women) (Beebe 2014; Chambers 2004; Narayanasamy 2013). Donaldson (2009) also warns not to weigh the input from more educated and accessible informants too heavily, as this can result in inaccurate user insight.

Obstacles regarding participants' reactivity

The literature analysis revealed the following nine influences that limit or influence participants reactivity towards the design team.

a) Presence of designer

By going into the field and interacting with people in their homes or observing people carrying out activities, designers interfere with people's normal course of action, possibly making the obtained data unreliable (Roibás 2008).

b) Position of designer

There is a cultural distance between the design team and the community (Simanis and Hart 2008). The designer enters, being an outsider, a foreigner and a professional (Larsen and Flensborg 2011), with often a different status, gender and ethnicity (Handwerker 2001), exerting a certain power and agency (Steen 2011). This social position influences designers' relationships with potential users (Barab et al. 2004) and influences participants' reactivity (Handwerker 2001).

c) Setting and audience

Participants' answers may be influenced by the environment and context of the activity (Narayanasamy 2013). It makes, for example, a difference if the activity is conducted in a public or private setting (Handwerker 2001). Freedom of speech can be limited if men and women are not equally valued and are both present, or due to the presence of people with higher status or age (IDEO 2008a; Larsen and Flensborg 2011). The presence of neighbours, friends and others might change the dynamic of the conversation, and limit story sharing (IDEO 2008b).

d) Power issues and conflicts

IDEO (2008a, p. 6) state that *"research with communities and individuals often involves issues of identity, power, and politics."* In cases of power conflicts between different people or groups

of people and powerful people, those in power may be unwilling to give up their power (Narayanasamy 2013). Depending on gender, ethnicity, class, income or status, participants' viewpoints might be valued differently in a community, hampering free speech (IDEO 2008b, 2008a). In group activities, a person or a group might dominate (Narayanasamy 2013).

g) 'Wrong' reasons for participation

Potential users might participate in ethnographic fieldwork because they want to influence the outcome (Kujala 2003), or because they expect things in return, such as grants, loans or jobs (IDEO 2008b; Larsen and Flensborg 2011; Simanis and Hart 2008).

e) Communication and terminology issues

In the field, designers often have to cope with differences in language (McNeill and Westby 1999), which makes it necessary to use a translator. Working with a translator takes time and induces challenges, such as translators who answer in place of the participant, those who do not stick to the 'rules of the game' (Larsen and Flensborg 2011). However, besides translation difficulties, the terminology used by the design team can be misunderstood by participants, even when speaking the same language. Vocabulary and meanings differ per context, and the meanings that designers and participants attach to words might not match (Handwerker 2001; Narayanasamy 2013; Martin and Hanington 2012). As Handwerker (2001, p. 83) explains: *"All speech reflects individually variable life experiences, as well as local and time-specific cultures"*. Another option could be to train local partners to conduct or assist in research activities (Larsen and Flensborg 2011; IDEO 2008b; Pelto 2013), but this might result in undesired filtering and distortion of information (Kujala 2003; Boztepe 2007).

f) Inability to share needs and knowledge

Steen (2011) states that potential users might not always be aware of their needs. What people say is not always what they do (Beyer, Holtzblatt, and Baker 2004; IDEO 2008b; Smart and Whiting 2002). Participants can lack awareness or insight, or their memory can be biased, confused or decayed (Handwerker 2001). Potential users may also not be aware or be unable to share their knowledge. According to Van der Veer (2008), participants can share their explicit expertise, but they also possess implicit knowledge that they are unable to explain. Thereby, Kujala (2003, p. 1) notes that knowledge that is relevant to designers might have become tacit to the participant due to automation, and is therefore *"no longer consciously available for the person and […] difficult to articulate"*.

g) Difficulty to articulate details

When people discuss what they do, they often use abstract terms (Beyer and Holtzblatt 1995). And when retelling an event or experience, people often remember the peaks and troughs, but tend to skip whole steps and leave out detail (Beyer and Holtzblatt 1995; Martin and Hanington 2012).

h) Difficulty to articulate needs and knowledge

Steen (2011) warns that potential users cannot always articulate their needs. Kujala (2003) found that users sometimes lack the confidence to talk to 'outsiders'.

i) Unwillingness to articulate needs and knowledge

Potential users do not always want to be observed or articulate their needs (Kujala 2003; Steen 2011). As Martin and Hanington (2012) argue, expressing innermost feelings, thoughts and desires can be a challenging and uncomfortable exercise. Participants can hold back in answering or even mislead designers (Chavan and Gorney 2008). Reasons can be a lack of motivation (Kujala 2003), disinterest, fatigue, embarrassment, feeling threatened, etiquette (Handwerker 2001), a lack of time (Handwerker 2001; FrogDesign 2012; Simanis and Hart 2008), unwillingness to make negative remarks (Chavan and Gorney 2008), scepticism or distrust due to negative prior encounters (Simanis and Hart 2008). Participants can also experience the topic or activity as traumatic (Handwerker 2001).

Obstacles regarding activities that can be used for data collection

The literature notes the following five limitations of activities for obtaining rapid user insight.

a) Ethical considerations

When working with people, ethics play a role. Privacy or personal behaviour in the field can present issues, as research activities can be intrusive and demanding for the participants (Martin and Hanington 2012; Roibás 2008). With current technological advances, risks of distortion and misuse of gathered data becomes higher (Pelto 2013). Thereby, it may be difficult to protect the anonymity of locations and informants (Pelto 2013). The time invested by participants on research activities cannot be spend for other purposes (Larsen and Flensborg 2011; Simanis and Hart 2008). This imposition on participants time and energy should be respected, and properly compensated (Larsen and Flensborg 2011).

b) Unclear which data to collect

Handwerker (2001) argues that the data to be obtained depends on what the designer wants to know. According to Boztepe (2007), it is still unclear which dimensions must be considered in a design process. She argues for a framework of dimensions that can be used in any culture to obtain insight in the situation and context where the products and / or services will be used, in order to aid product design decisions.

c) Methods, techniques and tools cannot be prescribed

According to Hanington (2010), there is often debate about which approach to use and which methods to select in a design process, especially in an interdisciplinary design context. The method of contextual inquiry, for example, therefore describes concepts to guide the designer, but does not prescribe certain steps (Viitanen 2011). According to Gielen (2008), design methods should suit the design partners, and according to Handwerker (2001), the tools should fit the purpose of research.

d) Methods need further development

Kujala (2003) notes that methods designed to involve users are in need of further development and should carefully consider the roles of the designers and the potential users. They need to fit the creative design process (Hanington 2010), become more efficient, and should consider *"subtle differences in people's ways of doing things"* in order to better address local cultures (Boztepe 2007, p. 517).

e) Methods need contextual adaptation

Van Boeijen et al. (2013) and Chavan and Gorney (2008) state that western methods need to be adapted for DfD purposes. In DfD projects, these methods do not always work as intended (Van Boeijen et al. 2013), as they carry built-in biases and assumptions (Chavan and Gorney 2008). Thereby, marginalised and disadvantaged populations often have a lower literacy and use local languages, which stands in the way of the direct application of western methods (McNeill and Westby 1999). McNeill and Westby (1999) found, for example, that the use of written documents, discreet points on subjective scales, and severity scales could not be used, and that subjective feelings had to be described more elaborately.

Obstacles regarding obtained data

The following four limitations of fieldwork outcomes are described below.

a) Time-consuming analysis

The amount of data collected from field studies is often huge (Kujala 2003; Oulasvirta, Kurvinen, and Kankainen 2003), which results in time-consuming data analysis and a complex interpretative process (Kies, Williges, and Rosson 1998; Martin and Hanington 2012). Data of each participant need to be analysed to allow for comparison across users (Kujala 2003), and analysing learnings from the field takes at least twice the time needed to collect the data (Handwerker 2001). According to Kies, Williges, and Rosson (1998), it is difficult to prepare standard coding schemes for insight obtained in natural settings.

b) Data contains errors

According to Handwerker (2001) all data contains errors and designers cannot be sure that they collected all the required data and that they measured the obtained data in the best possible way. He mentions eight errors that limit internal data validity:

1. Instrumentation: differences in ways of making observations. Different designers undertake similar activities in different ways. Thereby, experience improves observations, making observations of one designer different over time;
2. Diffusion: cultural elements from one person or group spread to others. Increasing project knowledge, social interaction or shared backgrounds of participants may result in diffusion;
3. Testing: participants respond differently at different times and days;
4. Regression: random errors occur due to changing interactions and context of fieldwork. Participants do things for many reasons and might not be aware of their reasons why they do things and of the influence of what they do;
5. Mortality or movement: participants may die or migrate during the fieldwork;
6. Maturation: during the fieldwork, people's age and experience increase, expanding their insights;
7. History: past events and experiences, which are not under investigation, influence the participant;
8. Selection bias: bias as a result from excluding a non-random subset of participants.

c) Data represents a snapshot in time

People's cognition, emotion, and behaviour evolve (Handwerker 2001) and so do their experiences (Martin and Hanington 2012), preferences (Van der Veer 2008), and goals (FrogDesign 2012). People continuously create and change context (Barab et al. 2004). Not only do the potential users change, the designers also change: the questions to obtain information are formulated at a specific point in time, based on the designer's knowledge at that moment (Johansson and Messeter 2005).

d) Data is often not generalizable

Villages differ, communities differ, and potential users within villages and communities also differ (Narayanasamy 2013). They differ in age, gender, ethnic or social group, poverty status, educational level, livelihood strategy, assets, occupation, etc. (Narayanasamy 2013). While close interaction with users results in valuable data (Iivari and Iivari 2011), it also has the risk of only including a limited number of participants, which makes it difficult to account for a broad variety of potential users (Newell et al. 2011; Viitanen 2011). Field data is therefore complex and situation-specific (Kies, Williges, and Rosson 1998), personalised and not generalizable (Pelto 2013; Hanington 2010; Newell et al. 2011; Smart and Whiting 2001; Viitanen 2011), except for the defined community (Handwerker 2001). This data therefore does not represent universal, but local truths and leads to understanding and not to generalization (Beebe 2014). Steen (2011) therefore warns designers not to overemphasise their findings from a limited sample of users, and in this way over-customise their product.

Obstacles for using fieldwork outcomes

Five obstacles of using the fieldwork outcomes to inform the design process are described below.

a) Not all needs and preferences can be addressed

Individual needs and wants differ throughout a country or region (Donaldson 2006; Van der Veer 2008; Viswanathan and Sridharan 2012), per person (Shahnavaz 1989; Smart and Whiting 2002), and per situation, depending on history, culture, context and actual needs (Van der Veer 2008). Due to individual variations, there is no one representative user (Beyer, Holtzblatt, and Baker 2004; Iivari and Iivari 2011). Designers have to deal with this variation in needs and wants (Sklar and Madsen 2010). Thereby, designers cannot usually consider all the relevant parameters at once (Shahnavaz 1989), they need to prioritise, make trade-offs and balance the needs of the individual with that of the community (Sklar and Madsen 2010). Therefore, designers define boundaries to support their design process (Ray and Ray 2011), but these boundaries often do not reflect deviations, differences and individualities (Banu 2009).

b) Balancing between cultural specificity and standardisation

The resulting data are specific to a certain context, while designers might want or need to develop products relevant for a broader user group. Standardisation relates to the extent the products and / or services can be used in other contexts (Barab et al. 2004). For DfD both Margolin (2007) and Banu (2009) argue for a certain level of standardisation, to support

self-sufficiency by design for export, but Banu (2009) also argues that DfD requires a certain cultural specificity to contribute to social development. The designer has to choose to what extent products and services will be standardised or adapted to individual or community preferences (Boztepe 2007).

c) Field data is not direct input for design

According to Boztepe (2007), there is a gap between user research and its applicability for design purposes. There is no specified way to turn fieldwork data into knowledge and formulations that designers can use (Diggins and Tolmie 2003; Friess 2010; Smart and Whiting 2002; Boztepe 2007) and it is unclear when user data can best be integrated in the design process to obtain the highest added value (Boztepe 2007).

d) Difficult to foresee all consequences of product use

Banu (2009) points out that design is never neutral, and might even harm a shared human world. Design can unite as well as segregate people, and economic need and environmental protectionism might collide (Banu 2009). Designers should therefore not only pay attention to user needs and wants, but also to the wider impacts of their designed products and services. These impacts are difficult to oversee, as product users differ in their ways of using products and services (Barab et al. 2004). In addition, according to Prahalad and Lieberthal (2003), the use of products can vary greatly in different regions in the world.

e) User insight informs design decisions, but does not make decisions

Designers have to balance between their own knowledge and the ideas and the needs and preferences of their potential users (Steen 2011). The obtained data comprise information about current or past practices, while designers develop products and / or services for alternative or future practices that bring change (Steen 2011). It is up to the designer to transform the obtained data into products and / or services for future needs and preferences (Van der Veer 2008) or allow for adaptability of the products and / or services (Banu 2009; Barab et al. 2004). In a case study, Friess (2010) identified that justification for design decisions comes from various sources, among which are users and outside authorities, but also designers' own impressions and storytelling about users' hypothetical situations.

3.2.4 Learnings from practice to obtain rapid user insight

The selected literature offers several learnings from practice which are relevant when obtaining rapid user insights. Ten learnings comprise general project requirements and 38 learnings can be combined in five steps: 1) select and prepare the research team; 2) prepare activities; 3) plan the fieldwork; 4) execute the fieldwork; and 5) analyse and interpret data.

General project requirements

When conducting fieldwork in a radically different culture, 10 general project requirements need to be fulfilled in order to conduct rigorous research leading to valid, usable outcomes. These are described below.

a) Organisational support

When doing user research for a company, it is important that the activity is supported by the company, in terms of providing resources and allowing for experimentation and evaluation focused on long-term results and learning (Simanis and Hart 2008). These kind of projects are often independent from a company's core business, but do need the support from the company management in order to ensure continuity (Simanis and Hart 2008; Crul and Diehl 2006).

b) Establish a creative project space

For continuous inspiration and for monitoring progress, both IDEO (2008b) and FrogDesign (2012) advise the design team to create their own space where they can work on the project, can visualise the process, and hang things on the walls. A creative environment where ideas can be shared and explored helps design teams to move forward (Martin and Hanington 2012).

c) Ensure local partnerships

Sklar and Madsen (2010) argue that in a developmental context, more comprehensive solutions must be designed, which fit into the existing context and infrastructure. They call this a 'systems view'. It is therefore important to build relationships with governmental and non-profit organisations (Bowman and Crews 2009; Verdu-Isachsen 2012), or at least have a 'local face' (Prahalad and Lieberthal 1998). This helps designers to acclimate quickly (Sklar and Madsen 2010), to obtain knowledge and information about the potential users (Simanis and Hart 2008; Larsen and Flensborg 2011; Viswanathan, Yassine, and Clarke 2011; Pelto 2013), to get advice on the planned activities (Larsen and Flensborg 2011), to build trust and relationships in communities (Sklar and Madsen 2010; Simanis and Hart 2008), and to gain access to make arrangements to start learning (Larsen and Flensborg 2011; Viswanathan, Yassine, and Clarke 2011; Sklar and Madsen 2010; Pelto 2013). Intentions should be made clear towards local partners in order to build proper expectations (Larsen and Flensborg 2011), and the relationships must be equal (Kapoor 2012; Grimstad 2012). Simanis and Hart (2008) recommend keeping the partnerships flexible, as the project needs may change along the way.

d) Direct contact with the potential users

Most of the reviewed authors argue that it is important to directly observe and interact with potential users in their natural settings. It may be tempting to do a quick questionnaire survey instead of conducting rigorous fieldwork, but the questionnaire cannot be properly established if the categories and words of the local people have not been identified (Beebe 2014). IDEO (2008b) and Naidoo (2012) argue that potential users are the experts in knowing the right solutions. According to Smart and Whiting (2001, 2002), the amount of customer contact is often related to a project's success. Direct contact allows for learning directly from the people through interactions (Kujala 2003; Newell et al. 2011; Viswanathan and Sridharan 2012; FrogDesign 2012; Chambers 2004; Narayanasamy 2013), aids building a shared language (Simanis and Hart 2008), and helps to obtain a good understanding about what people do and feel, about their tacit knowledge, their practices, needs, preferences,

and context (Van Boeijen et al. 2013; Kujala 2003; Newell et al. 2011; Kies, Williges, and Rosson 1998; IDEO 2008a; Polak 2008; Bowman and Crews 2009; Martin and Hanington 2012; Hanington 2010; Viswanathan, Yassine, and Clarke 2011; Steen 2011; Simanis and Hart 2008). First-hand experiences enable the design team to capture detail (Kujala 2003; Beyer and Holtzblatt 1995; Diggins and Tolmie 2003), to gather concrete data and experience (Viitanen 2011), to develop empathy (Kujala 2003; Lebbon, Davies, and Shippen 2011), to reduce undesired filtering and distortion of information (Kujala 2003; Boztepe 2007), to reduce biases, rationalisations and views of the designers (Smart and Whiting 2002) and to make enlightened decisions (Larsen and Flensborg 2011) in a rapid way (Beyer, Holtzblatt, and Baker 2004). It is especially important in a radically different culture to have direct contact with potential users, as the availability and dissemination of information about these regions varies and cannot always be found in secondary data (Larsen and Flensborg 2011). Being 'outsiders', the design team can only obtain an 'insider' perspective by spending time with the concerned 'insiders' (Handwerker 2001; Beebe 2014).

e) Engagement throughout and after the design process

It is important to continuously interact with potential users throughout the design project, beyond needs analysis and usability studies (Barab et al. 2004; Donaldson 2002; Simanis and Hart 2008; Sperschneider and Bagger 2003; Van der Veer 2008; Narayanasamy 2013). Together with potential users, value can be co-created (Simanis and Hart 2008). Ongoing relations deepen understanding (Kujala 2003; Barab et al. 2004) and are more respectful towards the local people. Full involvement of local partners and potential users also results in more appropriate design decisions (Sklar and Madsen 2010) and design outcomes (Barab et al. 2004), increasing the chances of success (Beebe 2014). Continuous learning from customers, also beyond the design project, is required in order not to miss cues (Handwerker 2001) and to stay in business (Polak 2008).

f) Decide on the goals and focus beforehand

In consultation with the client, the design team has to decide what kind of impact they aim for and which goals they want to achieve (FrogDesign 2012; Crul and Diehl 2006; Simanis and Hart 2008; Larsen and Flensborg 2011; Handwerker 2001). It can be useful to include the perspectives of all involved in order to form a consensus about the focus of activities (Martin and Hanington 2012). The way designers think about the world contains errors, and this needs correction in the field (Handwerker 2001). The problem the team is trying to solve and their goals might change during the process, but it is useful to start with something concrete (Handwerker 2001) and to align the team beforehand (FrogDesign 2012) in order to manage expectations (Crul and Diehl 2006; Verdu-Isachsen 2012) and improve productivity (Handwerker 2001). The focus steers the specific knowledge that needs to be obtained (Larsen and Flensborg 2011; Handwerker 2001; Chambers 2004), and therefore the field work activities, tools and discussion topics (Viitanen 2011; Handwerker 2001). A clear focus provides a starting point and prevents the research from continuing forever (Handwerker 2001; Pelto 2013). This focus must be broad enough to enable discovery of new, unexpected areas, but narrow enough to be able to manage the field research (Larsen and Flensborg 2011) without losing direction (Handwerker 2001).

g) Decide on the approach beforehand

Besides a human-centred / user-centred / participatory approach, many other design approaches exist such as: vision in product design, design for emotion, brand driven innovation, service design, cradle to cradle, eco-design (Van Boeijen et al. 2013), sustainable design (Kensing, Simonsen, and Bødker 1998) evidence-based design, participatory action research (Martin and Hanington 2012), co-design, lead user approach, empathic design (Steen 2011), informant design, learner-centred design (Nesset and Large 2004), inclusive design, universal design, critical design (Newell et al. 2011), scenario-based design (Iivari and Iivari 2011; Park 2011), architectural innovation (Ray and Ray 2011), ergonomic design (Shahnavaz 1989; Van der Veer 2008), activity centred design (Van der Veer 2008), bricolage approach (Viswanathan and Sridharan 2012), system design (Beyer and Holtzblatt 1995; Iivari and Iivari 2011), and interaction design (Johansson and Messeter 2005). Before starting an activity, a choice needs to be made for the approach to be used. This choice depends on the project goals and the team focus.

h) Triangulate for validity

In the context of user research, the number of participants is often not sufficient to provide statistically relevant data. Triangulation can be used to enhance data reliability and validity. There are a number of types of triangulation:

- Discipline triangulation: involving designers from multiple disciplines to look at the research from different perspectives, and in this way reduce errors (Johansson and Linde 2005; Handwerker 2001; Chambers 2004; Narayanasamy 2013; Beebe 2014; Smart and Whiting 2001, 2002).
- Investigator triangulation: conduct the research with multiple designers (varying in gender, age, ethnicity, status, insider / outsider role) to cross-verify observations and descriptions (Martin and Hanington 2012; Handwerker 2001; Chambers 2004; Narayanasamy 2013; Beebe 2014; Smart and Whiting 2001, 2002).
- Data triangulation: using different data sources. E.g. Learn from different people, look at places, and ask about changes to events and processes (Van Boeijen et al. 2013; Chambers 2004; Narayanasamy 2013; Beebe 2014; Pelto 2013);
- Theory and methodology triangulation: using multiple methods, for example a combination of observations with interviews and discussions (Narayanasamy 2013; Lebbon, Davies, and Shippen 2011; Martin and Hanington 2012; Handwerker 2001; Pelto 2013; Chambers 2004).
- Tool and technique triangulation: using multiple tools and sources of confirmation, for example by asking different type of questions about the same topic, by using drawings and showing pictures (Larsen and Flensborg 2011; Handwerker 2001).

i) Collect data iteratively

Although it is valuable to define the goals, focus, activities, topics and questions upfront, user-centred data collection is an iterative process. Iterative data collection is required for validation of outcomes (Smart and Whiting 2002) and it helps to identify and correct misconceptions (Oulasvirta, Kurvinen, and Kankainen 2003; Handwerker 2001). New information leads to

new and deeper understanding (Sperschneider and Bagger 2003; Johansson and Messeter 2005; Kies, Williges, and Rosson 1998; Handwerker 2001; Beebe 2014), requiring alterations to the research goals and strategy (Sperschneider and Bagger 2003; Nesset and Large 2004; FrogDesign 2012), the methods, topics and questions (Handwerker 2001; Simanis and Hart 2008; Sperschneider and Bagger 2003; Pelto 2013) and to the identified challenges and opportunities (Larsen and Flensborg 2011). This new or changed understanding often requires additional field work (Smart and Whiting 2002; Sperschneider and Bagger 2003; Van der Veer 2008; Kensing, Simonsen, and Bødker 1998; Beebe 2014; Handwerker 2001). Chambers (2004), Larsen and Flensborg (2011) and FrogDesign (2012) therefore advise remaining flexible by continuously developing and adapting research activities based on experiences and insights of the research team. Handwerker (2001) advises scheduling feedback loops during the context research process in order to change definitions and define further data collection activities. The process of iterative data collection ends when the research team decides that significant cultural variation has been exhaustively identified, or when the team members themselves are exhausted (Handwerker 2001).

Step 1: Select and prepare the research team

When conducting fieldwork in a radically different culture, the research team must be carefully selected and prepared before entering the field. Points of attention derived from the literature are provided below.

a) Multidisciplinary research team

For field context research, team work is critical (Beebe 2014). The research team should consist of specialists from different disciplines with different skills and knowledge (Nesset and Large 2004; Newell et al. 2011; Smart and Whiting 2001; Beyer, Holtzblatt, and Baker 2004; Margolin 2007; Simanis and Hart 2008; Crul and Diehl 2006; Narayanasamy 2013). The team should possess creative, decision-making and communication skills (Crul and Diehl 2006). Team members should have an interest in the topic (Handwerker 2001), should be personally committed, have critical awareness, improvisational skills (Chambers 2004), and *"a willingness and urge to understand and solve challenges"* (Von der Lippe 2012, p. 149). Preferably, one member has qualitative research expertise (Beebe 2014), and one member is an experienced development practitioner (Simanis and Hart 2008). Handwerker (2001) recommends including team members with skills that cannot be taught, such as intelligence, reliability, imagination, curiosity and sensitivity. For a balanced gender perspective, men and women should be involved in the process (IDEO 2008b; Simanis and Hart 2008; Handwerker 2001), and Simanis and Hart (2008) also argue for a combination of experienced and younger team members to combine experience and openness to new procedures. A diverse team, differing in gender, age, ethnography and status, might also allow access to a wider range of community members (Simanis and Hart 2008; Handwerker 2001). Team members should be well-funded, but also be given time, attention and trust (Handwerker 2001).

The use of a team speeds up the process, as more designers can do research at the same time (Barab et al. 2004; Beebe 2014; Handwerker 2001). It also helps in focusing and enables discussions about the findings (Lebbon, Davies, and Shippen 2011), and allows for detection

of errors due to multiple points of view (Handwerker 2001; Chambers 2004; Narayanasamy 2013; Beebe 2014). Investigator and discipline triangulation improves the validity of the results (Smart and Whiting 2001, 2002). Moreover, the various backgrounds and viewpoints of a diverse team of people helps in generating insights and developing solutions for complex challenges (d.School 2013; IDEO 2008b). For user context research in a radically different context, IDEO (2008b) advises establishing a team of three to eight people with different disciplinary and educational backgrounds, Simanis and Hart (2008) argue for four people per site, and Crul and Diehl (2006) state that a team should preferably not contain more than six people. To optimise the process, Crul and Diehl (2006) advise deciding on the roles, tasks and responsibilities of each team member in advance. Narayanasamy (2013) argues a team should consist of a facilitator, an interviewer, a content writer, a process observer and a gate keeper.

b) Consider professional partnerships

Stakeholders from knowledge institutes, consultancies or local partners can be included in the team (Crul and Diehl 2006). Wasserman (2012) and Verdu-Isachsen (2012) argue for partnering with professionals from varying backgrounds working in the domain of social development, such as social scientists, economists, political scientists, human factor specialist, and future scenario planners. According to Wasserman (2012), they bring essential knowledge to the table, for example about adoption behaviour, change-creating forces, and ways to scale up.

c) Consider using local researchers

Community members, students, NGO employees or other local partners can be trained to conduct or assist in research activities (Larsen and Flensborg 2011; IDEO 2008b; Pelto 2013). Simanis and Hart (2008) advise adding one or two individuals with deep ties to the community to the team to enhance access. Chambers (2004), Narayanasamy (2013) and Pelto (2013) argue that local community members conduct the research activities. In this case, the designers can be present at the start (Chambers 2004), or to observe and offer support when required (Larsen and Flensborg 2011). However, they can also stay away completely and let the local team members report their findings to them (Larsen and Flensborg 2011). Larsen and Flensborg (2011) indicate that including young local people in the team is useful, as they often like to express themselves. Advantages of using local team members are that participants might be more open and honest towards community members and they can help interpret hidden meanings and motivations (IDEO 2008b). It also leads to skill enhancement of the local team members and might enhance a feeling of ownership of the outcomes (Chambers 2004). The local team members should, however, not have a stake in the outcomes, and be fair and unbiased (Larsen and Flensborg 2011).

d) Attune work practices

To perform well as a team, it is relevant to be aware of what is important for each team member, what values they have, and how they work (FrogDesign 2012). Chambers (2004) proposes drawing up contracts with agreed norms, behaviour and modes of interaction.

e) Bring about existing knowledge

Within the team or organisation, knowledge regarding the potential users and the design challenge might already exist (IDEO 2008b; Larsen and Flensborg 2011). As Polak (2008) argues, designers should not reinvent the wheel. It is therefore relevant to include the existing knowledge before leaving for the field (IDEO 2008b; Martin and Hanington 2012; FrogDesign 2012; Sperschneider and Bagger 2003). Handwerker (2001) and Pelto (2013) thereby argue for conducting a thorough literature review about the geography, economy, sociality and demography of the region. This may also include information from local project partners (Pelto 2013).

f) Train team members

Hanington (2010) explains that the active consultation of users and the methods used to do so are often debated for their rigor and relevance. He therefore stresses that designers must have a solid and broad understanding of doing 'good' research in the field, and that they need a scientific attitude, which involves being systematic, sceptical, ethical and rigorous in order to reduce bias and produce valuable results for design. Beebe (2014) argues for including a team member with expertise in qualitative field work, but if this is not the case, the team members should at least learn about qualitative research. Beebe (2014), Chambers (2004) and Narayanasamy (2013) warn that rapid appraisal methods should not be applied without proper training to avoid misuse. In addition to training, Pelto (2013) also argues for adequate supervision when fieldwork is conducted.

Designers are not specifically educated to conduct applied ethnographic user research, and they must be taught the methods, techniques and tools, the underlying philosophy, and the skills needed to conduct this type of research (Simanis and Hart 2008; Hanington 2010), with an emphasis on attitude and behaviour (Narayanasamy 2013; Chambers 2004). Team members should also be trained to understand which information must be collected in the field (Handwerker 2001). Training will help designers to understand the limitations of their research and to obtain information that helps them to make informed design decisions (Hanington 2010). The level of training depends on the skills the team members already possess and on the skills that are required (FrogDesign 2012). According to Beyer and Holtzblatt (1995), team members can learn the appropriate roles, attitudes and behaviours for field research by following a one-day training course. Chambers (2004) states that the required course might take one hour, but can also take several weeks. Handwerker (2001) argues for a minimum of one week and preferably two weeks, and Pelto (2013) recommends at least five days of training. Further development of skills can and should come from experience, mutual learning (Hanington 2010; Beyer and Holtzblatt 1995; Chambers 2004; Handwerker 2001) and critical examination of behaviour in the field (Chambers 2004; Narayanasamy 2013).

The following recommendations for designers' behaviour and attitude are mentioned in the consulted literature:

- Focus on the process and on qualitative change, not on targets or products (Narayanasamy 2013).
- Minimise hierarchy. In order to minimise hierarchical perceptions, IDEO (2008b)

provides several tips: (1) the attending team members should sit at the same height level as the participants; (2) if more than one designer is present, they should not sit together; (3) organisation-branded clothing should be avoided; and (4) the attending team members should wear clothing with the same status as participants, which does not mean identical clothing. Nesset and Large (2004), who conduct research with children, also advise wearing casual clothing and being at the same physical level.

- Build rapport. The research team should build rapport during each activity, and therefore seek and listen carefully, demonstrate commitment, show respect, humility, interest, be honest, be clear about intentions, develop dialogue, be ready to learn and ask to be taught, share information, ideas, and food, invite and answer questions, accept and give gifts if appropriate, and 'share themselves' (see also step 3 under 'build relationships').
- Demonstrate willingness to learn from them. Von der Lippe (2012) recommends going into the field with the recognition that indigenous knowledge is essential. When people feel that their knowledge is recognised, they feel relevant as participants (Larsen and Flensborg 2011). Participants should be viewed as means that change the designers' perspective (Johansson and Messeter 2005), and teach them things (Polak 2008; Narayanasamy 2013; Chambers 2004). The designers should therefore not act as experts who know what is best (Larsen and Flensborg 2011; Ramberg 2012) and should not impose theories and insights on participants (Barab et al. 2004; Narayanasamy 2013). Instead, they should be willing to admit ignorance (Simanis and Hart 2008) and treat the participants as the experts. The participants should feel that the designers are open to learning from them (Larsen and Flensborg 2011; Viitanen 2011; IDEO 2008a; Beyer and Holtzblatt 1995; Narayanasamy 2013; Handwerker 2001; Chambers 2004), that the dialogue is about them, and that their knowledge is relevant (Larsen and Flensborg 2011). The designers should gain appreciation of the people, culture, customs (Narayanasamy 2013) and the way people live their lives (Simanis and Hart 2008; Narayanasamy 2013). The goal is to build empathy (d.School 2013) and to understand participants' perceptions rather than to correct them (Larsen and Flensborg 2011; IDEO 2008a; Pelto 2013).
- Start with an open mind. The designers are 'outsiders' who often speak a different language and have different perceptions of meanings (Simanis and Hart 2008; Larsen and Flensborg 2011) due to different life experiences and cultures (Handwerker 2001). Designers need to change their constructs towards those of the local people, to better understand their experiences. Therefore they need to learn to think differently about the world (Handwerker 2001). They need to understand the insiders' perspective, learn about the categories that local people use to describe situations (Beebe 2014), and they need to inquire about local perceptions of the meaning of important denominators (Larsen and Flensborg 2011). To avoid making assumptions, it is important that they enter the field with an open mind (IDEO 2008b; Sperschneider and Bagger 2003). This does not mean that designers must start with an empty head (Martin and Hanington 2012), it means that designers should put aside what they know (IDEO 2008a) and look at the project with fresh set of eyes (d.School 2013), and attention to detail (Beyer and Holtzblatt 1995). Designers should be open to learn from the unexpected (Van Boeijen et al. 2013) and should want to be surprised (Sperschneider and Bagger 2003). According to d.School

(2013), it is important to avoid making value judgements, to question everything, to be truly curious, to look for interesting threads and themes that arise, and to truly listen. It is useful to hear participants explain things in their own words (IDEO 2008a) and be aware that the answers might be surprising (FrogDesign 2012; d.School 2013). d.School (2013) and Polak (2008) advise thinking like a child. FrogDesign (2012) and Handwerker (2001) recommend appearing a little stupid; even if you think you know the answer, pretend you do not know (FrogDesign 2012).

- Listen with genuine interest. Designers should listen actively and attentively with genuine interest, enthusiasm and curiosity (Polak 2008; Larsen and Flensborg 2011; d.School 2013; IDEO 2008a; Beyer and Holtzblatt 1995; Narayanasamy 2013; Handwerker 2001; Chambers 2004), without thinking about the next question or comment (d.School 2013).
- Encourage answering. Participants' answering can be encouraged verbally and nonverbally (Handwerker 2001; Freudenberger 1999). Freudenberger (1999) advises saying things like 'mmmm', 'uh-huh', 'I see' or 'really?', and to use body language, such as head nodding, attentive forward leaning, and smiling.
- Mind your own body language. While body language can be used to encourage participants to share stories, it can also communicate, for example, disinterest or lack of commitment. Narayanasamy (2013) therefore advises being aware of and careful about body language, and keeping an appropriate level of eye contact.
- Pay attention to participants' body language. Designers should pay attention to non-verbal behaviour, as this can help them to decide how to continue (Narayanasamy 2013).
- Stimulate storytelling. Designers should encourage participants to tell stories (Beebe 2014; d.School 2013; Pelto 2013), as stories indicate how participants think about the world (d.School 2013). They should not try to make participants answer briefly and concisely, they should enable participants to tell their stories in their own way - in all their complexity (Narayanasamy 2013).
- Encourage informants to provide details and context (Pelto 2013). Designers should stimulate participants to help them understand which experiences have been significant to them and why they have been significant (Handwerker 2001).
- Limit interruption. The purpose of the activities is to elicit responses from the participants and therefore the interference of the designer should be minimal (Nesset and Large 2004). The facilitator should play an active role in engaging users (Smart and Whiting 2001), but not interrupt or rush participants (Larsen and Flensborg 2011; Narayanasamy 2013). Designers should listen first and then talk (Barab et al. 2004). It is important for the designer not to be afraid of silence (d.School 2013; IDEO 2008a; Freudenberger 1999; Narayanasamy 2013). However, pauses should not become awkward (Narayanasamy 2013). Participants should be given the time to reflect, think and respond (Larsen and Flensborg 2011; d.School 2013; Narayanasamy 2013).
- Do not suggest answers to questions (d.School 2013; Narayanasamy 2013).
- Engage in flexible but focused conversations. During activities it is useful to have a plan and a guiding set of topics and questions, but the research approach should remain flexible, allowing for divergence from the plan (Martin and Hanington 2012; Narayanasamy 2013; Pelto 2013). Designers should feel free to change the order of questions and pose new

questions (Larsen and Flensborg 2011). The facilitator should not ask questions from a script (IDEO 2008a). Therefore, it might be useful to hide the list of questions and to learn the key questions by heart or keep them out of sight (Larsen and Flensborg 2011). For participants, interviews should feel like dynamic open-ended conversations that make participants feel comfortable (IDEO 2008a). Conversations following a question should continue as long as needed (d.School 2013) and it is important to continue dialogue on topics that seem to be of interest to the participant (Larsen and Flensborg 2011; Handwerker 2001). It is also relevant to follow-up on surprising, idiosyncratic or contradictory responses or behaviour that arise during the activity (Martin and Hanington 2012). However, the facilitator should continue to keep sight of the questions that need to be answered (Larsen and Flensborg 2011) and exert some control over the topics (Handwerker 2001).

- Beware of habitual behaviour. Beyer and Holtzblatt (1995) argue that designers should behave like an apprentice and be open to learning, but recognise that it is easy to fall back into other, possibly more habitual behaviour, such as that of an interviewer, expert or personal friend;
- Look out for abstract talk. If participants start to talk in abstract terms, it is up to the facilitator to return the discussion to the participants' actual experiences (Beyer and Holtzblatt 1995). It can be useful to ask participants about concrete examples (Handwerker 2001; d.School 2013).
- Make it relaxed. The activities need to be conducted within a defined period, but this does not mean that they should be rushed (Beebe 2014; Chambers 2004; Narayanasamy 2013). Instead, interactions should be relaxed and conducted with commitment (Narayanasamy 2013; Chambers 2004).
- Be sensitive towards the participants' feelings (Narayanasamy 2013). Topics might be controversial or sensitive (Freudenberger 1999). It can be useful for designers to pretend they know what participants mean, so that they feel supported (Freudenberger 1999);
- Sympathise. It can be useful for designers to sympathise with the participant, even if they do not agree, in order to make the participant open up more (Freudenberger 1999).
- Learn from failures. Things will not always go as anticipated. Handwerker (2001) even states that things will go wrong anyway. When things do go wrong, designers should learn from the failures (Narayanasamy 2013) and, together with the team, start building new plans based on the failed ones (Handwerker 2001).
- Manage the time. Activities should be long enough to make participants feel that they are being properly heard (IDEO 2008a), but not go on too long (Narayanasamy 2013). Participants might become tired and lose interest if the activity takes a long time, and this might negatively affect outcomes (Larsen and Flensborg 2011). Activities should be ended when the designers no longer have any questions, or when they feel they delay a participant (Larsen and Flensborg 2011).
- Adhere to ethical principles. Designers need to be aware of the ethical boundaries of their research methods (Martin & Hanington, 2012) and should check for review obligations of their research plans in the home country and the country under study (Pelto 2013). Pelto (2013) strongly insists on research that is sound, well-conducted and

results in valuable data, as it is unethical to incompetently invade people's private lives resulting in questionable data. Privacy should be considered and people's sensitivities and rights should be recognised (Martin and Hanington 2012; Roibás 2008), designers should explain the goals and background of the research and how the outcomes will be used (Handwerker 2001; Pelto 2013), they should ask for consent to record and use the outcomes (Pelto 2013), should secure anonymity of locations and informants (Pelto 2013). Designers should be aware of power differences and the influence of their position (Barab et al. 2004; Handwerker 2001; Steen 2011; Simanis and Hart 2008).

The following recommendations for designers' questioning behaviour are mentioned in the consulted literature:

- Ask questions that are:
  - neutral. Directive questions introduce bias (Freudenberger 1999). Designers should therefore avoid steering participants' answers by implying a right or wrong answer (d.School 2013), and not lead them towards an expected answer (Martin and Hanington 2012; Narayanasamy 2013). They should furthermore avoid 'blaming questions' which suggest the participant is wrong or at fault (Martin and Hanington 2012);
  - specific. Designers should avoid using the word 'usually', and instead ask about a specific instance or occurrence (d.School 2013);
  - naïve. Designers should pretend not to know (FrogDesign 2012; IDEO 2008a; d.School 2013) in order to hear how people narrate things themselves (IDEO 2008a);
  - simple, short and to the point (Narayanasamy 2013);
  - open-ended. To stimulate conversation and stories, questions should elicit answers that require more than one word (Larsen and Flensborg 2011; IDEO 2008a; d.School 2013). Open-ended questions often start with 'why?' (Freudenberger 1999). Why-questions make people look into underlying reasons behind their behaviour and attitudes (IDEO 2008a). Narayanasamy (2013) and Van Boeijen et al. (2013) advise asking questions that start with: 'what?', 'when?', 'where?', 'who?', 'how?', and 'why?'.
- Avoid questions that are:
  - insensitive (Narayanasamy 2013);
  - offensive (Handwerker 2001; Narayanasamy 2013);
  - ambiguous (Handwerker 2001);
  - biased (Freudenberger 1999; Handwerker 2001). Questions with built-in assumptions are not always corrected by participants, who might answer the question to please the designers (Freudenberger 1999);
  - leading, blaming, or oriented (d.School 2013; Martin and Hanington 2012; Narayanasamy 2013; Freudenberger 1999; Larsen and Flensborg 2011);
  - abstract, or when included, they can be explained through a story (d.School 2013; Larsen and Flensborg 2011);
  - multiple questions in one (Narayanasamy 2013);
  - hypothetical (Narayanasamy 2013).
- Start with questions that are general and easy to answer, and then probe broader and deeper (IDEO 2008b; Narayanasamy 2013). Ask sensitive questions only after having

built sufficient rapport (Narayanasamy 2013).

- Ask follow-up questions. Chambers (2004) and Narayanasamy (2013) recommend probing into issues before continuing with the next topic. To improve understanding of how participants view the world, it is useful to ask them why they say or do things (d.School 2013). Handwerker (2001) even recommends that designers continuously ask 'why' until exhaustion, as it brings about reasons, intentions, and motivations. According to d.School (2013), asking 'why' results in more abstract answers and asking 'how' results in more specific answers. Johansson and Linde (2005) thereby note that 'how' questions might be preferred as they stimulate straightforward storytelling. Narayanasamy (2013) advises not immediately starting with 'why' questions, but with 'how' questions.
- Avoid terminology. Questions should be properly worded and asked (Narayanasamy 2013). Designers should avoid jargon, tricky language (Narayanasamy 2013), vague and abstract language that makes no sense to the participants, and terminology with multiple meanings attached that might mean different things to different participants (Martin and Hanington 2012; Handwerker 2001). Freudenberger (1999) and Larsen and Flensborg (2011) advise using local indicators and terminology.
- Ask questions that stimulate description, discussion and depth (Narayanasamy 2013). In order to stimulate further explanation and elicit additional information, participants can be asked to reflect more on a certain topic, to echo answers in a question format (Freudenberger 1999), or to retell answers or stories (Beyer and Holtzblatt 1995; Freudenberger 1999).
- Ask questions to verify answers. By asking different types of questions and using different tools, participants' answers can be verified (Larsen and Flensborg 2011). By summarising answers, understanding can be checked (Handwerker 2001). Designers should pay attention to and check inconsistencies and discrepancies, as they may hide interesting information (d.School 2013; Handwerker 2001; Narayanasamy 2013). Inconsistencies should be politely questioned (Narayanasamy 2013). Admit confusion (Freudenberger 1999) and ask for clarification (Handwerker 2001; Freudenberger 1999).
- •Ask questions to verify interpretations. It is important for designers to check their interpretations of answers or observations immediately by sharing them, in order to avoid misinterpretation (Martin and Hanington 2012; IDEO 2008b; Viitanen 2011). It can also useful to debrief immediately after the activity ends (Barab et al. 2004). Checking interpretations is not only useful for verification, but may also provide participants with a starting point for providing additional insight (Beyer and Holtzblatt 1995);
- Mix questions with discussions (Narayanasamy 2013).

g) Prepare the team for the experience

Sklar and Madsen (2010) advise preparing the design team for the possibly overwhelming experience and the influence this can have on their objectivity.

Step 2: Prepare activities

Before conducting fieldwork, the designers must prepare the activities to ensure rigorous data collection. The literature review provides the following learnings for activity preparation.

a) Decide on the amount of data to be collected in a specific timeframe

The amount of data to be collected depends on the type and the scope of the project (Beyer, Holtzblatt, and Baker 2004; Martin and Hanington 2012), and on the time available. IDEO (2008b) argues that deadlines and timeframes keep up the progress and motivation. The amount of context research that needs to be conducted for DfD is more extensive than designers are often used to, as they need to obtain a deep cultural understanding (Van Boeijen et al. 2013; Verdu-Isachsen 2012) of an unfamiliar culture that they can often not relate to (Viswanathan, Yassine, and Clarke 2011). By becoming deeply involved, a more holistic view can be obtained, leading to a thorough understanding of the people and their context (Barab et al. 2004). Chambers (2004) and Narayanasamy (2013) advise avoiding the collection of unnecessary detail and therefore to critically decide on which and how much information should be collected. Chambers (2004) argues that the research team should keep an eye on quantity, relevance, accuracy and timeliness of the information.

Beyer, Holtzblatt, and Baker (2004) explain that quick-iteration projects are relatively small and may need to involve only five to eight potential users, while large projects concerning disruptive innovation require more planning and data-gathering. They do advise obtaining information from at least three people in each role. IDEO (2008b) sketch two time-scenarios for user context research: a deep dive of one week to gather and analyse data quickly, and a deep dive of several weeks or even months for a deeper and more nuanced understanding, involving more locations and participants. Handwerker (2001) also sketches multiple scenarios. He argues that user insight can be obtained and analysed in three days, but that for deeper and broader insight, several weeks or months may be required. Beebe (2014) recommends a minimum of four to five days and a maximum time in the field of six weeks. Simanis and Hart (2008) argue for obtaining insight in eight to ten weeks per site. Verdu-Isachsen (2012) reports that staying for three weeks in the field and then working from the home-country is a cost-effective method with good results, but recommends the immersion of designers for at least a full year in order to be able to create a lasting change.

b) Select appropriate methods, techniques and tools beforehand

In order to make optimal use of time in the field, it is advisable to select data collection activities, techniques and tools in advance (Larsen and Flensborg 2011; Martin and Hanington 2012). From the reviewed literature the following selection criteria have been noted:

- Mix methods for triangulation (Narayanasamy 2013; Lebbon, Davies, and Shippen 2011; Martin and Hanington 2012; Handwerker 2001). IDEO (2008b) invites users of their human-centred design toolkit to be creative and rigorous when choosing and mixing methods, to ensure good outcomes.
- Handwerker (2001) advises mixing qualitative and quantitative methods. Pelto (2013) agrees, but also notes that to identify key problems, needs and the problem vocabulary, qualitative research methods are appropriate and that quantitative methods can then be used to analyse the resulting data and to numerically estimate the identified issues.
- Carefully consider sequence and combination of methods (Chambers 2004; Narayanasamy 2013). In order to increase participant commitment, to ensure triangulation, to build-up dimensions and detail, to ensure credibility, and to stimulate learning and understanding,

a careful consideration of the sequence and combination of methods is valuable (Chambers 2004; Narayanasamy 2013).

- Choose activities that fit the designers' creativity (Hanington 2010). Designer-friendly ways of conducting ethnographic research are increasingly being developed. Johansson and Linde (2005), for example, developed a game which takes into account ethnographic preconditions for the right perspective and attention to details, and Smart and Whiting (2002) show how a design team can adopt and use a complex ethnographic method.
- Pay attention to efficiency. Designers need to obtain a complex, comprehensive picture of the potential user group (Hanington 2010; Lebbon, Davies, and Shippen 2011), but cannot take up too much participants' time. People participating in activities invest time, which they cannot use for other purposes (Larsen and Flensborg 2011; Simanis and Hart 2008). Their time and energy should be respected, and activities should therefore be focused (Handwerker 2001), not be overly long (FrogDesign 2012; Handwerker 2001; Narayanasamy 2013), and sufficiently compensated (Larsen and Flensborg 2011). Methods, techniques and tools need to be efficient to enable quick collection of data (Boztepe 2007).
- Carefully consider group and individual exercises. Chambers (2004) and Narayanasamy (2013) advise focussing on groups instead of individuals in order to detect collective knowledge and wisdom and improve collective enthusiasm. Thereby, participants in groups share, check and correct the outcomes of activities, supporting progressive learning and triangulation (Narayanasamy 2013; Chambers 2004). Group activities also provide data from a larger set of participants (Handwerker 2001). When a topic of common interest is discussed, a wealth of information can be obtained (Handwerker 2001). However, group exercises also have disadvantages, such as dominance by a person or group (Narayanasamy 2013; Chambers 2004), and participants can be unwilling to share specific information in a group (Handwerker 2001). For obtaining information regarding a specific, sensitive, confidential or personal topic, individual activities may be more appropriate (Narayanasamy 2013). Individual activities are most appropriate for obtaining deep insight (Larsen and Flensborg 2011; IDEO 2008b).

c) Prepare methods, techniques and tools beforehand

Methods, techniques and tools must be well-designed and carefully established in order to reduce bias and to obtain the required information within ethical boundaries (Hanington 2010; Pelto 2013). Participants' personal lives should only be invaded for collecting relevant, useful data in an effective way (Pelto 2013). In the selected literature, the following requirements for activities were noted:

- Make activities enjoyable. Aesthetics, play and creativity help people to break out of social conventions and bonds (Ramberg 2012). Activities should not bore participants (Narayanasamy 2013), but should be fun and interactive (Larsen and Flensborg 2011; Chambers 2004; FrogDesign 2012; Narayanasamy 2013). This helps to create an atmosphere where participants enjoy themselves and feel free to express ideas, insights and even discuss sensitive topics (Larsen and Flensborg 2011).
- Keep activities simple. Activities that are difficult to understand by participants take time

to explain and use, and are prone to misconceptions, while activities that participants easily understand help them to gain confidence and share more insights (Larsen and Flensborg 2011). Therefore, activities should be simple (Larsen and Flensborg 2011) and not cause confusion (Handwerker 2001).

- Let participants perform tasks. As what people say and do can differ, it is useful to make people perform tasks (Smart and Whiting 2002; IDEO 2008b; Martin and Hanington 2012; FrogDesign 2012). This increases the reliability of the data (Martin and Hanington 2012). Depending on the topic being studied, people can, for example, perform work-related tasks (Smart and Whiting 2002; Martin and Hanington 2012), or show interactions with objects, spaces or tools (IDEO 2008b). Furthermore, Chambers (2004) argues that the participants should map, model, quantify, estimate, rank, score or make diagrams to express their knowledge and capabilities.
- Let participants create. By asking participants to visualise experiences, they are put in control (Chambers 2004; Narayanasamy 2013). Creations can lead to new discoveries about participants (Martin and Hanington 2012) and aids gaining a better view of participants' conceptions and order of things (IDEO 2008b). According to Narayanasamy (2013), mapping helps to break the ice and build rapport, as it engages, facilitates discussion, helps create diagrams, and aids communication, building consensus, and presenting information in a precise, clear and concise way. By letting participants create visual artefacts, they can project personal information and experiences onto them, as creating things can be a more comfortable way for them to express emotions, feelings, thoughts and desires (Martin and Hanington 2012; Gielen 2008). This enables participants to express tacit and latent needs, needs that cannot be expressed verbally or are subconscious (Gielen 2008). During activities, participants or their children can be asked to draw (IDEO 2008a) or to create (Lebbon, Davies, and Shippen 2011; Martin and Hanington 2012). However, Larsen and Flensborg (2011) warn that not everyone may be interested in drawing and modelling, and advise things like involving a local artist. IDEO (2008a) note that if neither the participants, nor their children want to do this, the participant or activity facilitator can also write. Participants can also create things without the presence of designers. They can, for example, create photo diaries or videos about their daily lives, which provides the design team with visual and deeper insights into a participant's life and culture (Lebbon, Davies, and Shippen 2011).
- Prevent materials from flying away. When conducting field research, the wind or fans can blow materials away (Larsen and Flensborg 2011). To prevent this from happening, glue, tape or sticky gum can be used (Larsen and Flensborg 2011).
- Consider using locally available materials (Chambers 2004; Narayanasamy 2013).
- Consider using ranking / comparing exercises in order to prioritise. Ranking exercises can be used to prioritise between the many problems and needs that often arise (Narayanasamy 2013; Handwerker 2001). Comparison might be quicker than exact measurement, as comparisons are easier to make and less sensitive (Narayanasamy 2013; Chambers 2004). It is important to ask for reasons of preference (Narayanasamy 2013).
- Consider card sorting exercises as a means of identifying terminology. Sorting cards with printed concepts, terms or features aids gaining an understanding of how participants'

group ideas or things, but also helps to identify misunderstood terminology (Martin and Hanington 2012).

- Consider collecting time-series data in order to be able to place data in context (Handwerker 2001). Historical data provides information about changes and participants' perceptions of change (Narayanasamy 2013).
- Consider using prepared visualisations. Handwerker (2001) argues that good ethnography comprises a mix of numbers, words and pictures. Visual materials help to create experiences and, in this way, to communicate things in an impactful and meaningful way (d.School 2013). Martin and Hanington (2012) thereby argue that visual references put participants at ease. Visualisations can be understood by illiterate and low-educated participants and therefore improve accessibility and equality (Chambers 2004; Narayanasamy 2013). They can also stimulate interaction (Larsen and Flensborg 2011). Larsen and Flensborg (2011) advise preparing of realistic visualisations with limited details of surroundings, as symbolic images and details can trigger irrelevant discussions.
- Consider enacting activities. Oulasvirta, Kurvinen, and Kankainen (2003) state that enacted activities are better remembered and can thus be better utilised. Enacting scenarios or processes may also encourage interaction or help participants show activities (Larsen and Flensborg 2011).
- Consider including a competition. Larsen and Flensborg (2011) recommend including a local competition, where participants present their outcomes and a local jury awards a prize.

d) Adapt the activities to the context

Methods for user context research should not be used randomly; they need to fit the context of use (Hanington 2010; Narayanasamy 2013; Handwerker 2001). Techniques might vary per situation (Beebe 2014) and methods and materials should be prepared and adjusted to local situations and conditions (Larsen and Flensborg 2011; Narayanasamy 2013). The materials prepared should, for example, consider literacy, educational level, and language (Larsen and Flensborg 2011; Narayanasamy 2013). Chambers (2004) and Narayanasamy (2013) argue for using local indicators, measures and judgements. Larsen and Flensborg (2011) argue for using context-specific illustrations, so that participants can relate to them. During the fieldwork, the designer may discover that different images are required for the specific context under study, which then should be added (IDEO 2008a). Illustrations should be represented in the same condition to avoid preconceived ideas (Larsen and Flensborg 2011).

e) Prepare topics and guiding questions

When starting, the team has to decide on which topics to address (Pelto 2013; IDEO 2008b; Van Boeijen et al. 2013; Narayanasamy 2013), divided into main and sub-categories (IDEO 2008b). The resulting list of topics ensures that all relevant issues are covered (Van Boeijen et al. 2013), provides structure, and improves the flow of the interview (Narayanasamy 2013). Key questions should also be established beforehand (d.School 2013; FrogDesign 2012; Handwerker 2001; Hanington 2010; IDEO 2008b; Larsen and Flensborg 2011; Narayanasamy 2013). According to Handwerker (2001), this improves the efficiency of conducting informal

interviews as designers are forced to think about the research content. Hanington (2010) adds that it also helps to ask the right questions and minimise bias. However, Martin and Hanington (2012) argue that the questions should be used as guidance, and that designers should keep an open mind, allowing for unexpected turns. Simanis and Hart (2008) and Sperschneider and Bagger (2003) state that most questions will need reformulation to better fit the context and local language. Handwerker (2001) agrees that questions need correction in the field and that additional questions may need to be formulated.

f) Test activities in advance

FrogDesign (2012) advise roleplaying the interview within the team. Testing the content and length of the activities locally is a valuable exercise, in order to be able to adapt them to the local dialogue and ensure that there is sufficient time to obtain all relevant information (IDEO 2008b; Larsen and Flensborg 2011; Van Boeijen et al. 2013). In addition, this helps to familiarise team members with the flow and structure of the activities (Larsen and Flensborg 2011).

g) Bring supplies

For documenting purposes it is useful to bring equipment, such as a video camera, a photo camera / smartphone, a voice recorder, a notebook, post-its and / or pens (Larsen and Flensborg 2011; IDEO 2008a). It may also be worthwhile packing small gifts for participants to compensate them for their time invested, although gifts can also be purchased locally (Larsen and Flensborg 2011).

Step 3: Plan the fieldwork

Before conducting fieldwork activities, the designers must plan the fieldwork to ensure efficient data collection. Recommendations for fieldwork planning are provided below.

a) Plan activities to use time efficiently

To smoothen the process, IDEO (2008a) and Larsen and Flensborg (2011) advise planning as much as possible ahead of time. However, this should be done without imposing agendas on the local people (Barab et al. 2004). Handwerker (2001) recommends allowing sufficient time for documenting and analysis and to limit intensive activities to a maximum of three per day. IDEO (2008a) and Larsen and Flensborg (2011) advise remaining flexible and keeping time free to allow for unexpected events, new appointments or activities. Simanis and Hart (2008) suggest visiting the field in advance prior to the fieldwork, in order to build local partnerships, align expectations and roles, and to arrange logistics such as housing and communication

b) Select and instruct a translator

Handwerker (2001) favours research assistants with identities that match the issues being researched. The gender, age, ethnography and status of research assistants depends on the kind of data to be collected and the circumstances within which they will be detected. Simanis and Hart (2008) also argue for a diverse team to be able to access a range of participants. This also applies to the translator. Translators can be local people who know and can explain the culture (Sklar and Madsen 2010), or can be members of the community itself (IDEO 2008b).

Larsen and Flensborg (2011) advise using the same translator when repeating activities, as this saves training time.

Larsen and Flensborg (2011) state that, before the activity takes place, a minimum of ten minutes should be spend on instructing the translator. The content of the activity should be explained and the rules set (Larsen and Flensborg 2011). The translator should be instructed to let participants participate openly and actively, and not to answer in place of the participants (Larsen and Flensborg 2011). The translator should not wear branded clothing, as this might place barriers and create distance between participants and the designers (IDEO 2008b).

c) Select team members and assign roles

d.School (2013, p. 10) argue that it is not possible to *"properly engage a user and take detailed notes at the same time"*. Therefore, it is useful to work in pairs where one person leads the activity, the facilitator, and the other captures and documents information and ideas, the note taker (FrogDesign 2012; d.School 2013; IDEO 2008a; Martin and Hanington 2012; Smart and Whiting 2002, 2001; Larsen and Flensborg 2011). Nesset and Large (2004) even advise having three people present during interaction with participants: one facilitator who is free to interact, one note-taker who can record activities, and one note-taker who can record dialogue. IDEO (2008b) agree that a third person can be useful for recording, however they warn that no more than three people from the design team should be present during each activity in order not to overwhelm the participant(s) and not to overcrowd the space. Conducting a research activity with multiple team members allows for comparison of interpretations, experiences and perceptions (IDEO 2008a). IDEO (2008b) recommend assigning roles so that each person has a clear purpose, which is also visible to the participants. IDEO (2008a) note that the roles can be switched per activity or day, however, Narayanasamy (2013) propagates fixed roles for each team member. If activities are conducted by a single designer, d.School (2013) advise bringing a voice recorder. IDEO (2008b) further suggest having female team members recruit and interview women, as this may be better accepted in some communities.

d) Build rapport in the community

In order to stimulate dialogue and open up discussions with respondents, it is important to build rapport before conducting research activities. Building rapport and trust with potential users and make them appreciate the design work being done enables better collaboration (Barab et al. 2004), acceptance (Kies, Williges, and Rosson 1998), and understanding (Beyer and Holtzblatt 1995; Van Boeijen et al. 2013). It is important to always create personal relationships, preferably early in the process (Handwerker 2001; Narayanasamy 2013; Chambers 2004). It takes time to win trust and build rapport (Simanis and Hart 2008) and this time should be taken (Narayanasamy 2013; Chambers 2004; Handwerker 2001). At first, the presence of the research team can be intimidating, preventing local people from opening up and showing interest, but once time is spent with potential users, they are more likely to fully participate and share information (Larsen and Flensborg 2011). With the right behaviour and attitude (see under step 1), the process of building rapport can be speeded up (Chambers 2004; Narayanasamy 2013). In order to build rapport, the design team should be aware of the following:

- Introduce yourself. The designers are outsiders, and therefore it is valuable that they introduce themselves, explain the research intent and goals and answer questions (Simanis and Hart 2008). This can for example be done during community meetings hosted by a local partner, or by organising community meetings (Simanis and Hart 2008).
- Immerse yourself. Designers should immerse themselves in the community to get to know their potential users informally. They can engage in 'icebreaking' opportunities (Simanis and Hart 2008), local activities (Narayanasamy 2013), and / or learn village tasks (Narayanasamy 2013; Chambers 2004). It is advisable to stay with the local people in their natural surroundings (Narayanasamy 2013; Handwerker 2001; d.School 2013; Lebbon, Davies, and Shippen 2011; Martin and Hanington 2012; Liedtka 2011; IDEO 2008b; Larsen and Flensborg 2011; Simanis and Hart 2008).
- Be aware of behavioural codes. In rural communities, codes of behaviour may be in place that have to be followed in order to obtain access and enable collaboration (Larsen and Flensborg 2011). A local partner can point out if there is a person or group of persons who should be met first, and whether (local) presents are required (Larsen and Flensborg 2011).
- Be aware of conflicts and power relations. It is important to investigate and understand community dynamics and power relations, and the research team must be careful not to find themselves part of a community battle about resources available in the project (IDEO 2008b). Narayanasamy (2013) recommends dealing with conflicts in a positive way and not to personalise issues.
- Consider a 'homestay' or 'working alongside' as this can speed up the process of building rapport (IDEO 2008b).
- Designers should:
  - explain who they are (Narayanasamy 2013; Chambers 2004);
  - seek and listen carefully (Beebe 2014);
  - demonstrate commitment (Barab et al. 2004; Kapoor 2012);
  - be honest (Verdu-Isachsen 2012; Narayanasamy 2013; Chambers 2004; Handwerker 2001). Be open and clear and do not make false promises (Narayanasamy 2013);
  - be clear about intentions (Simanis and Hart 2008);
  - be ready to learn, and ask to be taught (Narayanasamy 2013; Chambers 2004);
  - show respect towards the people, their culture, customs, attitudes, beliefs and way of life (Larsen and Flensborg 2011; Viitanen 2011; IDEO 2008a; Beyer and Holtzblatt 1995; Narayanasamy 2013; Handwerker 2001; Barab et al. 2004; Simanis and Hart 2008; Verdu-Isachsen 2012; Naidoo 2012; Beebe 2014; Chambers 2004; Pelto 2013);
  - show appreciation for how potential users live their lives (Simanis and Hart 2008);
  - show humility (Simanis and Hart 2008; Narayanasamy 2013; Von der Lippe 2012; Beyer and Holtzblatt 1995);
  - show interest (Narayanasamy 2013; Chambers 2004);
  - not criticise, correct or judge participants (Pelto 2013; d.School 2010; Larsen and Flensborg 2011; IDEO 2008a), but try to understand their perceptions and underlying reasons (IDEO 2008a; Larsen and Flensborg 2011; Pelto 2013);
  - develop a collaborative dialogue (Barab et al. 2004);

- invite and answer questions (Narayanasamy 2013; Chambers 2004; Handwerker 2001);
- share themselves. By sharing personal experiences, an open atmosphere is created that allows for vulnerability and gossip (Handwerker 2001; Larsen and Flensborg 2011);
- share information, ideas and food (Narayanasamy 2013; Chambers 2004);
- accept and give gifts if appropriate (Handwerker 2001);
- consider the community under investigation as equal partners. Team members should not dominate, appear arrogant, obsessive or judgemental (Narayanasamy 2013). The relationship with potential users should become one of mutual respect (Kapoor 2012), commitment and understanding (Verdu-Isachsen 2012). Both the designers and the participants should learn from each other and build a shared understanding and vision (Viitanen 2011; Viswanathan, Yassine, and Clarke 2011; Simanis and Hart 2008; Ramberg 2012);
- build confidence and empower local people to make decisions, set the agenda, and take initiative (Narayanasamy 2013; Chambers 2004). Collaboratively, the design team and the potential users can contribute to change and empowerment (Barab et al. 2004).
- develop empathetic understanding. Designers should build empathy with their potential users (Kujala 2003; Lebbon, Davies, and Shippen 2011; Liedtka 2011; d.School 2013; Naidoo 2012; Narayanasamy 2013), instead of relying on standards and guidelines (Newell et al. 2011). They should try to understand the users' motivations, aspirations (Sklar and Madsen 2010), and behaviour (IDEO 2008b), and build empathy for who they are and what they find important (d.School 2013; Martin and Hanington 2012). They should also communicate this empathy to the local people (Handwerker 2001), and teach their students to build empathy using a range of methods, among which are role playing and immersion (Lebbon, Davies, and Shippen 2011);
- take genuine interest in their potential users (Liedtka 2011) and try to see things from their point of view (Sklar and Madsen 2010).

e) Select participants

When selecting a sample of participants for activities, the following steps can be followed:

- Purposively select the location of investigation. According to Barab et al. (2004) places of investigation should be purposively selected for example by looking at convenience, resemblance to other potential contexts, and openness and interest in collaboration. However, spatial, project, seasonal and diplomatic biases should be avoided (Beebe 2014; Chambers 2004; Narayanasamy 2013). IDEO (2008a) advises selecting two to five different locations with varying characteristics (e.g., dry/wet area, central/remote location).
- Decide on selection criteria. According to IDEO (2008b), it is critical to select appropriate and inspirational participants. FrogDesign (2012) advise recruiting participants that want to help in reaching the design team's goals. Larsen and Flensborg (2011) advise not only considering the defined target groups, but identifying the next potential users. Participants can be selected based on different characteristics such as gender, social class, income, religion, age, ethnicity, occupation, adoption speed, access to resources, community (Narayanasamy 2013; IDEO 2008b; Larsen and Flensborg 2011; Simanis and Hart 2008). Handwerker (2001) advises using criteria based on relevant social labels as

they are used by local people.

- Use your established network to identify participants. Potential participants for research activities can be identified by local partners, stakeholders, translator(s) or other participants (Larsen and Flensborg 2011; Simanis and Hart 2008; IDEO 2008a; FrogDesign 2012), as long as it is clear what the participant's characteristics should be (Larsen and Flensborg 2011). IDEO (2008b) warn that community contacts may only select a specific type of community member, such as the most successful ones, or men only. These types of person biases should be avoided (Beebe 2014; Chambers 2004; Narayanasamy 2013). Handwerker (2001) argues that for an unbiased sample of participants, every one of the targeted population should have an equal chance of being included.
- Include a variety of participants. Depending on the goals of the research activity, the participants can have either the same or different characteristics (Narayanasamy 2013). If the goal is to obtain diversity and richness of information, viewpoints and perspectives, a heterogeneous group of informants should be included in the research (Nesset and Large 2004; Smart and Whiting 2002; Newell et al. 2011; Larsen and Flensborg 2011; Simanis and Hart 2008; Martin and Hanington 2012; Chambers 2004; Beebe 2014; Narayanasamy 2013; Handwerker 2001; IDEO 2008b). Beebe (2014) and Chambers (2004) recommend deliberately looking for contradictions, anomalies and differentness, instead of focussing on statistical samples or averages. Participants that are seldom heard should be included (Simanis and Hart 2008; Narayanasamy 2013), for example women, the poor (Chambers 2004), the silent, odd, dissenters, outliers or the invisible (Narayanasamy 2013). IDEO (2008b) advise developing a spectrum to recruit along and to equally include three categories of participants: the two extremes and those 'in the middle'. This helps to obtain a broad range of behaviours, beliefs and perspectives from a limited number of participants (IDEO 2008b).
- Consider including extreme users. Extreme users are often more aware of their needs, desires and behaviours (IDEO 2008b) and may therefore spur inspiration (d.School 2013; IDEO 2008b). Newell et al. (2011) recommend that when selecting extreme users, their characteristics should be relevant to the potential user group.
- Consider including lead users. Lead users experience needs or problems before others and expect benefits from addressing these needs or solving those problems (Steen 2011). Lead users are often used to express opinions and are open to creating, buying, using, and/or adapting new solutions (Larsen and Flensborg 2011; Steen 2011; Viswanathan and Sridharan 2012). They make good participants and can assist designers by sharing insights and co-designing with them (Viswanathan and Sridharan 2012; Steen 2011; Larsen and Flensborg 2011).
- Be clear about compensation. When entering a community, designers should clearly explain the intentions of the research team (Simanis and Hart 2008). They should explain that the team wants to collaborate with and learn from the community and that the team is not a source of funds, gifts or charity (Larsen and Flensborg 2011; IDEO 2008b). Expectations of getting money or jobs in return should not be a motivator for participation (Simanis and Hart 2008; Larsen and Flensborg 2011), as this might change the nature of the relationship from viewing each other as equals into a client-employee

situation (Simanis and Hart 2008). However, some compensation for time away from family, work and other activities can be provided (Larsen and Flensborg 2011). Simanis and Hart (2008) advise reimbursing costs made (e.g., for transportation) and providing food during the activity. Larsen and Flensborg (2011) also advise bringing snacks and suggest giving participants a product sample or a small gift. According to Beebe (2014, p. 168) *"generally, payment is to be avoided"*.

f) Decide on time and place

Designers should meet participants when and where it is convenient to them and where they feel comfortable (Larsen and Flensborg 2011; Narayanasamy 2013). Participants often feel at ease in their local context (at home or at work), which also allows designers to obtain additional insights in that context by viewing the objects, spaces and surroundings and by meeting people important to them (Larsen and Flensborg 2011; IDEO 2008b; Martin and Hanington 2012). The location should prevent any disturbance (Narayanasamy 2013). For group activities, designers should choose a location where participants from different gender, status and parts of the community can (Narayanasamy 2013).

Step 4: Execute activities

There are several points of attention when conducting fieldwork with participants. These are noted below.

a) Introduction and informed consent

The activity should start by greeting the participant(s) traditionally, and with small talk (Narayanasamy 2013). Designers should explain who they are (Narayanasamy 2013; Chambers 2004) and explain the research nature and goals to the participant(s) (Handwerker 2001; Pelto 2013). Then, the programme and purpose of the activity should be introduced (Larsen and Flensborg 2011; IDEO 2008b; Narayanasamy 2013). Designers should ask for consent to conduct the activity, to take pictures, and to record and use the outcomes (Handwerker 2001; Viitanen 2011; Newell et al. 2011; Larsen and Flensborg 2011). The participants should be informed that that their participation is voluntary, that the interview results will be anonymised (Handwerker 2001; Pelto 2013), that their privacy will be protected, and that the information obtained will be treated with confidentiality (Pelto 2013). Preferably, designers should provide a written statement in the local language to obtain consent, but if most participants are illiterate, verbal consent is more ethically appropriate (Pelto 2013).

b) Start with the participant's introduction

Ask each participant to introduce him/her-self (Larsen and Flensborg 2011). Show interest by first asking questions about the participant's background, before starting the actual research activity (Larsen and Flensborg 2011). Properly acknowledge the participant by noting down personal details (Narayanasamy 2013). Document who each participant is (gender, social class, religion, age, occupation or any other specific distinction), who else was present during the activity, what the objectives, date and location are, and which legend is used (Narayanasamy 2013).

c) Create an enabling atmosphere

It is important for participants to be able to 'open up' (Narayanasamy 2013), feel comfortable (Chavan and Gorney 2008; Handwerker 2001) and that they are able to freely speak and express themselves (Larsen and Flensborg 2011). To achieve this, the facilitator has to create an enabling and open atmosphere (Handwerker 2001). The facilitator should stress that the design team is nonthreatening and explain to participants that they should only participate if they can do so openly and honestly (Handwerker 2001). The facilitator should emphasise that there are no wrong answers (Larsen and Flensborg 2011), and that participants can ask questions at any time, can refuse to answer questions, can stop the activity at any time, and that they are free to exclude information (Handwerker 2001; Pelto 2013).

d) Limit the influence of audience

If there is risk of limitations of freedom of speech due to the presence of others (Larsen and Flensborg 2011; IDEO 2008a), it can be useful to split the participants into two groups, for example men and women (IDEO 2008a). This also allows for cross-checking and comparing stories (IDEO 2008a). When multiple designers are present, one of them can try to engage the audience in another conversation to draw them away from the main activity (IDEO 2008a).

e) Build dialogue

During activities, the dialogue is more important than the questions (Narayanasamy 2013; Chambers 2004). Narayanasamy (2013) recommends gradually building up the dialogue. When starting with general topics and simple, specific questions, participants feel comfortable (IDEO 2008a; Handwerker 2001) and are put in the right context (Van Boeijen et al. 2013). In this way, rapport is built during the activity, and a participant's general situation can be understood (IDEO 2008a). Handwerker (2001) recommends starting off by asking participants to describe a typical day in their life and changes to that day per week, month and year. Then, questions about hopes, dreams and perceived barriers can be posed, to obtain the participant's view of a better future and obstacles preventing that future from becoming reality (IDEO 2008a). The activity can then end with deeper questions related to the design challenge (IDEO 2008a).

f) Capture during the activity

Documenting activities is essential to be able to recall the outcomes later on, and to share experiences with the team (IDEO 2008b). Notes help the team to reflect on what happened (FrogDesign 2012). Pelto (2013) notes the relevance of documenting participants verbatim. Depending on the type of documentation, the environment, behaviours, interactions, language, motivations and perceptions of the participants can be captured (Martin and Hanington 2012). Documenting can be done using notes, sketches, photographs and recording devices (video or audio) (Martin and Hanington 2012; IDEO 2008a). Handwerker (2001) recommends noting down everything that occurs, Narayanasamy (2013) advises discretely making field notes and Chambers (2004) argues that field notes can be made during the activity, but also directly after the activity.

g) Things to pay attention to

Polak (2008) states that the designer should learn everything there is to know. Relevant knowledge not only comes from the participants, it is also present in the context (Van der Veer 2008). Designers should try to understand the details of people's lives and practices (Diggins and Tolmie 2003; Beyer and Holtzblatt 1995; Handwerker 2001) and detect patterns and structure (Beyer and Holtzblatt 1995; FrogDesign 2012). They should be able to transfer the experience to people who are not present (IDEO 2008a). The authors mention paying specific attention to:

- everything that is seen (IDEO 2008a; Narayanasamy 2013):
  - Things that are physically present (Martin and Hanington 2012);
  - Objects that participants care about (IDEO 2008a);
  - Body language (d.School 2013; IDEO 2008a);
  - Factual behaviour (Martin and Hanington 2012; Handwerker 2001) and things that change behaviour (IDEO 2008a);
  - Interactions with the environment (IDEO 2008a; Martin and Hanington 2012);
  - Adaptations and work-arounds (IDEO 2008a).
- everything that is heard (IDEO 2008a):
  - Language, vocabulary, words and categories (Martin and Hanington 2012; Handwerker 2001; Beebe 2014; Pelto 2013);
  - Expressions (IDEO 2008a);
  - Motivations (Martin and Hanington 2012);
  - Perceptions (Martin and Hanington 2012);
  - Issues, difficulties or obstacles (FrogDesign 2012; Beebe 2014);
  - Interactions (IDEO 2008a; Martin and Hanington 2012);
  - Social actors (Handwerker 2001);
  - Unarticulated needs (Liedtka 2011);
  - Events and circumstances that shape experiences (Handwerker 2001);
  - Prior experiences, current experiences and how those are perceived and conceptualized (Handwerker 2001).
- Everything that is felt (IDEO 2008a):
  - Emotions, moments or things that participant react upon emotionally (IDEO 2008a; d.School 2013);
  - Feelings (IDEO 2008a).
- everything that is smelled (IDEO 2008a);
- everything that is tasted (IDEO 2008a);
- anything surprising. Anything that changes assumptions or seems irrational (IDEO 2008a).

h) Thank people and compensate them

After the activity, participants should be asked what they thought of the activity, how they felt about it, and if they want to share anything else (Narayanasamy 2013). Then, the participants should be thanked for their contribution and involvement (Narayanasamy 2013). According to Narayanasamy (2013), it is desirable to thank people in their own language. To further

show appreciation, a small gift can be provided (Larsen and Flensborg 2011). Time, energy, and costs invested by participation in research activities should be compensated (Larsen and Flensborg 2011).

i) Document immediately after the activity and add questions

IDEO (2008a) advise documenting everything immediately after the activity, as the details and specifics are still fresh at that time and might otherwise be lost. Van der Veer (2008) thereby argues that if things are not documented right away, any surprising or new insights might not get documented at all, as they become evident after some time. This means, that they might not be communicated or taken into account during the design process. Team members present should immediately discuss and note down the way the activity went and their feelings and impressions of the participant(s) (Narayanasamy 2013), their thoughts (FrogDesign 2012), personal details, key points, insights, first interpretations of things that happened and were said (IDEO 2008a), things that were surprising (Van der Veer 2008) and / or not understood (Van der Veer 2008; Beyer and Holtzblatt 1995) and evaluations of the responses (Narayanasamy 2013). Van Boeijen et al. (2013) advise making summary notes and / or audio transcripts. Any additional questions that arise during the activities should be noted down and added to the prepared list of questions to ensure that these will be included in the following activities (Larsen and Flensborg 2011).

Step 5: Analyse and interpret data

The resulting data must be analysed and interpreted to be able to use it in the design process. Recommendations for analysis and interpretation are provided below.

a) Share findings within the team for better understanding

What is heard and observed should be shared within the design team (FrogDesign 2012; d.School 2013; Beyer, Holtzblatt, and Baker 2004; Smart and Whiting 2001, 2002; Narayanasamy 2013). By sharing outcomes and insights, the other team members who were not present, become informed, experiences can be compared, more nuances and meaning can be elicited, and all details can be captured (d.School 2013). Retelling helps to identify key points and build a common understanding of the community (Beyer, Holtzblatt, and Baker 2004). Smart and Whiting (2001, 2002) recommend sharing the information within the team as soon as possible after each activity.

b) Anonymise and secure data

It is the designers' responsibility to anonymise data (Handwerker 2001; Viitanen 2011) and to ensure that the data is protected from falling into the wrong hands (Pelto 2013). Names and identities should be removed from notes, recordings and other materials, and documents that link people to pseudonyms or codes must be kept in a safe place (Pelto 2013).

c) Review documentation

Recordings and notes enable designers to recall memories (Johansson and Linde 2005). Documentation can be seen, listened and read back to recall the outcomes and analyse the activities (Iivari and Iivari 2011; Kies, Williges, and Rosson 1998; Smart and Whiting 2001, 2002). This can be done together with the participants to identify critical incidents, discuss

reactions and suggest improvements (Kies, Williges, and Rosson 1998). Recordings can also be used to validate the notes that have been taken (Smart and Whiting 2001, 2002). Van der Veer (2008) advises letting a person who is not an expert in the domain under study conduct the analysis in order to reduce the risk of information going unnoticed.

d) Look for patterns and explain variation

During the fieldwork and when analysing the data, designers should look for patterns and themes (FrogDesign 2012; d.School 2013; Martin and Hanington 2012) and for relationships, similarities and differences between variables and participants (Handwerker 2001). These patterns help the design team to identify issues and solutions (FrogDesign 2012; d.School 2013). The themes and patterns can be articulated in guiding criteria (Martin and Hanington 2012) and creating a profile of the potential users (Larsen and Flensborg 2011).

e) Interpret

Designers should judge responses, but should do so carefully (Narayanasamy 2013). The things people say can be true facts, opinions, rumours or lies (Narayanasamy 2013). Designers should identify assumptions by comparing what people say and do, and try to explain why people believe, feel, and act the way they do, and then attempt to explain any variation (Handwerker 2001). Things that do not match ideas and preconceptions should be included (Narayanasamy 2013). Designers should be open about how they established their interpretations (Beyer and Holtzblatt 1995).

f) Share outcomes

- with participants. Information, knowledge and interpretations should be honestly shared with participants (Narayanasamy 2013; Barab et al. 2004). Participants can provide feedback (IDEO 2008b), point out misunderstandings (Barab et al. 2004) and clarify statements (Narayanasamy 2013), resulting in a more valid understanding (Beyer and Holtzblatt 1995).
- with the community and local partners. Generated knowledge should be shared with the community and with local partners (Simanis and Hart 2008; Donaldson 2002; d.School 2013; FrogDesign 2012; Narayanasamy 2013; Chambers 2004), but only if the participants agree to sharing the outcomes (Narayanasamy 2013) and when their anonymity can be secured (Pelto 2013). By doing so, the feeling of joint ownership is strengthened, stakeholders stay involved (Simanis and Hart 2008), and transparency and openness is enhanced (Narayanasamy 2013; Simanis and Hart 2008). It also facilitates mutual learning, data triangulation, and improves data reliability due to verification, amending and addition (Narayanasamy 2013; Simanis and Hart 2008). Handwerker (2001) also advises designers to share findings with people they meet during the process and who have different life experiences, as these people can indicate errors.
- with a wider audience – when relevant. By sharing outcomes through newspapers or a radio programme, participants might become proud, and other people might become interested in participating (Larsen and Flensborg 2011). This should only be done only if the participants agree to sharing the outcomes (Narayanasamy 2013) and when their anonymity can be secured (Pelto 2013).

g) Reflect critically

Designers should reflect critically on:

- Data limitations: Samples from qualitative research are often not statistically significant (IDEO 2008b). Therefore, qualitative findings from a small number of participants should not be represented as being generalizable or replicable (Hanington 2010; Narayanasamy 2013). Designers should, moreover, consider the possibility that their participants might have been wrong (Handwerker 2001) and should be conscious of the errors that may limit data validity (see 'challenges' in §3.2.2) (Handwerker 2001). Information obtained from the well-off, better-educated, elderly and from men only must not necessarily be over-relied on (Narayanasamy 2013).
- Method limitations: Steen (2011) argues that designers should be aware of the characteristics, benefits and limitations of the approach and methods they use, and reflect on the way they applied them.
- Designer limitations: Steen (2011) indicates that designers should reflect on their role in the design process, on the established relationships, on their way of working, and on how they handled the power delegated to them. They should also document the validity of their constructs (Handwerker 2001) and pay attention to how the political, social and cultural context and their own backgrounds informed the research (Beebe 2014). Designers should have critical self-awareness (Larsen and Flensborg 2011; Chambers 2004; Narayanasamy 2013), embrace and share errors and mistakes (Larsen and Flensborg 2011; Chambers 2004), and learn from failures (Narayanasamy 2013).
- Project limitations: Steen (2011) also recommends that designers reflect on the roles that potential users play in the design process, and how power and agency are distributed in the project. FrogDesign (2012) advises asking participants what went well and what can be improved.

h) Understand the data in a larger and future context

To make a sustainable impact that lasts, the data collection needs to be actually integrated in the design process (Barab et al. 2004; Hanington 2010). The local truths and understanding gained can be used to inspire the design process (Hanington 2010). To be able to do so, the design team needs to frame the locally obtained data into a larger context and needs to understand how the needs and change-creating forces will evolve in the future (Wasserman 2012). The design team needs to develop an understanding that goes beyond the participants, and needs to relate field work to historical events and trends (Handwerker 2001).

3.2.5 Methods, techniques and tools

The list of methods, techniques and tools for rapidly obtaining user insight mentioned by the authors of the selected literature is extensive. However, they do not all suit the purpose of obtaining rapid user insight in DfD projects. Therefore, some filters can be applied:

1. Comprehensiveness. Many of the methods mentioned aim at obtaining insight in specific activities, flows or tasks. For example, activity analysis is a method focusing on a specific task, while resource flow analysis investigates in and outgoing resources. These methods do not fulfil the requirement of obtaining comprehensive user insight;

2. Insight in the user. All methods, techniques and tools that focus on obtaining insight into something other than the user (for example obtaining insight in a product, product use or in specific trends) do not fulfil the requirement of obtaining user insight;
3. Insight beyond product-user interaction. All methods, techniques and tools that focus on the analysis of the user in relation to a specific topic, issue or product do not fulfil the requirement of obtaining user insight beyond product-user interaction;
4. Direct contact. Following the project recommendations, direct contact with potential users in their natural environment is a requirement. Therefore all simulation and other methods without personal contact with potential users in their own surroundings do not fit the purpose of this research;
5. Focusing on relationships and/or dialogue. Following the project's recommendations, methods, techniques and tools should stimulate rapport building and / or dialogue. Any methods, techniques and tools that do not fulfil either one of these conditions should be discarded;
6. Adaptability. Following the project recommendations, the methods, techniques and tools must be able to adapt to an environment with regional languages, limited access to computers and / or internet and low literacy.
7. An overview of all methods, techniques and tools can be found in Appendix B. The methods, tools, techniques and exercises relevant for the purpose of this research are presented in table 3-1, 3-2 and 3-3.

Methods

The selected methods which are mentioned and explained in the consulted literature are presented below.

Table 3-1: Filtered list of methods mentioned in the consulted literature

Name and description	Mentioned by
1. Personal Documentaries / Self-reporting / Cultural probes Participants document important events, interactions or experiences in their lives and narrate orally or in written form about their documentation. They can provide self-reported insight into people's lives, culture and environment, their thoughts, preferences, desires, beliefs, interactions, feelings, behaviours and priorities throughout a day, week or month. • Can be done with photos, videos, notes or a combination of these. • Can be done individually or in pairs • Participants can be signalled at random or timed intervals • A cultural probe package which may include diaries/ notebooks, postcards, maps, text, imagery, and/or recording devices	• HCD: Barab et al. (2004), d.School (2013), Gielen (2008), Hanington (2010), Johansson & Linde (2005), Lebbon et al. (2011), Martin & Hanington (2012), Roibás (2008), Smart & Whiting (2001, 2002) , Sperschneider et. al. (2003), Steen (2010), Van der Veer (2008) • DfD: IDEO (2008b), Larsen & Flensborg (2011), Van Boeijen et al. (2013)

2. Immersion Experiencing what potential users experience by meeting people where they live, work and socialise. In order to understand situations and behaviours and to build rapport. This can be marginal (blend in as natural observers), or full (becoming complete members)	• HCD: d.School (2013), Lebbon et al. (2011), Martin & Hanington (2012), Liedtka (2011) • DfD: IDEO (2008b) • RE: Handwerker (2001), Narayanasamy (2013), Pelto (2013)
3. Homestay Staying over in the home of potential users to build trust and rapport. This option depends on local customs, level of safety, and language barriers.	• DfD: IDEO (2008b), Larsen & Flensborg (2011), Simanis & Hart (2008).
4. Learning by doing Participation in work routines, activities, village tasks, household tasks or community events in order to better understand needs, barriers and constraints.	• HCD: Kies et. al. (1998), Martin & Hanington (2012), Sperschneider & Bagger (2003) • DfD: IDEO (2008b) Larsen & Flensborg (2011), Simanis & Hart (2008) • RE: Chambers (2004)
5. Direct observation Attentive looking and systematic recording of phenomena, variables or other interrelations by carefully observing and studying potential users in their natural context, in order to discover latent needs. • Can be interspersed with discussion and listening: seeing, hearing and perceiving • Can be fly-on-the-wall, casual, intensive, or unobtrusive observation • Can be documented using video, photographs, notes, sketches or audio	• HCD: Barab et al. (2004), Beyer & Holtzblatt (1995), Beyer et al. (2004), Boztepe (2007), d.School (2013), FrogDesign (2012), Hanington (2010), Iivari & Iivari (2011), Kensing et. al. (1998), Kies et. al. (1998), Lebbon et al. (2011), Martin & Hanington (2012), Nesset & Large (2004), Oulasvirta et al. (2003), Roibás (2008), Smart & Whiting (2001, 2002), Sperschneider & Bagger (2003), Steen (2010), van der Veer (2008), Viitanen (2011) • DfD: Van Boeijen et al. (2013, Polak (2008), Viswanathan et al. (2012) • RE: Beebe (2014), Handwerker (2001), Narayanasamy (2013), Pelto (2013)
6. Shadowing Closely following a potential user throughout his/her daily routines. • Can be interspersed with discussion and listening • Can be fly-on-the-wall, casual, intensive, unobtrusive, or covert observation • Can be documented with video, photographs, notes, sketches or audio	• HCD: Lebbon et al. (2011), Martin & Hanington. (2012), Sperschneider & Bagger (2003) • DfD: Larsen & Flensborg (2011)
7. Informal talks Unscheduled, short 'intercept' encounters with potential users, during which the researcher talks and listens to concerns and views. In order to build rapport and learn. This can be casual or 'controlled gossip' (researchers give some direction).	• HCD: FrogDesign (2012), Liedtka (2011) • DfD: Polak (2008) • RE: Handwerker (2001), Narayanasamy (2013)
8. Participatory Exploration Workshop Workshop with a group of participants aimed at gaining an understanding of the user's world. • Can consist of projective techniques, such as collage, mapping or diagramming exercises	• HCD: Martin & Hanington (2012) • DfD: Simanis & Hart (2008)

9. Interviews / dialogue (situated) Scheduled, face-to-face consultations with potential users in order to collect first-hand personal accounts of experience, opinions, attitudes, motivations, behaviours and perceptions. • Can be short and informal or long and in-depth • Can be semi-structured, open or closed/structured • Can be qualitative or quantitative • Can include visual and verbal methods • Can be video-recorded for later analysis by the team • Can be with individuals, couples or with strategic groups, with potential users, stakeholders, experts, or key informants	• HCD: Barab et al. (2004), Boztepe (2007), Hanington (2010), d.School (2013), Van Boeijen et al. (2013), FrogDesign (2012), González et al. (2003), Hanington (2010), Iivari & Iivari (2011), Kensing et. al. (1998), Kies et. al. (1998), Kujala (2003), Lebbon et al. (2011), Martin & Hanington (2012) Nesset & Large (2004), Roibás (2008), Smart & Whiting (2001), Sperschneider & Bagger (2003), van der Veer (2008), Viitanen (2011) • DfD: IDEO (2008b), Larsen & Flensborg (2011), Simanis & Hart (2008) • RE: Beebe (2014), Chambers (2004), Handwerker (2001), Narayanasamy (2013), Pelto (2013)

Techniques

The selected techniques which are mentioned and explained in the consulted literature are presented below.

Table 3-2: Filtered list of techniques mentioned in the consulted literature

Name and description	Mentioned by
Observe & Ask techniques	
1. Touchstone tour Guided tour using the participant's artefacts and environment as touchstones for questions and insights	• HCD: Martin & Hanington (2012) •
2. Show me / personal inventory Asking participants, in their natural environment, to show the things they interact with (objects, spaces, tools, etc).	• HCD: Martin & Hanington (2012) • DfD: IDEO (2008b)
3. Video/photography time-lapse Creating video or photo material over time and location to follow activities. Can be, for example, a documentary about a day in the life of a potential user	• HCD: Barab et al. (2004), Martin & Hanington (2012)
Questioning techniques	
4. Five why's Asking "Why?" questions in response to five consecutive answers in order to detect the underlying reasons for participants' behaviour and attitudes.	• DfD: IDEO (2008b)
5. Directed storytelling The participant is asked to tell a story about something and is guided by the researcher. Who, what, when, where and how are additional questions.	• HCD: Martin & Hanington (2012)
6. Guided speculation Asking questions about possible future developments – hopes and fears.	• HCD: Park (2011)

7. Sacrificial concepts An abstract question is turned into a concrete scenario with two options posed to the participant. By changing the variables and re-asking the question, more insight is generated on the issue in question.	• IDEO (2008b)
8. Talking Diaries Participants have to describe important life events as if they were reading diaries from a certain time period.	• Barab et al. (2004)
9. Thinking aloud Participants who perform a process or execute a specific task, have to describe aloud what they are doing and/or thinking. In order to help uncover motivations, concerns, perceptions, and reasoning.	• Kensing et. al. (1998), Martin & Hanington (2012) • DfD: IDEO (2008b)
10. What-if scenario's/ storylines The participant has to complete scenario's or storylines posed by the researcher.	• HCD: Gielen (2008), Nesset & Large (2004)
Issue generating techniques	
11. Brainstorming Topics are brought up in a group without critical evaluation. While mainly being indicated as useful for generating ideas / solutions after data collection, brainstorming can also be used to generate issues in the analysis phase of a design process.	HCD: d.School (2013), FrogDesign (2012), Nesset & Large (2004), Smart & Whiting (2002) DfD: IDEO (2008b), Crul & Diehl (2006)
12. Bodystorming Issues are brought up in a group without critical evaluation and participants are asked to act them out.	HCD: Oulasvirta et al. (2003), d.School (2013), Martin & Hanington (2012), Steen (2010)
13. Brainwriting Participants individually record what they think of, and pass their records on to the next participant who can use it as a trigger for his / her own ideas / issues.	DfD: Crul & Diehl (2006)
Creating techniques	
14. Pictures/drawings Creating visual materials during the activity that represent the context, user group or product category. This helps participants to express their innermost feelings, thoughts, emotions and desires. • Can be drawings, symbols, collages, pictures, graphs • Can be, a daily schedule, chronology of events, exquisite corps, graphic organiser	• HCD: d.School (2013), Gielen (2008), Hanington (2010), Johansson & Linde (2005), Kensing et. al. (1998), Lebbon et al. (2011), Liedtka (2011), Martin & Hanington (2012), Steen (2010) • DfD: IDEO (2008b),Larsen & Flensborg (2011), DfD: Van Boeijen et al. (2013) • RE: Narayanasamy (2013), Pelto (2013)
16. Modelling People construct three-dimensional models during the activity to express their thoughts, feelings, desires and emotions, that might otherwise be hard to articulate. • Can be, for example, contextmapping / generative, flexible / velcro modelling, business origami • Can be done with local materials	• HCD: Gielen (2008), Martin & Hanington (2012), Steen (2010) • DfD: Van Boeijen et al. (2013) • RE: Chambers (2004)

15. Diagramming / mapping Creating a simple schematic device to present information in a readily understandable form. • Can be systems diagrams, bar diagrams, flow diagrams, flowcharts, pie charts, maps, circular depictions, matrices etc. • Can be, for example, about an activity, journeys, context, experience, territory, behaviour, mobility, relationships, price, products or brands, transects, resources, locations, importance of elements ('Chapati' or Venn), seasons, work surroundings	• HCD: d.School (2013), Gielen (2008), Hanington (2010), Kensing et. al. (1998), Martin & Hanington (2012), Nesset & Large (2004), Roibás (2008), Steen (2010), Smart & Whiting (2002) • DfD: Larsen & Flensborg (2011), Simanis & Hart (2008), Van Boeijen et al. (2013) • RE: Beebe (2014), Chambers (2004), Handwerker (2001), Narayanasamy (2013), Pelto (2013)
Valuing techniques	
17. Ranking Participants have to place elements in an order, to compare, discuss, adjust and look at data, to prioritise and to present information. It is important to ask why. • Can be done by using rating scales, such as binary responses or the Likert scale • Can be pair-wise, matrix, or direct ranking • Can be done in a group or individually	• HCD: Martin & Hanington (2012) • DfD: Larsen & Flensborg (2011) • RE: Chambers (2004), Handwerker (2001), Narayanasamy (2013)
18. Sorting Participants have to place elements in different categories, in order to analyse data and present information. It is important to ask for reasons. • Can be, for example, card sorting, criteria-based card sorting, or pile sorting • Can be done in a group or individually	• HCD: Hanington (2010), Martin & Hanington (2012) • DfD: Larsen & Flensborg (2011) • RE: Beebe (2014), Chambers (2004), Handwerker (2001), Narayanasamy (2013), Pelto (2013)
19. Scoring Participants have to give weight or prominence to different elements, in order to compare, discuss, adjust and look at data. It is important to ask for reasons. • Can be, for example, matrix scoring or hundred-seeds scoring • Can be done in a group or individually	• RE: Chambers (2004), Narayanasamy (2013)

Tools / Materials

The selected tools / materials which are mentioned and explained in the consulted literature are presented below.

Table 3-3: Filtered list of tools mentioned in the consulted literature

Name and description	Mentioned by
1. Annotated map or plan Architectural plan or measured diagram that can be used as the underlay for documenting observations.	• HCD: Martin & Hanington (2012)

2. Picture cards Picture cards contain images and words that help people think about and tell stories of their life experiences, grounded in context and detail. The images are connected to the personal accounts of participant lives.	• HCD: Martin & Hanington (2012)
3. Aspirations exercise cards Participants have to pick three pictures from a set of cards that represent what they hope for or fear for the future, and have to describe what the picture means to them and why they chose this picture.	• IDEO (2008a)

3.2.6 Conclusions

The current literature from the domains of UC, DfD and RE has provided valuable information on obstacles, learnings and efficient methods, techniques and tools for objectively and rigorously obtaining comprehensive user insights. Obtaining comprehensive user insight in a limited time is a challenging task, for which designers are not specifically educated. Once trained and the right attitude and behaviour has been instilled, they will be able to obtain a comprehensive picture of their potential users. Five steps for successfully obtaining comprehensive user insights have been identified, which may include 9 methods, 19 techniques and 3 tools relevant to obtaining insights beyond product-user interaction in DfD projects. The methods, techniques and tools selected are considered to fit designers' behaviour, as they all follow from design literature. They are also considered to be efficient, as they are being used in design projects and come from literature on obtaining rapid user insight. The derived steps and selected methods, techniques and tools provide an answer to research question 2: "*Which designer-friendly ways are available to efficiently explore people's well-being to inform Design for Development?*". This practical guidance will be integrated in a systemic approach to enable designers to comprehensively understand people's well-being in DfD projects.

3.3 Conclusions and next steps

In this chapter, four literature studies have been included to identify obstacles and learnings for operationalising the CA, and to identify obstacles, learnings and methods, techniques and tools which can aid product designers when obtaining comprehensive user insight. In this concluding section these findings are reflected on and the next steps of this research project are presented.

3.3.1 Limitations of literature studies

The literature investigated in this chapter is derived from scientific journal articles, editorials and reviews, from manuals, toolkits and books. An extensive volume of literature has been studied and analysed and reported. However, the consulted literature does not cover all the literature available on the investigated topics. By using different search keys and knowledge

of other institutions, organisations and companies working in the fields of the CA, UCD, DfD and RE, more literature will be found. Thereby, being an industrial design engineer with a specific background, experience, motivation, ability, goals, agenda, education, standpoints, knowledge and views, the literature has been analysed in a specific way with a specific mind-set. Still, the data presented has been noted in the words of the researcher, who tried to limit subjective interpretation.

3.3.2 Theoretical and practical implications

The following implications for operationalising the CA for product design purposes have been derived:

- The CA is a complex, abstract and underspecified approach, and requires simplification for use in design practice. For product designers to be willing and able to use CA-inspired methods, techniques and tools, they need to be able to rapidly understand and apply those methods, techniques and tools. This might result in a loss of the CA's conceptual richness. However, the purpose of obtaining broad user insight is key and therefore has been given priority;
- Rapid ethnographic inquiry is often focused on a specific topic. This sharp focus enables the inquiry process to be efficient. In this study, the goal was to obtain comprehensive insight, not focused on a specific topic or variables, in a short period of time. In order to reduce the time taken, less effort can be spent on transcribing, coding and analysing the data, if sufficient attention has been paid on documentation, analysis and interpretation of activities;
- The goal of obtaining comprehensive user insights is not to obtain generalized data that can be statistically analysed, but to rapidly build rapport, learn local language vocabulary, get to know the potential users to enhance decision-making processes during the remainder of the design process, and to obtain key insights which are relevant for the product and / or service to be designed;
- Each design project and context is different, as are the people executing the study in the field. The learnings also suggest contextual adaptation. This complicates establishing a generic basis which ensures specific outcomes. However, as argued in the introduction, some guidance, especially regarding topics and questions is useful. By providing a generic basis, guidelines, and recommendations, designers can be guided towards getting the most out of their fieldwork;
- Continuous direct engagement with the experiences and the views of the potential product users seems to be incontestable from the point of view of the CA, UCD, DfD and RE. In every design project, however, the time available for obtaining user insight in the field varies greatly. This also depends on who executes the specific project: students from the faculty of Industrial Design Engineering often have 2 - 5 weeks in the field; design professionals working for a design firm or in the research & development department of a large company or organisation might only have a few days in the field. As can be concluded from the learnings, a longer stay results in more empathy and deeper insight, however, practical design project limitations might not allow for this. Therefore, different scenarios can be developed to serve as a basis for different projects.

3.3.3 Conclusions and next steps

Individuals have their own preferences, and therefore their choices can never be fully predicted. By offering people a choice that they value and have reason to value, product designers can design products and/or services to enhance their capabilities and, in this way, improve their well-being. Product design can be a means to providing people with opportunities that they value, but in order to be able to do so, designers must understand people and their context in order to make informed design decisions. Specifically in the field of DfD, it is essential to develop products and services that offer the capabilities that people need, desire and aspire to. The CA offers a thinking framework and a comprehensive view of well-being which can be used to supplement design practice in a prospective manner. As can be concluded from this chapter, it is possible to operationalise the CA, but until now this has not specifically been used to obtain user insight for product design purposes. As there are no practical guidelines for how the CA has to be operationalised, and it depends on the specific domain and on possible additional theories, there is no clear-cut way to use the CA in the domain of product design. Going into the field to obtain objective, rigorous and comprehensive user insight in a designer-friendly and efficient way, is an activity which introduces its own obstacles.

There are, however, also learnings in the CA and product design literature that guide the way to helping designers to obtain comprehensive user insight. In the CA literature, four steps have been identified for operationalising the CA to identify capabilities. In the consulted product design literature, similar steps were found. By combining these steps, the following next steps can be identified in order to develop a CDD approach:

1. The CA must be adapted to the domain of product design, and more specifically to DfD. By simplifying, refining, specifying and supplementing the CA towards the domain of product design, without losing sight of its conceptual richness, the CA can be operationalised for practical application by product designers;
2. The topics that constitute the well-being of a person's life should be identified and transformed into a workable set of discussion topics for product designers to use;
3. The CA, UCD, DfD and RE literature provides steps for a practical procedure that product designers can follow when conducting user context research. This step-by-step approach should be further specified;
4. The CA, UCD, DfD and RE literature provides learnings which can aid designers to understand what to look for, the skills they need, and their knowledge, behaviour and attitude. These learnings should be transformed in guiding principles and in tips & tricks that product designers can follow.
5. UCD, DfD and RE literature provides several methods, techniques and tools which product designers can use during user context research. Which ones to use depends on the type of project and on the time available. Establishing a generic basis for activities will support product designers to obtain comprehensive user insights.

The results of the above research actions will support product designers analytically and practically to identify the relevant dimensions that they can use to guide them through the design process. The task of data analysis, interpretation and selection and prioritisation of

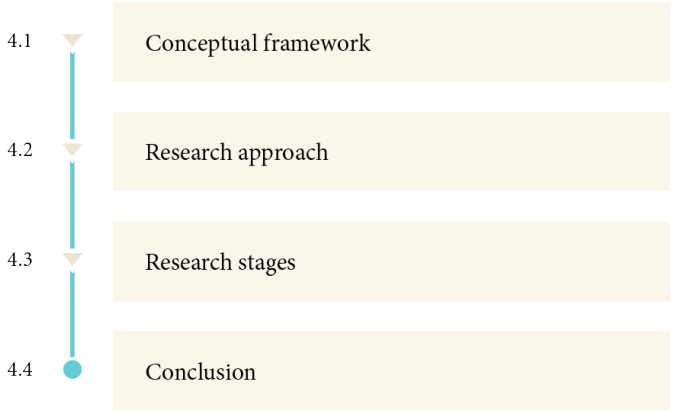
dimensions are not the focus of this research project, and will therefore not be extensively explored.

From the literature presented in both this chapter and in chapter 2, a conceptual framework, a step-by-step procedure, guidelines, tips and trics have been derived which links the CA with UCD, DfD and RE. The framework is presented in chapter 4, along with the research design and the research stages of this research project. Chapter 5 and 6 set out the first steps to be taken towards operationalising the CA to obtain comprehensive user insights in the domain of product design.

CHAPTER 4

Conceptual Framework and Research Design

In chapter 1, the problem and research questions have been identified, followed by chapter 2 and 3 in which the Capability Approach (CA), User-Centred Design (UCD), Design for Development (DfD), and Rapid Ethnography (RE) have been explored in order to build a theoretical basis for conducting rapid and comprehensive user context research in DfD projects. In this chapter, the information obtained is summarised and brought together in the form of a conceptual framework (§4.1). In §4.2 the research approach is explained, and in §4.3 the different research stages of this approach are presented and discussed. This is followed by a short conclusion in §4.4.



4.1 Constructing the conceptual framework

In chapter one, the research scope and the three research questions have been introduced and discussed. The first two questions, *"Which analytic guidance does the capability approach offer designers to understand people's well-being?"* and *"Which designer-friendly methods are available to efficiently explore people's well-being to inform Design for Development?"* have been answered in chapter 2 and 3. The next step is to integrate both the analytic and the practical guidance in a systemic, designer-friendly and efficient approach which will lead to a better understanding of people's well-being (research question 3). In this chapter a conceptual framework is constructed, based on the literature studies executed in chapter 2 and 3. This conceptual framework provides an overview of the interconnection between the different analytic and practical elements of the CA, UCD, DfD and RE. In this section, first the analytic elements of the conceptual framework are developed (part A) and then the practical elements (part B). Finally, both elements are combined into one conceptual framework. This framework forms the basis for the development of a systemic user context research approach (chapter 5).

4.1.1 Part A: Analytic guidance from the Capability Approach

In chapter 2, the rationale behind the CA has been explored, as well as its key ideas and variables. This resulted in a thinking framework about what comprises people's well-being.

Analytic guidance: key variables

The CA-based thinking framework offers analytic guidance about what to explore when obtaining comprehensive user insight. The key variables identified are:

- *Conversion factors.* Social, environmental and personal factors that limit or advance the conversion from resources into capabilities;
- *Resources.* Those resources that are available to a person in a certain context;
- *Capabilities.* The sets of real opportunities that people possess and have reason to value, which enable them to do what they want to do and to be who they want to be;
- *Sense and use of choice.* The awareness of the choice to fulfil available capabilities and the actual usage of this choice to fulfil a set of capabilities;
- *Functionings.* The sets of people's achieved opportunities;
- *Objective well-being dimensions.* Non-feeling dimensions which are externally assessed and approved;
- *Subjective well-being dimensions.* Refers to a person's feelings and / or judgement. Relate to individual preferences, aspirations and desires.

These variables influence each other as visualised in figure 4-1.

Product designers can influence people's real and valued opportunities, and in this way try to influence people's choices. However, they cannot influence what people actually do with these opportunities. Although product designers do have a responsibility for the consequences of their products and / or services and therefore have to think carefully about their creations, it is up to the people who are offered those opportunities if and how they use them. By investigating potential users' resources, conversion factors, preferences, aspirations, desires,

values, needs and choice making behaviour, product designers can better understand and influence people's real opportunities and choices.

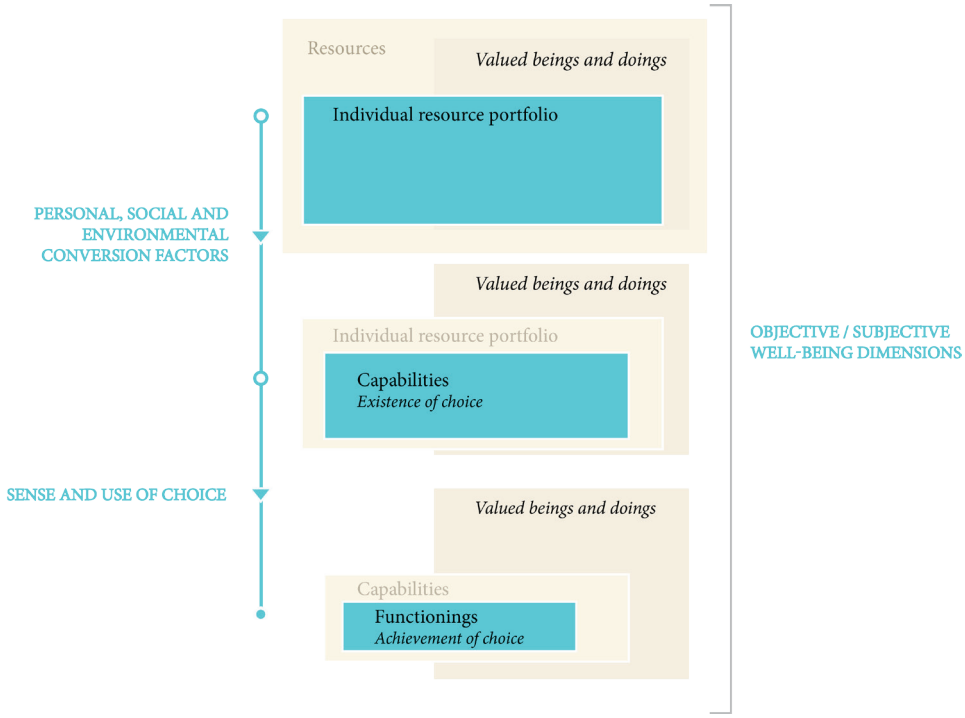


Figure 4-1: Conceptual framework part A: What to explore?

Which insights to obtain? Establishing a list of *themes*

As argued in chapter 2, this study focuses on both subjective and objective well-being, and follows the advice of Gasper (2007) to include subjective well-being dimensions in the larger set of objective well-being dimensions, and to add ways to measure both people's ability to choose and their engagement in choice. However, which dimensions should be included in an 'objective list account of well-being' and which subjective dimensions should be added, is not disclosed.

Van De Poel (2012) argues the case for an objective list account of well-being, but points out that user goals differ and contexts-of-use differ, and therefore the specification of a list differs per group or subculture, and should be explored in context. Among CA scholars, the formulation of a standard list of capabilities is subject of debate. Sen (2005) is against the establishment of a fixed list based on theory. He propagates that important capabilities and their weight should be selected in the light of the purpose of study and the values of the referent populations (Alkire 2008a, 2007). Therefore, Sen (1999) suggests that a list of capabilities should be established by democratic deliberation. He argues that using a fixed list of capabilities does not only ignore the fact that capabilities are used for different purposes, but also that social conditions and thus priorities vary, and that *"public discussion*

and reasoning can lead to a better understanding of the role, reach, and the significance of particular capabilities" (Sen 2005, p. 160). Nussbaum (2003), however, argues that the CA remains too vague to offer a valuable perspective as long as no commitments about substance are made. She established a list comprising ten central human capabilities formulated at an abstract level, and according to her, the translation to implementation and policies should be done at a local level, taking local differences into account (Alkire 2007, 2008a; Anand et al. 2009). Although Nussbaum stresses that her list is *"humble and open-ended and always open for revision", her critics say that her list is too universal and argue that it does not allow a sufficient 'voice of the people concerned'* (Robeyns 2006, p. 355-6). Alkire (2007, 2008a) takes a stance between that of Sen and Nussbaum, arguing against the use of one single list of poverty dimensions, by proposing 37 lists of poverty dimensions. Several other CA researchers have proposed, developed, or mention even more lists. These lists come from a range of sources and from theory and / or practice.

To bring about well-being dimensions of interest for design, establishing a list seems to be a valid method: it brings guidance in a clear and easy-to-check manner and is therefore directly practically applicable. In §2.4, a list of capabilities has been used to investigate the relevance of the CA for product design practice, and this list indicates some interesting well-being dimensions when analysing the Anna Tasar Reeling Machine with hindsight. However, as argued in chapters 1, 2 and 3, user involvement is an important characteristic of the domains of CA, UCD, DfD and RE. It seems a relevant approach, as users and context-of-use differ, and is therefore recognised as a means to improve product accessibility, applicability, acceptance and adoption. However, it seems logical not to compile a list of capabilities, but a list of themes or conversation topics that guides designers to gather relevant information from potential users and their context for designing products that these potential users value and have reason to value. In this way, the starting point is not a list with a pre-determined set of values, but a list that guides designers when exploring values together with their potential users. This list will support designers to detect not only capabilities, but also resources, conversion factors, habits, behaviour, beliefs, values, motivations, attitudes, thought processes, needs, desires, and aspirations.

Both the CA and the product design literature provide multiple lists and dimensions that should be brought to the surface when exploring the user context. These lists and dimensions are used to establish a single list of themes. The CA lists considered comprise those lists mentioned or proposed by: Burchardt and Vizard (2007); Chiappero Martinetti and Roche (2009); Hulme and McKay (2005); Walker et al. (2009); Anand, Krishnakumar, and Tran (2011); Anand and van Hees (2006b); Frediani (2010); Rudra (2009); Alkire, Qizilbash, and Comim (2008); Chiappero Martinetti (2008); Lelli (2008). The dimensions taken from UCD, DfD and RE include those mentioned by: Handwerker (2001); Oulasvirta, Kurvinen, and Kankainen (2003); Roibás (2008); Kujala (2003); Guimaraes, Penny, and Moody (1996); Viswanathan, Yassine, and Clarke (2011); Viswanathan and Sridharan (2012); Waeyenberg and Hens (2008); McNeill and Westby (1999); Krishnan and Prabhu (1999); Ray and Ray (2011); James (2011); Prahalad and Lieberthal (2003b); Souiden, Pons, and Mayrand (2011); Donaldson (2006); Iyer, LaPlaca, and Sharma (2006); Boztepe (2007); Banu (2009);

Shahnavaz (1989); Chavan and Gorney (2008); Gardner, Acharya, and Yach (2007); Sklar and Madsen (2010); IDEO (2008b); Narayanasamy (2013); Bowman and Crews (2009); Martin and Hanington (2012); Van Boeijen et al. (2013); Wasserman (2012); Pelto (2013). A full overview of all these lists and dimensions can be found in Appendix A.

The dimensions have been clustered due to the many overlaps and interconnections between them. In chapter 3, seven criteria for establishing a list of dimensions have been presented: the dimensions should be philosophically and theoretically meaningful, not be over-specified or derived from a particular metaphysical worldview, be made explicit and clarified, be scrutinised, discussed and defended, contain different levels of generality, should be short, and should include all important issues related to agency and well-being goals. These were the criteria kept in mind when establishing the list of themes, and also during further development of the list. To establish one list from all the dimensions identified, the 'find themes' method, as explained by design company IDEO, was used. IDEO (2008b, p. 67) states that this method can be used to explore *"the commonalities, differences, and relationships between the information"*.

First, all dimensions were noted on post-it notes and clustered, if related. At the same time, the levels of the different dimensions have been reviewed, leading to a division of dimensions in categories and sub-categories. The categories have been grouped and re-grouped by moving the post-it notes around. The established categories were discussed in the research team in order to consider alternative groupings. Large categories were broken down into smaller ones. The list was then evaluated by a graduate student from the faculty of Industrial Design Engineering of Delft University of Technology, van der Marel, who was temporarily added to the research team for his master's graduation project (Van der Marel 2012), and after that again discussed within the research team. Eventually, 12 different categories were identified to serve as themes; these are listed in table 4-1. While the list is carefully established and multiple sources of information have been used to inform the list, the researcher is aware that such a list can never be fully free of normative assumptions.

Table 4-1: Twelve themes to pay attention to when comprehensively exploring the user context

Theme	Related capabilities
Health	*Comprising physical health, mental health (internal) and healthcare (external)*
	Being able to: have good health, live to the end of a human life of normal length, have good reproductive health, have adequate water, sanitation and hygiene, have adequate periodic rest, have adequate physical activity / Being able to: have good health, lead a happy, enjoyable, prosperous life without worries and with confidence in the future, be treated as a dignified being whose worth is equal to that of others, have a sense of the aspects that makes one unique, adjust to circumstances, accept oneself and one's circumstances, seclude oneself or information about oneself, express and activate all one's aspirations and capacities, receive good healthcare. Having: the freedom of thought, imagination, opinion, the freedom to experience emotions and express oneself, the social bases of self-respect and non-humiliation.

Nutrition	*Separated from health as being a good indicator of economic status and physical health.* Being able to: be adequately nourished.
Accommodation and surroundings	Being able to: have a place to stay, have adequate shelter, reside where one wants. Having: places to meet others for educational, spiritual or creative purposes.
Safety and Security	Being able to: live in an open, just, and secure environment, have pleasurable experiences, safety, harmony and stability. Being secured against harassment, pain, anxiety, violent assault and not having one's emotional development compromised by fear and anxiety.
Education	Being able to: receive education, experience and appreciate beauty, develop curiosity, learning, and understanding.
Self-determination	*Self-determination and self-expression: similar to practical reason. Includes politics, cultural identity and spiritual life.* Being able to: form a conception of the good, engage in critical reflection about life planning. Having: a sense of goodness, righteousness, duty, and obligation / Having: the right of political participation, protections of free speech and association Being able to: have control or power in the general social system (includes decision-responsibility) / Being able to: live according to culture or own preference. Having: respect for the customs and ideas that one's culture or religion / Being able to: choose to reject or accept those customs and ideas, find meaning and value, be free to believe or not believe in a greater than human source, find meaning, inner harmony and inner peace.
Partner and family	Being able to: experience and give love and affection, have control or power within the household (includes decision-responsibility), care for, bring up, marry, settle and raise children, have opportunities for sexual satisfaction and for choice in matters of reproduction.
Mobility	Being able to: move freely from place to place.
Meaningful work	Being able to: choose one's work, work as a human, exercise practical reason, enter into meaningful relationships of mutual recognition with other workers, accomplish one's aspirations, demonstrate competence and making a lasting contribution, be economically secure at present and in the future.
Leisure	Being able to: laugh, to play, to enjoy recreational activities.
Friends and community	Being able to: form friendships, enjoy companionship, live in and participate in a community, have attachments to people and things outside ourselves, recognize and show concern for other humans, engage in various forms of social interaction, imagine the situation of another, be recognized and having social status and prestige.
Products, animals, plants	*Comprising goods & services and environment.* Being able to: own property, have sufficient assets, have control over material environment, have access to services concerning i.e. mobility and media services / Being able to: live with concern for and in relation to animals, plants, and the world of nature.

4.1.2 Part B: Practical guidance from design and ethnography literature

The literature reviewed on UCD, DfD and RE resulted in a large amount of information on how to obtain user insight. Many toolkits, manuals, books and articles have been written containing methods, techniques, tools, challenges and learnings for exploring the user context. The following key variables were extracted from the consulted literature and serve as practical guidance:

- Activities, consisting of:
  - A selection of methods: Self-reporting, immersion, homestay, learning by doing, direct observation, shadowing, informal talks, interviews, and participatory workshops;
  - A selection of techniques: Observe and ask techniques (touchstone tour, show me, and video and / or photography time-lapse), questioning techniques (five why's, directed storytelling, guided speculation, sacrificial concepts, talking diaries, thinking aloud, what-if scenarios), issue generating techniques (brainstorming, body storming, brain writing), creating techniques (pictures, drawings, diagramming, mapping and modelling) and valuing techniques (ranking, sorting and scoring);
  - A selection of tools: annotated map or plan, picture cards, aspirations exercise cards;
- Guiding topics and questions: The literature suggests that topics and questions should be prepared beforehand to serve as guidance during interactions with potential users. This list of topics is directly linked to part A of the conceptual framework (the identified 'themes') and should fulfil the requirements of the 'list of dimensions' mentioned in part A, in order to provide comprehensive insights matching the CA's rationale;
- Prerequisites: Nine prerequisites have been derived from the literature review to be completed during each activity: 1) the design team should be multidisciplinary; 2) activities should be conducted in pairs or with a maximum of three designers; 3) the activity should be carried out in the field; 4) the design team should be trained to conduct the activity; 5) activities should be participatory, simple and fun; 6) local partnerships should be established; 7) data should be analysed after each activity and inform the next activity; 8) outcomes should be shared and checked with participants and a larger audience; and 9) designers should critically reflect on the activity's limitations. In addition to these nine prerequisites, a tenth one has been added: to become familiar to the guiding themes and questions;
- Steps: The literature suggests eight steps to be followed in a specific order before conducting an activity: 1) preparing the team; 2) preparing methods and materials; 3) planning activities; 4) meeting local partners; 5) selecting the research area; 6) building rapport; 7) selecting and instructing a translator, conducting a local pilot; and 8) selecting participants. Another six steps have to be followed in a specific order when conducting an activity: 1) assign roles within the team; 2) decide on time and place; 3) introduce research and activity; 4) obtain consent; 5) facilitate the activity and take notes; and 6) thank the participants. Furthermore, the literature notes three steps to be followed in a specific order after conducting an activity: 1) document the activity; 2) analyse, interpret and reflect on the activity within the team; and 3) share outcomes with participants and a larger audience.

Besides these key variables, a number of actors also influence the activity of obtaining comprehensive user insight:

- The design research team. This is the team which executes the user context research in the field. A maximum of three members of the multidisciplinary, trained team will be assigned a specific role per activity. One of these three team members might be local;
- Translator. In addition to the research team, a translator may need to be present to be able to talk to the participants. The translator should preferably be interested in the topic of research, should not let biases and assumptions interfere with the questioning, and have matching identities regarding the participants. The translator should be fully and correctly instructed before conducting the activity;
- Participants. Participants for the activities should be carefully selected to obtain a varied view of the community under investigation. The participants should comprise a heterogeneous group, should form an unbiased sample, and should not attempt to influence the outcomes or obtain benefit.

All the variables are visualised in figure 4-2. The prerequisites are not mentioned separately, but as part of the different variables.

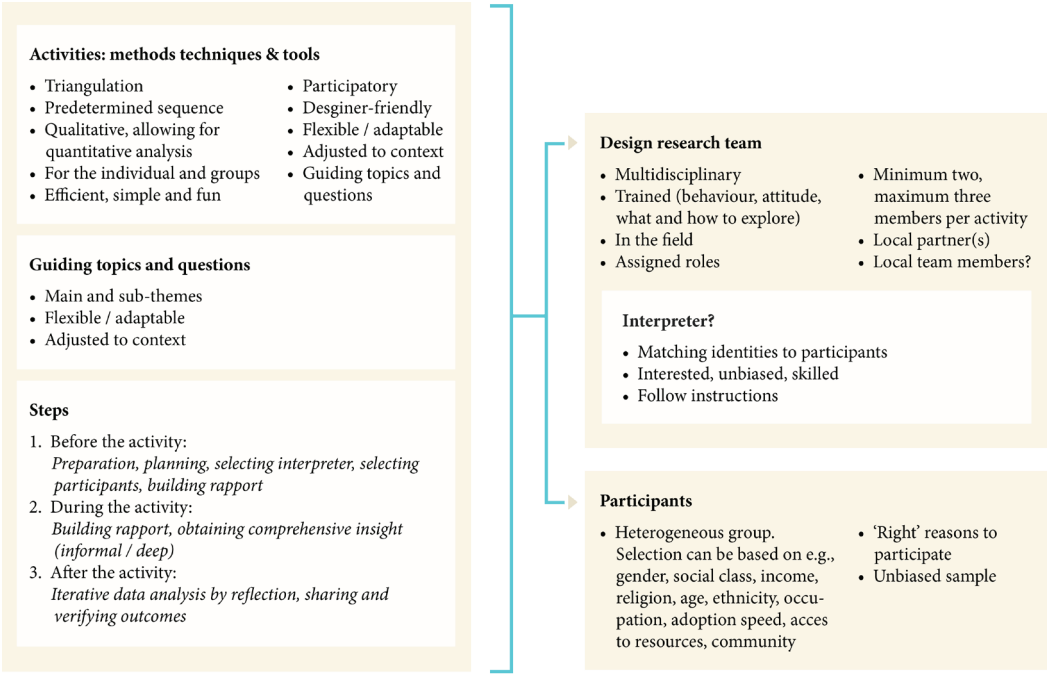


Figure 4-2: Conceptual framework part B: How to explore?

4.1.3 Comprehensive insight to guide the design process

The full conceptual framework is presented in figure 4-3. The capability elements and the list of themes (analytic guidance), as well as the activities, prerequisites and steps (practical guidance) have been structured in this way to illustrate how product designers can obtain

comprehensive insight in their potential users and their context in an objective, efficient and designer-friendly way in the context of developing regions. This process of exploring the user context should be iterative, participatory and focused on the individual, while also paying attention to groups and the environment. Different social actors can influence this process, depending on the social setting in which the research is conducted.

The insights obtained through this process enables the designer to detect design opportunities, establish design requirements, frame the right problem, and make informed design decisions throughout the design process. The design team does not have to – and will probably not be able to - address all issues, needs, preferences and / or desires of the potential users. The design process is a creative process and is not only influenced by insights from potential users, but also by technical possibilities, business opportunities, politics, and/or client or stakeholder demands. Thereby, the design team has its own expertise and creativity and is forward looking. However, by following a participatory design process, products can be co-created that improve acceptance and enhance valued opportunities.

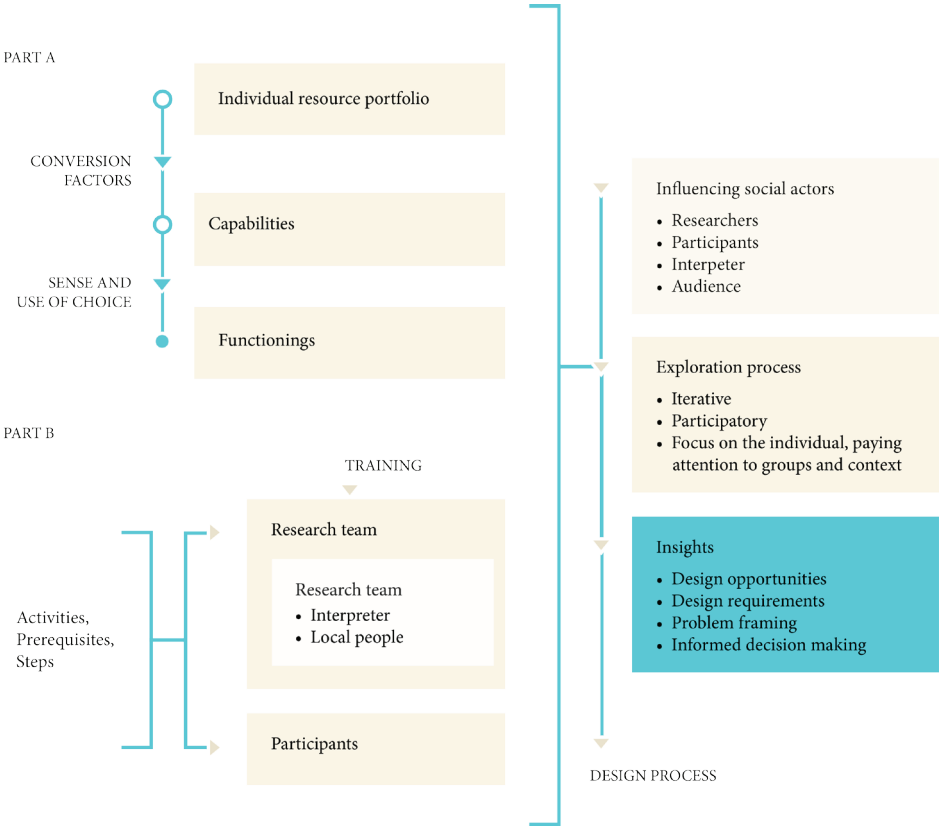


Figure 4-3: Conceptual framework

4.1.4 Conclusion and next steps

The conceptual framework interconnects the outcomes of the literature studies and provides an overview of both the dimensions and elements that need to be explored in order to obtain comprehensive user insight. It can be concluded that the user context exploration process is complex as it comprises numerous factors that inform and influence this process. To guide designers when conducting rapid and comprehensive user context research, a thinking framework and a list of themes have been established which can be combined with the methods, techniques and tools found suitable for gaining user insight in a DfD context. The themes and thinking framework provide the design team with a direction, as they indicate a comprehensive range of dimensions that need to be discussed or observed.

There is a need to explore how comprehensible and usable the thinking framework is for product designers, whether the list of themes is complete and adequate, and if the methods and tools used to obtain rapid conceptual insight are appropriate and usable. To investigate these aspects, empirical research has been conducted to complement this theoretical basis with insights from practice. In the remainder of this chapter the research approach, methods and stages used to execute this exploratory, empirical research are elucidated.

4.2 Research approach and methods

In chapter 1, the need for guidance in user context exploration has been identified and discussed and the CA was proposed as a partial solution. In chapters 2 and 3, the literature has been reviewed to construct a conceptual framework which forms the foundations of this exploratory research project. In this section, the research approach is clarified, which underpins this study, and guides both the next steps to be taken and the selection of methods used within these steps.

4.2.1 Research approach: Design-Based Research

In this study, the rationale that lies behind the 'Design-Based Research' (DBR) approach is used. DBR was developed as a research approach by and for educators to construct and evaluate artefacts, practices or theories in order to improve learning and teaching (Anderson and Shattuck 2012; Cole et al. 2005). More traditional approaches mainly focus on description, while DBR focuses more on prescription (Plomp 2013). DBR is close to action research, but where action research focuses on studying the effects of changes made towards certain processes, in DBR an intervention is designed and improved upon in order to induce desired change (Cole et al. 2005). *"Design-Based Research should involve theory work, treating the design platforms as contexts through which theory may be advanced"* (Barab and Squire 2004, p. 9). DBR aims at developing theory that provides real guidance and practical impact (Anderson and Shattuck 2012).

Relevance of DBR for this research project

In this research project, the focus is on the analytic guidance that designers need in order to obtain comprehensive user insight (RQ1) and on how product designers can obtain this insight

in an efficient and designer-friendly way (RQ2). The analytic guidance can be constructed and tested in order to confirm or refute whether it is adequate and comprehensive, as a law-like generalisation, independent of the feelings and attitudes of social actors. However, this analytic guidance is supposed to be used in the product design process, and design projects are complex and unique processes as they have their own set of circumstances and individual actors. These individual actors, product designers, differ in background, experiences and skills which influences the outcomes of their projects. For this study, it is important to consider the behaviours, feelings and attitudes of designers.

Taking this into consideration, the DBR approach seems relevant to use for this research project. While the research described in this thesis is not aimed at advancing educational practices, this research approach does seem particularly suited for the purpose of this study. DBR is pragmatic and explorative in nature (Herrington et al. 2007) and aims at advancing theoretical knowledge while directly impacting practice (Barab and Squire 2004). In this study, the purpose is to advance user context exploration theory and practices in the domain of product design. Thus it is also pragmatic and exploratory in nature, and there is a need for practical and theoretical guidance to obtain rapid and comprehensive insights beyond product-user interaction. The focus on developing regions introduces a complex factor making it advisable to test and experiment in the development setting itself in order to grasp the full extent of the problems. Thereby, as design practitioners know best what they require in the field, it seems logical to involve them in the research process. It therefore seems relevant to use DBR as an approach for this research project, as the study aims match those of the research approach.

However, in the goal of this study is not to develop learning and teaching practices, but to develop user context exploration practices for product designers. In DBR the practitioners are teachers, in this study the practitioners are product designers. This study sets out to achieve the following outcomes:

1. *Practical:* user context exploration methods, tools and a manual for product designers in order to improve the practice of user context exploration in developing regions (= the intervention).
2. *Theoretical:* design principles or guidelines for product designers to advance theoretical knowledge towards conducting field research beyond product-user interaction in an effective and efficient manner.

Characteristics of Design-Based Research approach

The following characteristics of DBR underlie this research project:

- Theory-oriented. Interventions are developed based on existing theory and knowledge, and are advanced by iterative field testing in order to contribute to theory-building (Herrington et al. 2007; Van den Akker et al. 2006; Barab and Squire 2004; Cole et al. 2005; Reeves 2006).
- Process-oriented. Not only does DBR focus on measuring input and output, it also includes understanding, explaining, adjusting and/or constructing an intervention (Van den Akker et al. 2006; Barab and Squire 2004; Plomp 2013).

- Interventionist. DBR focuses on designing a real-world intervention that works in complex social settings (Van den Akker et al. 2006; Anderson and Shattuck 2012; Barab and Squire 2004). Plomp (2013) explains that 'intervention' refers to all the things that can be designed and developed.
- Naturalistic. Problems are addressed by testing and experimenting in the real context (Herrington et al. 2007; Barab and Squire 2004; Anderson and Shattuck 2012; Reeves 2006), in order to obtain a more complete understanding of learning processes (Plomp 2013). The context of use should be fully examined and considered (Barab and Squire 2004).
- Holistic. DBR does not simply investigate isolated variables; it includes multiple dependent variables of complex problems (Plomp 2013; Barab and Squire 2004). The interventions are studied as being integral and meaningful phenomena (Van den Akker et al. 2006).
- Iterative, cyclical process. The research is flexible and iterative in nature, the intervention will be adjusted depending on its success in practice (Barab and Squire 2004; Anderson and Shattuck 2012; Plomp 2013) in order to continuously test and refine theoretical claims (Barab and Squire 2004; Reeves 2006). The process ends when the outcomes are satisfactory to all people concerned (Reeves 2006). *"Each new application is an extension of the theory as its specific characteristics are situated in local dynamics"* (Barab and Squire 2004, p. 10).
- Involvement of practitioners. Practitioners are not subjects, but co-participants in the research process and should be involved throughout the research process (Barab and Squire 2004; Anderson and Shattuck 2012; Reeves 2006; Plomp 2013). Their concerns and problems are put first (Herrington et al. 2007). *"Interaction with practitioners is needed to gradually clarify both the problem at stake and the characteristics of its potential solution"* (Van den Akker 1999, p. 8).
- Both theoretical and practical outcomes. The results of DBR are reusable design principles; they advance and/or validate a theory beyond a specific setting (scientific value), and they lead to research-based solutions for practice (practical value) (Herrington et al. 2007; Plomp 2013; Reeves 2006). These practical outputs can be constructs, models, methods or instantiations (Cole et al. 2005). Herrington et al. (2007) adds societal value to these, as the researchers and participants experience personal development.
- Prove by utility. The relevance and value of the theory is evaluated by its utility: it can be proven by showing its ability to produce changes in the world (Cole et al. 2005; Barab and Squire 2004). Evidence should therefore come from the intervention's trustworthiness, credibility and usefulness and the range of contexts for which it is useful (Barab and Squire 2004).
- Often multi-levelled. Often classroom practices are linked to events or structures outside the classroom (Plomp 2013).
- Triangulation. A variety of tools and techniques are typically used to conduct DBR research (Anderson and Shattuck 2012), and multiple research methodologies and designs are used in different phases of the project (Diehl 2010).

4.2.2 Formative evaluation methods

According to Plomp (2013), formative evaluation methods aimed at improvements are key to and used in all stages of the DBR approach. Nieveen and Folmer (2013) and Plomp (2013) provide an overview of several methods that can be used for formative evaluation:

- Screening. Research team members who are not involved in the development, check the intervention to point out errors;
- Walkthrough. The research team examines the intervention together with representatives of the potential users (in this study: designers), to obtain insights into its clarity and appeal, and to point out errors;
- Expert appraisal. A group of experts comment on the content, design and technical quality of the intervention;
- Micro-evaluation. A small group of potential users (in this study: designers) use the intervention outside its intended setting in order to obtain feedback on the intervention's effectiveness, appeal and implementability;
- Try-out. A group of potential users (in this study: designers) use the intervention in practice to obtain insights in its user acceptance, implementability and organisational acceptance.

These methods have been used to develop and evaluate the approach and intervention (see chapters 6 and 7).

4.3 Research stages

Reeves (2006) describes four stages within DBR: preliminary research, prototyping, iterative testing and reflection. These have also been used in this research project. Within these stages, qualitative methods were used as they explore phenomena in a flexible, iterative style in order to understand and describe the topic under study (Mack et al. 2005). According to Mack et al. (2005, p. 1) qualitative research is particularly suited to obtain *"culturally specific information about the values, opinions, behaviours, and social contexts of particular populations."* As in this study specific information is sought about the values, opinions and behaviours of product designers in developing regions in a flexible, iterative manner, qualitative methods ideally serve this purpose. The different research stages, and the approach and qualitative methods used are described in this section.

4.3.1 Stage 1: Preliminary research

The first stage of the DBR approach is defining and analysing the identified problem together with practitioners (Reeves 2006), and then conducting a literature study and reviews of projects addressing similar problems (Plomp 2013). This information leads to insights regarding the gap between the existing and the desired situation (Nieveen and Folmer 2013) and results in a conceptual or theoretical framework and a plan for the intervention (Plomp 2013). The emphasis in this stage is on relevance (Plomp 2013).

This research stage has now been completed. Chapter 1 introduces, defines and analyses the problem to be addressed in this study. Based on experiences in the field and experiences with

guiding and interacting with design students in Design for Development projects at Delft University of Technology, a lack of guidance for obtaining rapid, comprehensive user insight was identified. After conducting a preliminary literature study, which also included reviews of DfD projects, the scope and purpose of this research were defined and a set of research questions developed. A thorough study of the scientific and practical literature (chapters 2 & 3) laid the foundations for the development of a conceptual framework, presented in this chapter. This foundation also forms the basis for the design of the intervention.

4.3.2 Stage 2: Development of the intervention

This stage involves developing solutions which are derived from existing principles and innovations (Reeves 2006). According to Plomp (2013), different activities in this stage include consulting experts and practitioners, analysing the practical context and promising examples, and a focused literature review, all of which lead to the development of a prototype. This prototype of the intervention consists of a conceptual framework which refers to all the underlying notions, and a presentation-mode which refers to the format of the intervention (Nieveen and Folmer 2013). Multiple prototypes can be developed and subjected to formative evaluation (Plomp 2013). The focus is on consistency and practicality (Plomp 2013).

In the conceptual framework presented in this chapter, a first set of principles are presented which underlie the design of the intervention. In chapter 5, the presentation-mode of the intervention will be addressed by conducting a focused literature review, which takes the practical context into account. Based on the literature studies presented in chapter 2, 3 and 5, an overall approach for conducting rapid and comprehensive user context research is proposed, termed 'Capability Driven Design' (CDD). In chapter 6 a first prototype of the intervention is presented, which addresses one specific method of the CDD approach: individual semi-structured interviewing. This intervention has been called the 'Opportunity Detection Kit' (ODK). The contents and procedures of this intervention are developed and refined by four formative evaluations: by using it out of context (micro-evaluation) and in context (micro-try-out), by consulting with experts (screening, expert consultation) and practitioners (walkthrough). The micro-evaluation and micro-try-out focused on the ODK's procedure, and the screening, expert consultation and walkthrough focused on the ODK's content. The full development of the ODK, resulting in an intervention ready to be used in the field, is described in chapter 6.

4.3.3 Stage 3: Evaluation of the intervention

This research stage consists of iterative testing and refining the intervention in practice (Reeves 2006). According to Plomp (2013), micro-cycles of research should be conducted which result in data that needs to be analysed in order to refine the intervention, after which it is implemented again. In the phase of data collection and analysis, it may be required or desired to adjust the intervention (Plomp 2013). Plomp (2013) notes that it should be explicit which criteria are emphasised in each iteration in order to properly construct the research design. Herrington et al. (2007) stress the need to clearly describe the participants, the data collection process and the data analysis process. The initial focus is on consistency and practicality, while later on effectiveness becomes more important (Plomp 2013).

In chapter 7, the iterative steps taken to refine the intervention are described. After establishing the first prototype of the intervention it is then used by novice design teams in the field during their DfD projects to address challenges in different regions of the world. Five design teams were asked to use the ODK, providing insight on the ODK's acceptance, implementability and effectiveness. Three design teams were given more time to apply the ODK in their DfD projects in order to improve the ODK: they not only reflected on the ODK's procedure and effectiveness, but also on its contents in the specific contexts they worked on. To thoroughly evaluate the ODKs content, an expert appraisal was held in the form of eight focus group sessions comprising a variety of experts. Table 4-2 presents these formative evaluations with their main characteristics. In chapter 8, the final ODK and CDD approaches are presented. The ODK underwent significant changes based on the executed iterations. The CDD approach was then adjusted based on these development, however it mainly remains a theoretically constructed approach.

Table 4-2: Formative evaluations conducted to develop and evaluate the Opportunity Detection Kit (the ODK's intended usage is indicated in bold: by designers, in the field, as a prospective application)

Development of the Opportunity Detection Kit						
	Focus	**Users**	**Context of use**	**Application**	**Experts**	**Expert affiliation**
Micro-Evaluation	Procedure	Researchers	In the 'Lab'	Descriptive		
Micro-Try-Out 1	Procedure	Researchers	**In the field**	Evaluative		
Screening	Content				Internal	Academic
Micro-Try-Out 2	Procedure	Researchers	**In the field**	Evaluative		
Walkthrough	Content				External	Designers
Expert Consultation	Content				External	Academics
Evaluation of the Opportunity Detection Kit						
	Focus	**Users**	**Context of use**	**Application**	**Experts**	**Expert affiliation**
Try-Out 1	Procedure	**Designers**	**In the field**	**Prospective**		
Try-Out 2 (intensive)	Procedure	**Designers**	**In the field**	**Prospective**		Academics, Designers & Other practitioners
Expert Appraisal	Content				External	

4.3.4 Stage 4: Reflection

The final DBR research stage consists of a reflection to establish theoretical principles and / or guidelines, and to improve the implementation of the intervention in order to result in a practical product (Reeves 2006; Plomp 2013). Plomp (2013) argues that reflection often results in new recommendations for improving the intervention, and that this stage can be termed 'semi-summative'. The focus in this phase is on practicality, relevance, sustainability, and effectiveness of the intervention (Plomp 2013). Once the intervention is sufficiently developed, it can be implemented and scaled up (Plomp 2013).

In chapter 9, the findings of a critical reflection on both the CDD and ODK are presented: their efficiency, effectiveness and designer-friendliness. This resulted in a set of theoretical

design principles and recommendations for further research in order to improve the CDD approach and the ODK method and to improve their implementation. Finally, a critical reflection on the quality, validity and limitations of the conducted research is provided.

4.3.5 Addressing the limitations of the research approach

The DBR approach has a number of limitations which users need to be aware of. In DBR literature, several areas for consideration related to the DBR are mentioned; these are discussed below, as well as how they have been dealt with in this research project.

Quality and validity of research with a changing research design and multiple roles

Being able to guarantee quality and validity is a point of attention when conducting research with a continuously changing research design (Diehl 2010). As DBR is a cyclical, iterative process; next steps are based on the outcomes of former steps (Plomp 2013). This changing research design may be weak (Plomp 2013) and challenging for the researcher (Barab and Squire 2004; Diehl 2010). Thereby, in DBR the researcher is a designer and researcher at the same time (Barab and Squire 2004), as well as often in the role of evaluator and implementer (Plomp 2013). This results in a thin line between objectivity and bias in DBR processes (Anderson and Shattuck 2012) and makes it difficult to ensure the credibility and reliability of the outcomes (Barab and Squire 2004; Anderson and Shattuck 2012). If the researcher comes from 'outside', 'insiders' can be hesitant to open up and if the researcher comes from 'inside', objectivity and diminished forgiveness towards mistakes may be issues (Plomp 2013).

In this research project, the researcher was either actively or closely involved in the execution of the interventions. This enabled a thorough understanding of and access to the complexity of the data, but also led to inclusion of the researcher's bias and subjectivities in the data and data analysis. The researcher in this project is an insider. Therefore, the objectivity of the researcher and the level of forgiveness of product designers towards mistakes are more in question than the opening up of product designers towards the researcher. Following advice provided by Anderson and Shattuck (2012) and Plomp (2013) regarding data validity and reliability, the following measures were taken:

1. The research is open to outsiders for scrutiny. Outsider scrutiny was also sought by presenting the ongoing research project at conferences and seminars;
2. An explicit conceptual framework has been developed and used (as presented in this chapter);
3. Each iteration has been thoroughly analysed to provide input for the next iteration;
4. Data is systematically documented, analysed and reflected upon;
5. Data have been triangulated by varying time, location and participants;
6. Different methods were used to conduct this research: interviews, group discussions and observations;
7. Research assistants executed parts of the research;
8. Inductive and deductive data analysis methods were applied;
9. Context-rich descriptions were used;
10. Outcomes were checked with participants;
11. Practicality and effectiveness of the intervention were empirically tested.

Generalizability of outcomes

The DBR findings cannot be statistically generalized (Plomp 2013). Researchers influence the context under research and claims may therefore not be generalizable to other contexts which are not influenced and which have their own agency (Barab and Squire 2004). As DBR has a context-bound nature, it is difficult to generalize outcomes towards a broader context (Van den Akker et al. 2006) and this can only be done analytically, not statistically (Plomp 2013). In DBR, researchers should strive to derive findings that are relevant to other contexts (Barab and Squire 2004) by generalizing findings to a broader theory or domain (Plomp 2013). Barab and Squire (2004) therefore argue for finding a balance between refinement and local adaptability of the advanced theory. The concluding chapter of this thesis reflects on the generalizability of the outcomes of this research project and the balance kept between refinement and adaptability.

Difficult to replicate the research and findings

As the social setting in which the research is conducted is the natural context, and no one context is the same, replication of research and findings are difficult (Barab and Squire 2004). Barab and Squire (2004) therefore argue that researchers build a narrative which describes the intervention's temporal unfolding over time. In this thesis, therefore, the context of research, the features of the ODK during each intervention and the effects of these features on participation and learning are described for each iteration.

Long-term commitment is required

DBR is an iterative process of which it is unclear when it is completed (Anderson and Shattuck 2012). This results in a long-term commitment of both researchers and practitioners (Barab and Squire 2004; Herrington et al. 2007). Herrington et al. (2007), however, argue that DBR is a feasible research approach for doctoral students who have four to five years in which to complete their work.

Ensuring valuable outcomes

According to Barab and Squire (2004), researchers must demonstrate the reliability, validity and generalizability of the research outcomes. Nieveen and Folmer (2013) describe four criteria for ensuring high quality intervention outcomes, which are:

- Relevance. The intervention addresses a need, and is based on state-of-the-art knowledge;
- Consistency. The components of the intervention are consistently linked to each other;
- Practicality. Practitioners find the intervention usable and easy to use largely according to the developers' intentions;
- Effectiveness. Using the intervention leads to desired outcomes.

To be able to judge between expected and actual practicality and effectiveness, the data must be obtained from practitioners actually using the intervention in the setting it is meant for (Plomp 2013). According to Barab and Squire (2004), evidence for validity can be derived from changes or consequences in a system. These consequences must be clearly stated with all details, generalized beyond the local context, with reflection on the limitations (Barab and Squire 2004). The reader should be able to understand the complexity and dynamics of

the research process and the broader relevance of the outcomes beyond the context (Barab and Squire 2004). In chapter 7, the ODK is evaluated by designers using the kit in the setting it is meant for. The complexity and dynamics of these try-outs, as well as the outcomes are described in detail. The outcomes are reflected on in chapter 9.

4.4 Conclusion and next steps

In this chapter a conceptual framework, derived from the literature reviewed in chapters 2 and 3, is presented. This framework consists of a list of themes and a thinking framework ('WHAT to detect'), as well as a set of activities, prerequisites, steps and actors ('HOW to detect'). The conceptual framework forms the basis of the study presented in this thesis. The DBR approach used suits the purpose and nature of this research project. During the research the limitations of this research approach are considered and addressed. The presentation of the conceptual framework concludes the preliminary research stage. Three research stages now follow on from this first stage: development, evaluation and reflection. These stages are described in the following chapters, in order to test the completeness and adequateness of the list of themes, the user-friendliness, effectiveness and efficiency of the developed intervention (the ODK), and to advance existing theory. The next steps are presented in figure 4-4.

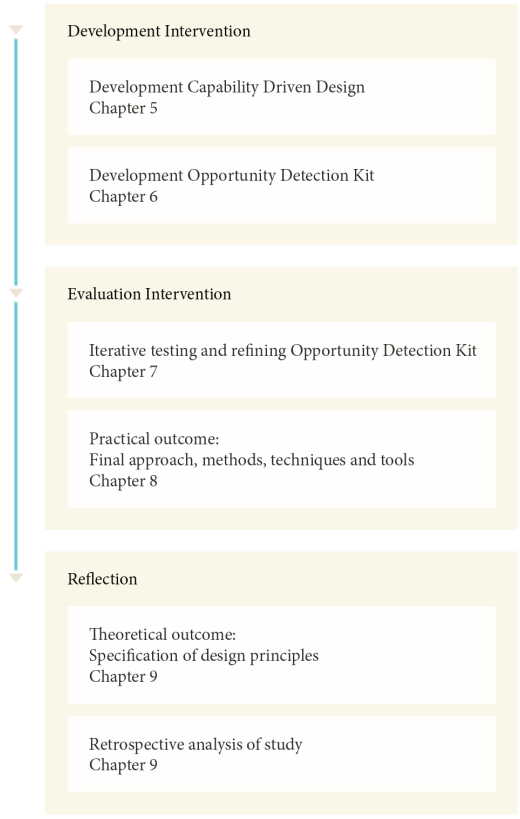
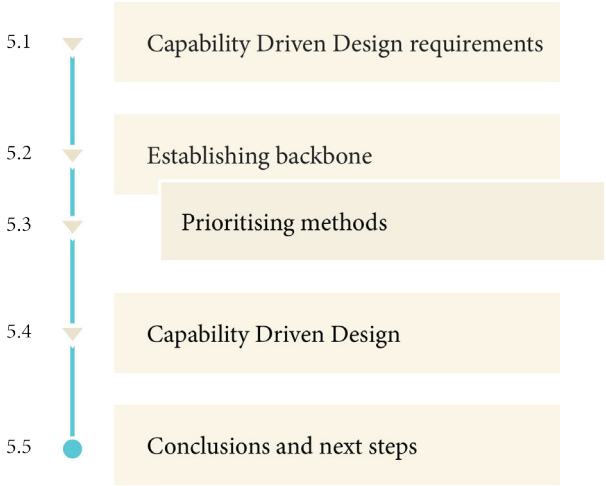


Figure 4-4: Next steps per research stage

CHAPTER 5

Developing Capability Driven Design

In chapters 2 and 3, the analytic guidance offered by the Capability Approach (CA) is explored, as well as the practical guidance offered by User-Centred Design (UCD), Design for Development (DfD) and Rapid Ethnography (RE). In chapter 4, these analytical and practical guidance are integrated in a conceptual framework. However, the conceptual framework does not yet offer the guidance that product designers require when obtaining comprehensive user insights in practice. In this chapter the development of a 'Capability Driven Design' (CDD) approach is described: an efficient and designer-friendly approach to conduct user context research. In §5.1, the requirements for the approach are established. In §5.2, the CDD backbone is presented, which consists of a thinking framework, with prerequisites to keep in mind, and themes and example questions that guide user context exploration. In §5.3, a focused literature review leads to a division of the methods selected in §3.2.5, providing a set of core methods for the CDD approach with a set of add-on methods. A step-by-step guide for designers to follow in order to obtain comprehensive user insight in an efficient way is described in §5.4. The chapter ends with conclusions and next steps (§5.5).



5.1 Requirements for Capability Driven Design

As argued in chapter 1, current design manuals and toolkits, such as the Human Centred Design Toolkit (IDEO 2008b) and the BoP Protocol (Simanis and Hart 2008), do not provide information about the type of information and insights that need to be collected for obtaining comprehensive user context research, and do not provide sufficient analytic and systematic guidance for conducting this type of research. Existing ethnographic approaches are not specifically tailored to the needs of designers who are often not trained to conduct ethnographic research. The CDD approach aims to address these issues. Based on what is lacking in current design manuals and toolkits, and on the identified obstacles and learnings in chapter 3, the requirements for the CDD approach have been determined.

These requirements are:

1. **CDD needs to offer a comprehensive view, beyond product-user interaction**

As argued in chapter 1, the main goal of the CDD approach is to obtain a comprehensive understanding of the valued beings and doings of their potential user group. The main requirement of the CDD approach is therefore to provide the designer guidance regarding the type of information and the insights that need to be collected.

2. **CDD needs to offer a procedure**

Current design manuals provide methods, tips, tricks, techniques and tools for designers to conduct effective, efficient user context research, but they do not provide a systematic way to get the most out of the research. The CDD approach aims to include such a procedure which includes several methods, techniques and tools.

3. **CDD needs to be designer-friendly**

As Daalhuizen (2014) argues, methods should help designers to see the structure of the activity and act as a mental tool. According to Daalhuizen and Badke-Schaub (2009, p. 4266), design methodology is designer-friendly when it supports designers to:

> *"1.) Access, choose and apply methods and tools in an easy and intuitive way in the midst of action, and based on the characteristics of the situation at hand, i.e. help them to deal with situations of uncertainty.*
>
> *2.) Communicate methods, tools and related experiences through communities of practice, i.e. to help them to use the right methods and tools efficiently."*

The CDD approach should therefore help designers to apply the right methods and tools in an easy, intuitive, and efficient way.

4. **CDD needs to be efficient and rigorous**

As mentioned in chapter 3, designers have limited time and resources to immerse themselves, and there is a need for an approach to gather user needs in an efficient way with high productivity, while maintaining rigor. CDD should therefore offer an efficient approach which efficiently leads to valid and usable outcomes. To limit the risk of misinterpretations of outcomes, due to biases, assumptions, preconceptions or misunderstandings, the research should include data triangulation, sharing of interpretations within the team, with the participants and in a broader group, and critical reflection on outcomes and limitations.

5. **CDD needs to be self-explanatory**

According to Daalhuizen (2014) for designers to use a specific method, designers should first learn to know the method; they should have theoretical and practical knowledge about the method. Then, they need to belief in the method's added value and have confidence in their ability to use the method. Last, different designers have different preferences for using a specific method. Therefore, for designers to use the CDD approach, the benefits should be clear, and the approach should be self-explanatory.

6. **CDD needs to be adaptable and flexible**

According to Daalhuizen (2014), the use of methods in design depend on the designer, the context and the specific design project at hand. Therefore, methods should be flexible resources which structure can be fitted and adapted *"to the peculiarities of the situation at hand"* (Daalhuizen 2014, p. 29). The CDD approach therefore should provide analytic guidance and a procedure to follow, but in a flexible manner, the approach' elements should be adaptable to the designer, the context and the DfD project at hand.

- CDD needs to fit different contexts and projects. As DfD contexts and projects vary, the CDD procedure and content need to be usable in these different contexts and projects. CDD therefore needs to offer a context-independent approach. This does not mean that the approach needs to stay on a general level. As argued above, the CDD approach needs to be adaptable and flexible, and therefore its elements can be based on a context-independent format, but can be adapted to the specific context by the design team.
- CDD needs to fit different designers. Daalhuizen (2014, p. 56) argues that it is not *"easy for designers to adapt their work practices according to a method"*. CDD should therefore not prescribe one fixed way of doing things, but should allow designers to think for themselves, and allow for adaptation and flexibility in use.

7. **CDD needs to fit the 'Design for Development' context**

The CDD approach is meant to be used in the field in DfD contexts. Therefore, the methods, techniques and tools must be able to adapt to an environment with regional languages, limited access to computers and / or internet and low literacy.

8. **CDD needs to stimulate dialogue and rapport building for deep understanding**

As described in chapter 3, in order to obtain valuable information, designers should build rapport before conducting activities and during each activity. CDD needs to stimulate rapport building in order to enhance dialogue. The methods and procedure should not be executed like a script, but should allow for conversations to go different ways, should help in building empathy and forming deep connections with potential users and allow for a deep understanding of thoughts, beliefs and behaviours.

9. **CDD needs to adhere to ethical guidelines**

The CDD approach will be applied in DfD contexts, to obtain comprehensive user insights from marginalised and disadvantaged populations. In every research it is important to adhere to ethical standards, and therefore also for the CDD approach it is important that the methods and procedures are according to ethical standards.

5.2 The backbone of Capability Driven Design

Based on the literature study in chapter 3 and the established requirements, this section shows how the backbone of Capability Driven Design (CDD) has been derived. This backbone includes a thinking framework, prerequisites, guidelines, and themes. Furthermore, a set of questions has been developed for each theme, which product designers can use to guide their observations of, and conversations with, potential users in the field.

5.2.1 Thinking framework

In §2.3, a CDD thinking framework has been proposed, explaining the core elements of investigation when exploring the user context. Figure 5-1 visualises the model of this thinking framework (for a bigger view: see figure 2-10 on p. 54-55). The process of identifying the opportunity space of potential users (1), leads to insights which can be used to inform the design process (2) can be used throughout the design process (3), in order to develop products and / or services that enhance people's opportunities (4), and impact the lives of potential users when being used (5).

5.2.2 Prerequisites

Using CDD, certain prerequisites are key to obtaining comprehensive and valid data in an efficient way. Nine prerequisites (A to I) have been identified from the literature presented in §3.2.4. A tenth prerequisite (prerequisite J) states that the themes and topics derived from the CA and product design literature in §4.1.1, and which are also presented below in §5.1.3, should always be kept in mind:

A. Multidisciplinary team. In order to enhance data reliability and validity, designers should triangulate data. CDD already prescribes the use of multiple data sources, methods, tools and techniques, but to improve outcomes, team members from multiple disciplines should be included: designers with different backgrounds, skills and knowledge. This leads to a balanced perspective, access to a range of participants, and speeds up the process.
B. Activities should be conducted in pairs. In order to enhance data reliability and validity designers should triangulate data. CDD already prescribes the use of multiple data sources, methods, tools and techniques, but to improve outcomes, activities should be conducted with at least two team members. By assigning one activity facilitator and one note taker, each of them can focus on their own specific task, while interpretations, experiences and perceptions can be compared, ensuring investigator triangulation. A third person can be added to take photographs or produce videos, however, too many can overwhelm the participants.
C. In the field. Potential users should be directly observed and interacted with in their natural settings in order to improve learning and understanding by building a shared language, capturing detail, gathering concrete data, developing empathy, and reducing bias and rationalization, filtering and distortion of information.
D. Training. In order to conduct sound, rigorous research that does not incompetently invade people's private lives, and which results in valuable data, designers should have a solid and comprehensive understanding of what good field research entails. The research should be executed in a systematic, sceptical, ethical and rigorous manner and therefore

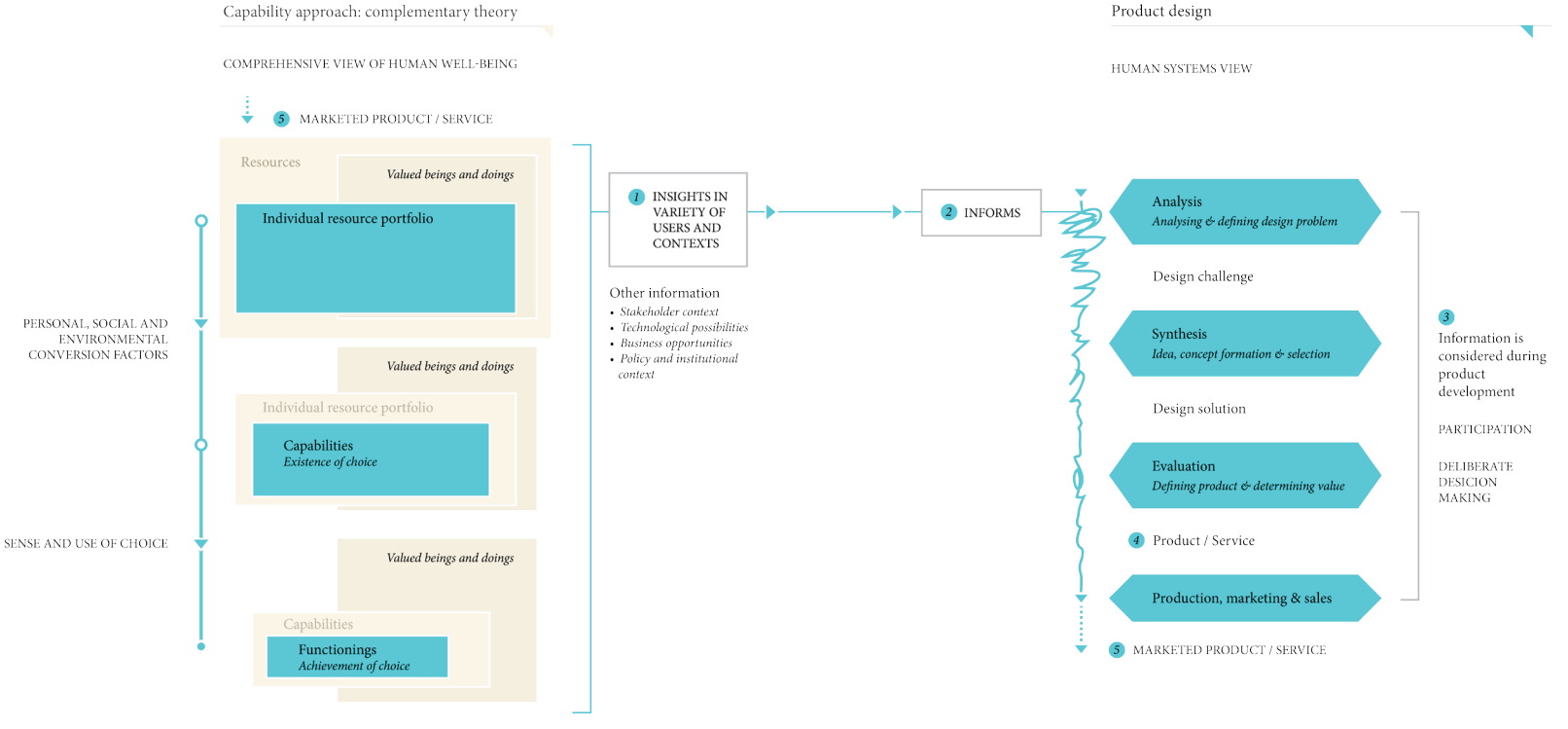


Figure 5-1: Conceptual model of the thinking framework of Capability Driven Design

designers need to be trained to learn the right attitude, behaviour and questioning skills. Designers should also continuously examine their attitudes, behaviour and questioning in order to improve on them.

E. Participatory, simple and fun activities. CDD techniques and tools can be tweaked by the designers to better fit their purpose. However, they should keep in mind that activities should be enjoyable, interactive and simple, in order to create an enabling atmosphere in which participants feel free to express themselves. It also helps to let participants perform tasks or create things.
F. Local partnerships. Local partners are required in order to adjust quickly to the local circumstances, obtain information about the potential users, get advice on activities, gain access, and to build trust in communities. They can also help in selecting participants and finding translators.
G. Iterative data analysis. As newly obtained information leads to new understanding, research goals and methods should be changed accordingly to obtain additional information. The research outcomes should therefore be analysed by the team after each activity so that activities can be adjusted based on these new insights.
H. Sharing and checking outcomes. The information, knowledge and interpretations should be shared with participants to point out misunderstandings and to improve data validity. If participants agree, they should also be shared with the community and local partners in order to keep stakeholders involved, enhance transparency and openness, and improve data reliability.
I. Critical reflection on limitations. The data obtained, the methods used, the researchers involved and the project executed all have limitations, and the researchers should reflect on them and be open and honest about them. Some example are the generalizability of outcomes, errors in data collection, the role different people played in the process, and mistakes that were made.
J. Be familiar with the themes and topics. In order to obtain comprehensive insights into all aspects that comprise a person's life and context, the themes and topics are leading.

5.2.3 CDD Guidelines

In chapter 3, several tips, tricks and advice were distilled from the literature. These have been captured in the following five guidelines that designers are advised to follow when using the CDD approach:

A. Select a variety of participants with different characteristics. Variety in gender, social class and age are especially important to include. Be aware to not only select participants that are easy to access.
B. Appropriate behaviour and attitude. All team members should follow the tips and tricks for 'appropriate behaviour and attitude'. These tips & tricks have been presented in §3.2.4., but the ethical considerations from the literature review are extended with information from the 'Developing Areas Research Group', as this research group specifically provides ethical guidelines for conducting geographical research in developing regions. The full list of tips & tricks can be found in §3.2 and Appendix C1. Here, only the ethical guidelines are presented, as they have changed:

- The participant community should be central in the research process, the research should be participatory and conducted with respect for everyone, regardless of ethnicity, culture, religion, gender, class, sexual orientation, disability etc. The first responsibility is towards the participant community: their interests should be central to the study. Do not use your power to the disadvantage of participants, act responsibly.
- Different participants should be included in the research, not only the ones who are easily accessible.
- Permission to conduct research should be obtained, follow formal requirements and procedures. Review obligations of research plans in the designers' home country and in the country under study should be checked.
- Designers should explain who they are, what the nature and goals of the research are and what the programme and purpose of the activity is.
- Objectives, expected outcomes, source of funding, methods to be employed, output usage, risks and benefits should be shared to the community prior to conducting research. Their rights and responsibilities should also be shared. Designers should be open and honest, frank and realistic about research constraints and outcomes, do not make false promises, do not raise unreasonable or unrealistic expectations.
- Informed consent should be obtained. Preferably a written statement in the local language, but if most participants are illiterate, verbal consent is more ethically appropriate. Consent should be obtained for conducting the research activity, recording the activity, and using and sharing the – anonymised – outcomes.
- Designers should be aware of the risks and dangers that the research may pose to local communities and individuals and take appropriate action to eliminate them, in order to protect the weakest in a community. Participants' privacy should be protected. Data should be secured and anonymised in order to protect identities and locations of participants. It should be ensured that the data is protected from misuse and falling into the wrong hands. Designers should be careful to engage with organisations who might use research results against – certain members of – the participant community.
- Designers should conduct research that is sound, well-conducted and results in relevant and useful data, as it is unethical to incompetently invade participant's personal lives resulting in questionable data.
- Designers should recognise and respect people's sensitivities and rights, should not trick them into revealing dark, shameful, personal or sensitive information or feelings, should not be intrusive or too demanding. The designers interests should not be placed ahead of those of the collaborators or the participants. Designers should not mine developing societies for data and should minimise social harm (e.g., intrusion, distress, indignity, physical discomfort, personal embarrassment, psychological harm) and maximize social benefit.
- Designers should be aware of their position, their background and training, power differentials, cultural distance, and the privileged position of power to influence situations through design, as these influence the way they think, the relationships with participants and the reactivity of participants.
- Designers should appreciate varying contexts, cultures, traditions, norms, mores,

values, practices, systems and structures and be open to learn without judgement.

- Designers should try to limit inequalities: they should build local partnerships and collaborate on different levels, and try to contribute in a positive way, without making false promises.
- Designers should properly thank participants and local assistants, and provide appropriate compensation for time and effort taken. The research should not result in any material gain or loss for the participants. They should avoid making excessively high rates of payments, but provide appropriate compensation to participants and local assistants. Designers should provide gifts where this is culturally appropriate or expected, but should not end up in bribery or corruption. They should avoid exploitation of local assistants by providing them a fair return. The appropriate compensation can be discussed with local stakeholders.
- Designers should judge responses, but do so carefully. They should limit misinterpretation of outcomes due to preconceptions or misunderstandings, by triangulation, sharing of data, and consult stakeholders, participants and / or participant communities. They should be open about how interpretations are established.
- Designers should critically reflect on:
  - data limitations. E.g., regarding generalizability, errors;
  - method limitations. E.g., regarding the approach and methods used and the selection of participants;
  - designer limitations. E.g., regarding their position, established relationships, way of working, documentation, handling of delegated power, personal errors and mistakes;
  - project limitations. E.g., regarding the roles of participants, distributed power and agency.
- Designers should resist pressure from funding agencies or local authorities to make the outcomes match their needs or expectations: outcomes should be transparent, genuine and honest.
- Designers should make the research outputs available locally, ideally in a language and / or form that the communities can understand and use. This enhances transparency and openness, and facilitates mutual learning. Designers should acknowledge the contribution of everyone involved.
- Designers should provide follow-up / keep the people involved in an accessible and understandable manner, without making false promises.

C. Appropriate questioning. The facilitator(s) should be trained on qualitative research skills (prerequisite). In order to guide them, the tips & tricks regarding 'appropriate questioning' should be followed. These tips & tricks can be found in §3.2 and Appendix C1.

D. Document everything. Note down characteristics of the participants (e.g., name, gender, social class, religion, age, occupation), of the activity (e.g., type of activity, the people present, date and location, materials used), and of everything that is seen, heard, felt, smelled, tasted, and / or surprising. Follow the tips and tricks for 'what to pay attention to'. These tips & tricks can be found in §3.2 and Appendix C1.

E. Bring along the required supplies. The materials for the activities, recording devices, a

notebook and pen should be brought along to the interview. Consider bringing pictures of yourself and your surroundings, as well as food for the participants.

5.2.4 Themes and questions

In §4.1.1, a set of 12 themes was derived from the literature. These themes comprise several topics which designers need to pay attention to when comprehensively exploring the user context. This list is part of the conceptual framework presented in §4.1.3. The learnings presented in §3.2.4 indicate that it is not only relevant to think about the topics to be addressed during activities, it is also useful to devise key questions beforehand. These key questions then serve as guidance during interviews, making interviews more efficient and less biased. In order to guide dialogue, questions have been developed for each theme. The questions are based on Nussbaum (2000)'s capability definitions and on the questions developed by Anand in collaboration with other authors (Anand and Dolan 2005; Anand and van Hees 2006; Anand et al. 2008; Anand et al. 2009; Anand, Krishnakumar, and Tran 2011). Anand published extensively on questions developed to obtain quantitative capability data about various life domains and issues. Although the questions for CDD are intended to collect qualitative data, Anand's questions still give good guidance. In addition, questions have been brainstormed and refined in discussions with the research team. The questions per theme can be found in Appendix D1.

IDEO (2008b) and Narayanasamy (2013) explain that questions should be carefully structured so as not to overwhelm the participant. Therefore, for each theme, first more general, open and easy-to-answer questions are phrased, followed by broader, deeper and more sensitive questions. For nutrition for example, the questioning starts with *"What do you eat during the day?"*. This question is followed by more personal questions like *"Do you have sufficient food to feed your family?"* Open-ended as well as closed questions are included, as indicated by Narayanasamy (2013). The questions for each theme serve as guidance, not as a structure to follow rigidly: the dialogue should remain spontaneous (d.School 2013). According to IDEO (2008b), the designer needs to balance between engaging in empathetic dialogue and obtaining the required information. The questions that have been developed are therefore options for starting conversation, rather than questions that need to be followed rigidly. Questions can be left out and designers can add questions during the dialogue about topics and experiences that arise during the conversation (Narayanasamy 2013; Chambers 2004).

5.2.5 Conclusions and next steps

The backbone of the CDD approach provides a thinking framework, ten prerequisites, twelve themes and, for each theme, a set of conversation starters. This backbone can be used by designers to guide their activities in the field. The thinking framework provides designers with a focus and a goal, the prerequisites ensure data validity, and the themes and questions ensure a comprehensive view of the lives of the potential users. This backbone is visualised as part of the CDD approach in figure 5-2. The other parts of CDD are elaborated in the following sections.

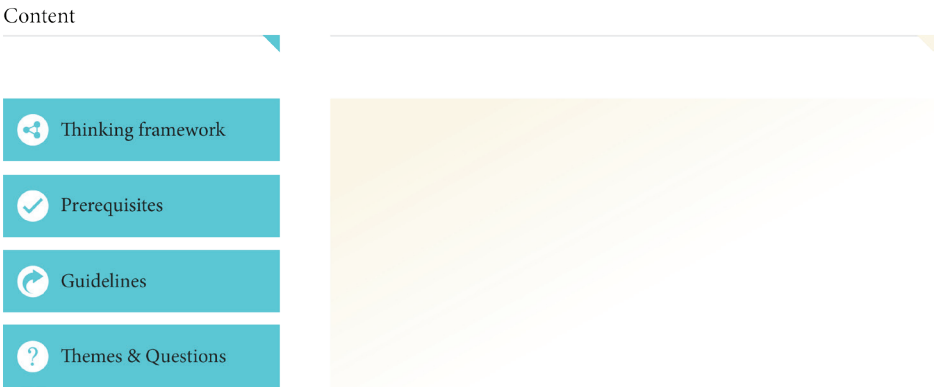


Figure 5-2: Backbone of Capability Driven Design as part of the total approach

5.3 Prioritising methods for Capability Driven Design

In §3.2.5, nine relevant methods have been selected for the purpose of efficiently exploring the DfD user context in a designer-friendly way. These methods are: self-reporting, immersion, homestay, learning by doing, direct observation, shadowing, informal talks, situated interviews, and participatory workshops. Although all of these methods may be valuable, depending on the DfD project and context, deploying all these methods would require a serious amount of time and resources which are often not available in design projects. Chambers (2004), Narayanasamy (2013) and Sperschneider and Bagger (2003) argue that the selection and use of methods in the field depend on the context, Sperschneider and Bagger (2003) that no rigid prescription should define the fieldwork, but rather different alternatives should be offered to researchers from which they can choose to develop their own course of inquiry. In this section, therefore, a basic set of methods is proposed. Of the nine methods selected in §3.2.5, four have been selected which should at least be deployed during each DfD project for obtaining comprehensive user insight. These methods are considered essential for the collection of qualitative and comprehensive user insight within a few days' time. The other six methods comprise a set of 'add-on methods' that can be deployed when more time and resources are available, leading to more comprehensive and deeper insights. For verification of insights, a fifth essential method has been selected. In this section, the methods and the selection of the essential ones are described, based on a focused literature study of the same articles, books, manuals and toolkits used for the literature study in §3.2.

5.3.1 Essential methods for Capability Driven Design

Four methods are considered to be essential for obtaining comprehensive user insight efficiently: informal talks, immersion, direct observation and situated interviews. One method is considered to be essential for efficient verification of the obtained insights in the field: focus group sessions. The selection criteria and the choice for these methods are explained below.

Method selection criteria

Four criteria were considered in order to select a basic set of methods for CDD. These are: the combination and sequence of methods, the amount of time available, the required type of method, and the opinions of experts.

Combination and sequence of methods

As discussed in §3.2.4, triangulation is important to improve data validity. To ensure theory and methodology triangulation, multiple methods should be deployed (Narayanasamy 2013; Lebbon, Davies, and Shippen 2011; Martin and Hanington 2012; Handwerker 2001; Pelto 2013; Chambers 2004). According to Chambers (2004) and Narayanasamy (2013) , the combination and sequence of methods is important as it influences the commitment of the participants, the number of dimensions and detail that is built-up, the credibility, and the learning and understanding. Therefore, a combination of different methods needs to be selected and ordered that enable building-up these dimensions and details, offering an efficient and designer-friendly approach.

Required time

As mentioned in §3.2.4, different authors indicate different time periods for conducting user context research. Simanis and Hart (2008) argue for at least eight weeks in the field, while Verdu-Isachsen (2012) mentions a full year. However, Beebe (2014), Handwerker (2001) and IDEO (2008b) all argue that user insight can be obtained in a few days. The amount of time spent in the field depends on the cultural variation present among the potential users (Handwerker 2001), on the researcher's behaviour and attitude, and on the amount of rapport built before and during activities (Chambers 2004). Product designers have limited time and resources to spend on obtaining user insight. Therefore, the combination of methods should allow for the collection of comprehensive insight within a few days. It must however be stressed that a longer stay will result in deeper and more comprehensive insight, and additional methods should therefore also be provided.

Type of method: qualitative, quantitative or mixed?

While many researchers propagate a mixed-methods approach combining qualitative and quantitative methods, qualitative research is apt when identifying *"key problems and needs in specific communities, and [learning] about the 'vocabulary of the problem'"* (Pelto 2013, p. 278). In the phase of user insight collection, quantitative methods miss contextual details and situation analysis, such as language use and belief structures (Pelto 2013). Qualitative methods lead to deep understanding and enables empathy-building (IDEO 2008b). They do, however, not result in statistically relevant data (IDEO 2008b). Therefore, quantitative methods are relevant after this initial phase, enabling statistical analysis to estimate frequencies and identify correlations, and to generalize outcomes (Pelto 2013). Quantitative methods can also be used to understand possible adoption or consequences of developed products and / or services (IDEO 2008b). Therefore, qualitative methods are selected when obtaining comprehensive and deep contextual insight.

Opinion of experts

Many of the selected authors of RE, UCD and DfD describe experiences from the field. Their opinion is valuable, as they either experienced it themselves or collected the experiences of others, and therefore know which methods work well in the field, and which methods are essential for collecting a comprehensive, detailed view of the well-being of people.

Selecting a basis of essential methods for obtaining insights

Based on expert opinions and keeping in mind that a combination of qualitative methods should be selected, whilst paying attention to the timeframe, four methods are selected to form the basis of CDD.

Experts' opinions on key methods

Narayanasamy (2013) mentions interviewing as a data-collection method which is often superior to other methods. By means of interviewing a wide range of participants, information can be obtained (Narayanasamy 2013). Interviews are considered as being critical (IDEO 2008b), fundamental (Martin and Hanington 2012), and even vital (Larsen and Flensborg 2011). Participants often prefer talking above writing, they may share confidential, personal and intimate information in interviews, and interviewing allows for probing deeper (Narayanasamy 2013). Pelto (2013) explains that direct observation generates insights that can never be obtained from interviews. He also states that observation has always been considered key to ethnographic research, but that rapid ethnographic methods offer less opportunity for observation. Martin and Hanington (2012) and Narayanasamy (2013) argue that observation is a good method to cross-check information obtained by interviews. The inconsistencies between what people say and do often hide interesting insights (d.School 2013). Chambers (2004) and Narayanasamy (2013) note that interviews and discussions should preferably be mixed with observation and visual methods. Sperschneider and Bagger (2003, p. 54) state that *"participant observation and interview techniques are paired as the dynamic duo of field research"*. According to d.School (2013), insights into human behaviour are best captured by developing empathy through a combination of in-context observation, interaction with, and interviewing potential users, and by experiencing what these potential users experience by immersion. Zimmermann (2006) also advises immersion into people's life-worlds. Many authors agree that designers do not have the time and resources to immerse themselves in context for longer periods of time, but that it is important to meet people where they live, work and socialise in order to create personal relationships, stimulating people to open up and to start sharing.

Selecting key methods for obtaining insights

According to the expert opinions expressed in the literature, a combination of interviewing with observation seems to be essential to conduct user context research, and informal talks and immersion into people's life-worlds are key to build rapport. Those four methods fulfil the criteria of being qualitative and including triangulation, and will form the basis of the CDD approach (see figure 5-3). For conducting ethnographic research in only three days, Handwerker (2001) suggests first observing participants and talking to them informally, then

to continue with short structured interviews. Following his advice, the methods of informal talks, immersion and observation should be combined in order to obtain informal insights and build rapport in an efficient manner, and then be succeeded by situated interviews. These four methods are explored further below.

Selecting a basis of essential methods for verification of insights

The CDD approach is focused towards obtaining comprehensive user insights. However, the obtained insights should also be verified with the participants in order to improve data reliability and validity as misunderstandings can be pointed out, statements can be clarified, and the data are triangulated and verified. This activity can be more focused on understanding and exploring key insights. Therefore, the selected methods in §3.2.5 are not fitting this purpose. In Appendix B1, the full list of methods derived from the literature reviewed in chapter 3 is provided. Going through this list and following the opinion of the experts, focus group sessions are selected as the 'basic' method for insight verification (see figure 5-3), as it brings about usable data in an efficient manner (Narayanasamy 2013). Focus group interviews are useful for obtaining a deeper understanding of specific issues, and the information can be obtained from a large group of participants which can then be selected for their diversity (Handwerker 2001). This method is also explored further below.

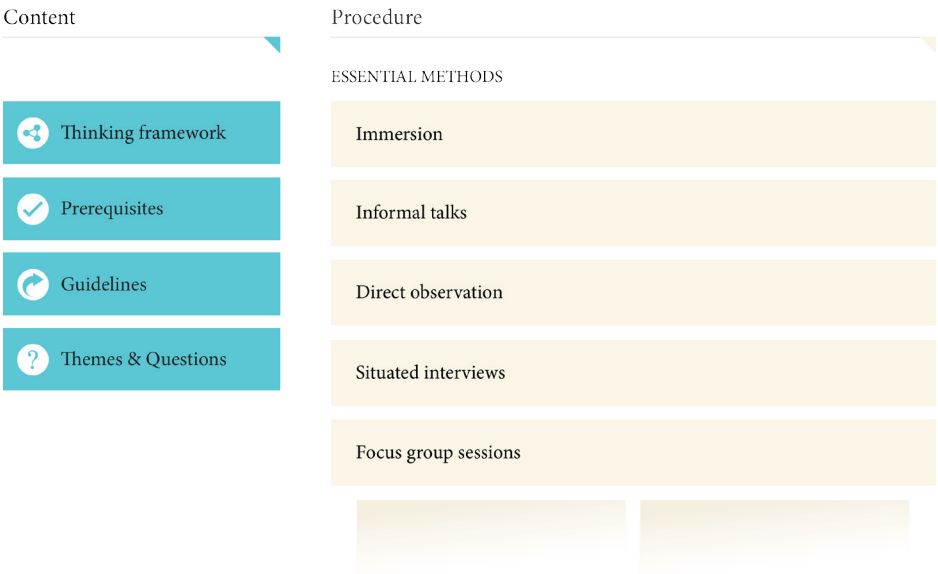


Figure 5-3: Essential methods of Capability Driven Design as part of the total approach

5.3.2 Immersion, direct observation and informal talks

Martin and Hanington (2012, p. 120) describe observation as *"attentive looking and systematic recording of phenomena – including people, artifacts, environments, events, behaviors and interactions"*. By observing people, designers can find out what people do, think and feel

(Smart and Whiting 2001; IDEO 2008a; d.School 2013; FrogDesign 2012). By observing people, the intangible meaning of their experiences can be captured (d.School 2013). Seeing what happens in 'real life' helps to understand phenomena, variables and interrelations (Van Boeijen et al. 2013). Observations can be interspersed with discussion and listening. Informal talks stimulate engagement and empathy-building (d.School 2013). Narayanasamy (2013) notes that, for the purpose of data collection, observation should be done in a proper setting. Observation of and talking to potential users can best be done where these users live, work and socialise (IDEO 2008b), in other words, by immersion into their life-worlds.

Immersion

It is important to build rapport with potential users before conducting interviews or other activities. A good relationship creates trust and results in a more thorough understanding of the people (IDEO 2008b; d.School 2013; Martin and Hanington 2012). In their own environments, participants are more at ease and enthusiastic about sharing their space and artefacts (Martin and Hanington 2012). By immersion, the differences between what people say and do can be better observed and understood, leading to insight in what people think and feel, beyond what people say (IDEO 2008b). Immersion leads to the formation of 'informed intuition' which aids the designer to take on the participants' perspective during the design process (IDEO 2008b). Immersion thereby shows commitment and interest and generally results in better relationships and improved understanding of needs, barriers, constraints, plans and hopes for the future (IDEO 2008b). Rapport should preferably be built early in the process as it takes time (Handwerker 2001; Narayanasamy 2013; Chambers 2004). However, with the right behaviour and attitude (see §3.2.4) the process of building rapport can be speeded up (Chambers 2004; Narayanasamy 2013), and by getting to know the potential users and building trust and empathy, people will be more willing to participate, to open-up and to share stories. Handwerker (2001) argues that personal interest, sensitivity and creativity are more likely to make people feel comfortable with them. Researchers with a deep and personal interest build empathy and discover opportunities they would otherwise have missed (Liedtka 2011). The attitude and behaviour of the researchers are important, as they influence the insights obtained and the rapport being built (Chambers 2004). However, it is possible that the participants do not like the researcher, or vice versa (Handwerker 2001).

Informal talks

Informal talks are *"short, intercept encounters"* which aid in uncovering needs, beliefs, values and emotions (d.School 2013, p. 2). By showing a deep and personal interest in the potential users, unarticulated needs can be discovered (Liedtka 2011). According to Handwerker (2001) informal talks or interviews are important, as valuable insights arise from casual conversations during which participants are free to gossip. This type of interview can aid in directing the research focus and deepen insights into sensitive topics (Narayanasamy 2013). According to Handwerker (2001), the best insights come from 'controlled gossip'. Active listening, probing, verbal and nonverbal encouragement, asking for clarifications, communicating empathy and 'sharing yourself' help to provide access to gossip (Handwerker 2001). Handwerker (2001) suggests designing these informal talks up front to guide the

collection of the required understanding. The combination of informal talks and observation leads to a *"rich description of life"* at minimum cost (Narayanasamy 2013, p. 15). Informal talks, however, reach only a few people and do not provide insights into the significance of information (Handwerker 2001). The results thereby depend heavily on the skills of the researcher (Martin and Hanington 2012).

Observation

According to Narayanasamy (2013), direct observation is widely used in PRA, as it is a flexible method leading to rich insights. There are different types of observation methods varying in structure and intrusiveness. These are explained below, after which the choice for selecting semi-structured, marginal participant observations is described. Martin and Hanington (2012) argue that it depends on the purpose and the situation which observation type is most relevant. Limitations of observation are that it takes time, is sensitive to researcher bias, and researchers might oversimplify or distort observations (Narayanasamy 2013). Thereby, being present might affect the behaviour of the people under observation (Narayanasamy 2013; Martin and Hanington 2012; Van Boeijen et al. 2013). Moreover, observation of people does not lead to understanding their motives for doing the things they do, and it does not reveal information about past events or activities (Narayanasamy 2013).

Structure

Observations can be semi-structured or structured. During structured observation, forms are used to codify observations. This type of observation is often used to deepen insights into specific behaviour or environments (Martin and Hanington 2012). There is an opportunity for quantification if the observational sample is large enough (Martin and Hanington 2012). The risk is that researchers 'find what they are looking for' or force certain information into the pre-set categories. Semi-structured observation is conducted with a set of questions in mind which are used as guidance, but the observation is conducted with an open mind allowing for deviations (Martin and Hanington 2012). Semi-structured observations are conducted to collect baseline information in order to guide inspiration, but can also be used to uncover themes and patterns (Martin and Hanington 2012). Martin and Hanington (2012) indicate that, for exploratory purposes, semi-structured observations are suitable and that thereafter structured observation can be used to deepen the obtained insights (Martin and Hanington 2012).

Intrusiveness

Observations can be conducted in an unobtrusive or intensive manner. Unobtrusive observation, also called 'fly-on-the-wall' observation, means that the researcher does not directly participates in or interfere with the group or culture being observed (Martin and Hanington 2012). It is used to limit bias and any influence on the behaviour of the observed group, but it also limits the forming of deep connections and building of empathy (Martin and Hanington 2012). Researchers can act as distant observers, where participants do not know they are being observed (Martin and Hanington 2012) or can be 'recognised outsiders' where participants are aware of being observed, possibly influencing their behaviour (Martin

and Hanington 2012; Van Boeijen et al. 2013). When conducting unobtrusive observation, researchers must consider ethical guidelines (Van Boeijen et al. 2013). Intensive participant observation means that the observer actively participates in the community, resulting in deep connections and empathy-building (Martin and Hanington 2012). According to Sperschneider and Bagger (2003), participant observation means the researcher acts as both an insider and outsider, engages in activities, hangs around, and talks to people in order to observe activities, people and physical aspects. Participant observation allows for *"forming deep connections and empathy with the people and the things that are important to them"* (Martin and Hanington 2012, p. 124). A distinction is made between marginal and full participants. In the former, the researcher blends in as a natural observer, in the second, the researcher becomes a full member of a group or culture.

Selecting observation method for CDD

As the aim of CDD is to explore the user context, semi-structured observation is considered to be the most suitable form of observation. Thereby, direct participant observation aids in building empathy and forming deep connections with potential users, and is easy to combine with immersion and informal talks. Becoming a full member of a group or culture takes up too much time, therefore, semi-structured marginal participant observation has been selected as part of the CDD approach (see figure 5-4).

5.3.3 Interviews

Narayanasamy (2013, p. 291-2) defines interviewing as "*a two-way systematic conversation between an investigator and an informant, initiated for obtaining information relevant to a specific study.*" Narayanasamy (2013) stresses that interviewing means dialogue. Prahalad and Ramaswamy (2004, p. 6) describe dialogue as not only comprising listening, but as *"shared learning and communication between two equal problem solvers"*. Martin and Hanington (2012) argue that it depends on the purpose which interview type is most relevant. The benefits and limitations of interviews are summed up, and different interview structures and types are presented in the next section. Thereafter the choice for selecting individual semi-structured interviews is explained.

Benefits and limitations of interviews

Good dialogue does not only provide insights for the researcher, but also for the participants, who might not always be aware of all the values and thoughts they hold (d.School 2013). Interviewing is a useful way of obtaining deep user insights and broad understanding (IDEO 2008b; Larsen and Flensborg 2011; Van Boeijen et al. 2013), as it reveals the specific situations that the participants are in. It is also a good way of bringing about information on multifaceted and sensitive topics (Barriball and While 1994; Hannabuss 1996). Narayanasamy (2013) argues that good interviewing leads to dialogue where participants share their perceptions, opinions, recommendations and ideas, leading to insights about problems, customs, practices, systems, attitudes, values, beliefs, past experiences, existing situations and future intentions. It also reveals how people think, act and perceive things (Narayanasamy 2013). Interviews help to understand people's behaviour, choices, thoughts, emotions and motivations (d.School

2013). Good interviewing leads to a lively dialogue resulting in accurate, true, authentic and relevant insights (Narayanasamy 2013). During an interview, not only should attention be paid to the things heard, but also to the things seen, felt, smelled and tasted (IDEO 2008a). In §3.2.4, a list of specific things to pay attention to has been described (see also Appendix C).

Qualitative interviewing has certain limitations. It takes time (Hannabuss 1996), especially when using a translator (Kapborg and Berterö 2002). Not only does the interview itself take time, relationship building prior to the interview does as well (Kapborg and Berterö 2002). Consequently, the obtained data is often derived from a small population sample, and therefore not generalizable (Britten 1995; Hannabuss 1996; Mendoza and Morén-Alegret 2013; Pelto 2013; Hanington 2010; Newell et al. 2011; Smart and Whiting 2001; Viitanen 2011). Moreover, it might be difficult for participants to express tacit and implicit knowledge; what people say is not always what they do (Kujala 2003; Smart and Whiting 2002; Van Boeijen et al. 2013; Van der Veer 2008; IDEO 2008b), nor may they express details (Beyer, Holtzblatt, and Baker 2004; Martin and Hanington 2012), their innermost feelings, thoughts and desires (Martin and Hanington 2012). The outcomes might not accurately reflect reality (Martin and Hanington 2012). Finally, it results in large amounts of data (Kujala 2003; Oulasvirta, Kurvinen, and Kankainen 2003) which is generally *"complex, discursive, and difficult to organize*" (Hannabuss 1996, p. 27) and thus complicated and time-consuming to analyse (Handwerker 2001; Kies, Williges, and Rosson 1998; Martin and Hanington 2012).

Interview structure

Interviews can be conducted in an informal, semi-structured or structured way. These three types are elucidated here.

- Informal interviews. Informal interviews are conversations where the researcher provides minimal guidance, creating a permissive ambiance (Narayanasamy 2013). They are conversational and comfortable for participants (Martin and Hanington 2012). The interview provides information about the participants' understanding and view of the world (Handwerker 2001). This type of interview is selected for use in combination with immersion and observation in order to build empathy, rapport and understanding when starting the fieldwork.
- Semi-structured interviews. Semi-structured interviews are open-ended conversations, but researchers keep a checklist of topics and questions in mind, or bring one along as a guidance (Narayanasamy 2013; Chambers 2004). This type of interview provides deep and varied insight in existing knowledge, attitudes, perceptions, needs and experiences of people, their contexts and existing networks (Larsen and Flensborg 2011). They can be used to obtain quantitative as well as quantitative data (Narayanasamy 2013). *"This type of interview is free from inflexibility of formal methods, yet gives the interview a set form and ensures adequate coverage of all topics"* (Narayanasamy 2013, p. 292). Limitations are that researchers are likely to make mistakes (Narayanasamy 2013) and that only a few people are reached, resulting in non-generalizable data (Handwerker 2001).
- Structured, formal interviews. Structured interviews are focused, and are conducted using a detailed and standardised interview schedule (Narayanasamy 2013). During each interview, all the questions listed are posed, and they are asked in exactly the same way

(Narayanasamy 2013). This type of interview is suited to collect generalizable data from a diverse and large set of people, providing insight in the significance of the information (Handwerker 2001). Time and questions are easier to control, researchers have less influence on the outcomes, and the data is easier to analyse (Martin and Hanington 2012). However, participants can perceive the interview as being formal and impersonal (Martin and Hanington 2012), and there is a risk that researchers miss out on information they are not specifically looking for or does not fit their pre-set categories.

Martin and Hanington (2012) indicate that, for exploratory purposes, the flexibility of more unstructured interviews is suitable. Handwerker (2001) points out that for exploring cultural variables and cultural variation, semi-structured interviews are useful. Semi-structured interviews are commonly used in Participatory Rural Appraisal (PRA), as they encourage conversation but also provide control and structure (Narayanasamy 2013; Chambers 2004). Semi-structured interviews can also be used to deepen specific topics and issues (Handwerker 2001). According to Handwerker (2001), structured interviews can best be used after conducting informal and/or semi-structured interviews in order to verify preliminary answers and to make comparisons between participants.

Participants

Interviews can include potential users, stakeholders or experts. This thesis is about insight in potential users, so these are the participants in this study. They can be interviewed individually, in couples or in strategic groups. According to Narayanasamy (2013), individual interviews are apt for revealing specific, sensitive, confidential and / or personal information, resulting in representative information. IDEO (2008b, p. 28) argue that *"individual interviews are critical to most design research, since they enable a deep and rich view into the behaviors, reasoning, and lives of people."* Group and couple interviews are more efficient and lead to more natural dialogue (Martin and Hanington 2012), and they can be focused on more specific topics (Narayanasamy 2013). IDEO (2008b) explain that group interviews result in quick learning about the life, dynamics and issues of a community, and they offer all community members a voice. However, a group interview does not result in deep understanding of thoughts, beliefs or behaviours of people (IDEO 2008b), as in groups, personal information is often more difficult to discuss (Narayanasamy 2013). Thereby, participants might influence each other and there is a risk of domination (Martin and Hanington 2012).

Selecting interview method for CDD

As the aim of CDD is to explore the user context, semi-structured interviewing is considered to be the most suitable observation structure. It encourages conversation while providing control and structure. Individual interviews are more likely to result in deep understanding of thoughts, beliefs and behaviours than group interviews. Therefore, individual, semi-structured interviewing has been selected to be part of the CDD approach (see figure 5-4).

5.3.4 Focus group sessions

Focus group sessions use group interaction to collect contextual information (Narayanasamy 2013) and provide deep insight into participants' opinions, feelings, and attitudes (Martin

and Hanington 2012). A prerequisite for good outcomes is facilitation by a skilled moderator, which stimulates participants to share *"experiences, stories, memories, perceptions, wants / needs, and fantasies"* (Martin and Hanington 2012, p. 92). Focus group sessions provide deeper insight into specific topics, and shared constructs of participants (Martin and Hanington 2012). According to Narayanasamy (2013) focus group sessions are useful to further investigate behaviour and motivations, and the outcomes allow for understanding and explaining empirical phenomena. The outcomes of focus group sessions cannot be generalized for the entire populations (Martin and Hanington 2012), but result in deeper insight into a larger group of people. Focus group sessions in the CDD approach will be used to verify insights and interpretations (see figure 5-4).

Van Boeijen et al. (2013) advise conducting at least three sessions with six to eight participants in order to obtain data that can be generalized to some extent. Focus group sessions should start with an introduction that creates an *"open and informal setting"* and result in detection of the more active and passive participants (Larsen and Flensborg 2011, p. 57). The moderator plays an important role and should try to involve passive participants, and motivate participants to share thoughts and opinions (Larsen and Flensborg 2011). If a translator is used during the session, the outcomes not only depend on the skills of the moderator, but also on those of the translator (Larsen and Flensborg 2011).

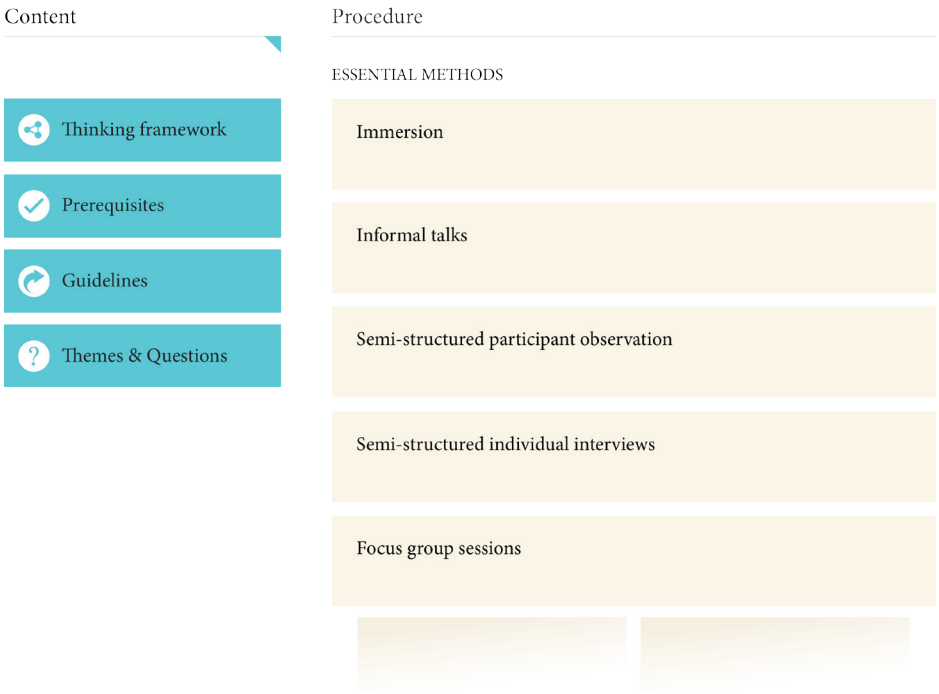


Figure 5-4: The essential methods of Capability Driven Design are further specified

5.3.5 Add-on methods for Capability Driven Design

In addition to semi-structured participant observation and individual semi-structured interviewing, structured observation and structured interviews can be used to deepen observations and verify answers. Group interviews can be conducted to obtain more focused information on specific topics from a larger group of participants. Moreover, self-reporting, shadowing, homestay, learning by doing, and participatory workshops can be added to the basic set of methods. All, or a selection of these methods, can be made and used, depending on the design team's available time and resources and the situation in the field. If time and resources allow for more fieldwork or more insight is required, more methods can be selected to obtain a more comprehensive and deeper insight.

Nine add-on methods have been selected and are visualised in figure 5-5. For a detailed description of these methods, see Appendix G. The nine add-on methods are:

- Shadowing. Observation during which a specific participant is followed throughout his or her daily routine without interrupting this routine (Sperschneider and Bagger 2003; Martin and Hanington 2012). Aids in understanding participant's actions, routines and decision patterns (Martin and Hanington 2012);
- Homestay. Immersion method during which designers stay a few nights with participants in their homes, resulting in improved understanding and empathy (IDEO 2008b). The focus is on building trust and rapport (Simanis and Hart 2008; Larsen and Flensborg 2011). Insights might be limited when participants treat the researcher as a guest (IDEO 2008b). The attitude and behaviour of the researchers influence the insights obtained and the rapport being build (Chambers 2004), as well as the extent to which participants and researchers like each other (Handwerker 2001);
- Learning by doing. Immersion method during which designers work alongside participants to experience their daily activities, to accelerate the process of building rapport and improve understanding (IDEO 2008b). Obstacles are that the researcher might endanger the work, might experience the activities differently (Larsen and Flensborg 2011), or might create an extra burden (Simanis and Hart 2008). The results are influenced by the attitude and behaviour of the researchers (Chambers 2004), and by the extent to which participants and researchers like each other (Handwerker 2001);
- Self-reporting. Participants are provided means to report about their daily lives (Van Boeijen et al. 2013). Designers obtain insights about users, their behaviour and priorities, without being present, that would otherwise not emerge (Larsen and Flensborg 2011; Martin and Hanington 2012). Disadvantages are that self-reporting cannot be used to validate results, to provide answers to specific questions, and does not explain reasons behind the things documented (Van Boeijen et al. 2013). Participants might not complete the assignments (Van Boeijen et al. 2013; IDEO 2008b) or misuse the materials for different purposes (Larsen and Flensborg 2011). The outcomes depend on the open-mindedness of the team (Van Boeijen et al. 2013) and are unstructured (Roibás 2008);
- Semi-structured group interviews. Open-ended conversation with a group of selected participants, with a checklist of topics and questions kept in mind (Narayanasamy 2013; Chambers 2004). It provides deep insight in existing knowledge, attitudes, perceptions,

needs and experiences of participants, their contexts and networks (Larsen and Flensborg 2011). Outcomes depend on the designers' skills (Narayanasamy 2013), and only a few people are reached, resulting in non-generalizable data (Handwerker 2001);

- Participatory workshops. Several participants and designers conduct activities together that enable designers to understand the participants' world (Martin and Hanington 2012), and to build a shared language (Simanis and Hart 2008). The workshops might take a lot of time and effort to prepare and conduct (Martin and Hanington 2012), it might be difficult for participants to share personal information in a group (Narayanasamy 2013), and participants might influence each other (Martin and Hanington 2012);
- Structured observation. Observation method using forms to codify the observations. Often used to deepen insights into specific behaviour or environments (Martin and Hanington 2012). There is an opportunity for quantification if the observational sample is large enough (Martin and Hanington 2012). The risk is that researchers 'find what they

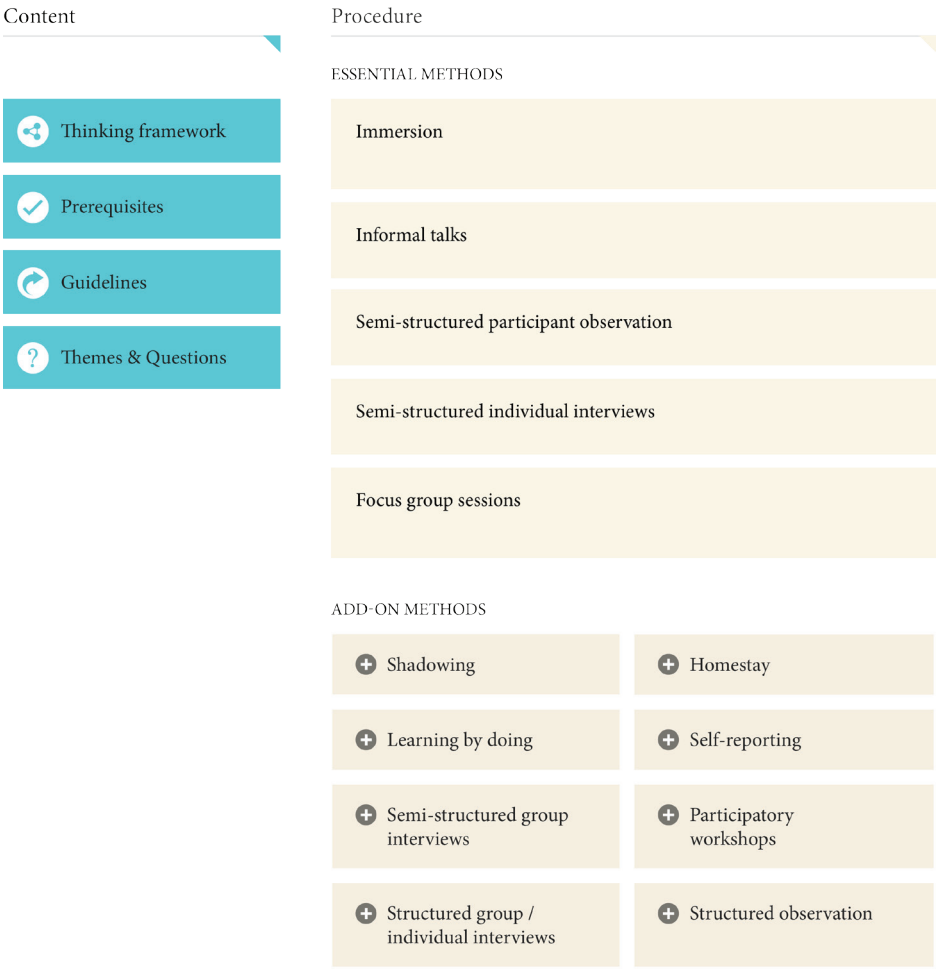


Figure 5-5: 'Add-on' methods of Capability Driven Design as part of the total approach

are looking for' or force certain information into the pre-set categories;
- Structured group interview. Focused conversation with a group of participants, using a detailed and standardised interview schedule (Narayanasamy 2013). Useful to collect generalizable data from a diverse and large set of people, providing insight in the significance of the insights (Handwerker 2001). Time and questions can be controlled, designers' influence on the outcomes is limited, and outcomes are easy to analyse (Martin and Hanington 2012). However, participants can perceive the interview as being formal and impersonal (Martin and Hanington 2012), and there is a risk that researchers miss out on information they are not specifically looking for or does not fit their pre-set categories;
- Structured individual interview. As the structured group interview, but with individual participants instead of with a group.

5.3.6 Conclusions and next steps

Immersion, informal talks, semi-structured participant observation and semi-structured individual interviews have been selected as the essential methods that have to be executed when obtaining deep user insight with limited time and resources. They allow for building rapport, empathy and enable a proper understanding of participants' well-being. Nine add-on methods have been identified which can complement this 'essential set' if time and resources allow or when it is required to obtain more insights. As a next step, a procedure will be developed for the set of essential methods, based on the literature study presented in §3.2.

5.4 Capability Driven Design: Basic procedure

In the conceptual framework (see §4.1), three steps are presented for guiding product designers to obtain comprehensive user insight. These steps are:

1. Preparation and planning before entering the field;
2. Obtaining insight in the field in an iterative way;
3. Reflection and sharing outcomes in a larger group.

Based on the 'essential set' of methods, the second step can be divided into 'obtaining informal insight and building rapport' and in 'obtaining deep insight'. This divisions results in four steps which together constitute the basis of 'Capability Driven Design' (CDD) (see figure 5-6). The add-on methods can supplement this basis, resulting in additional sub-steps. The four steps comprising the CDD basis are described below. The information which forms this basis is derived from the literature study presented in §3.1.4, §3.2.4 and §3.2.5.

5.4.1 Capability Driven Design step 1: Preparation

Before entering the field, several steps need to be taken to ensure comprehensive and efficient user context research: 1) local partnerships must be established; 2) the team must be prepared and trained; 3) the team must select and prepare methods and materials; and 4) activities must be planned.

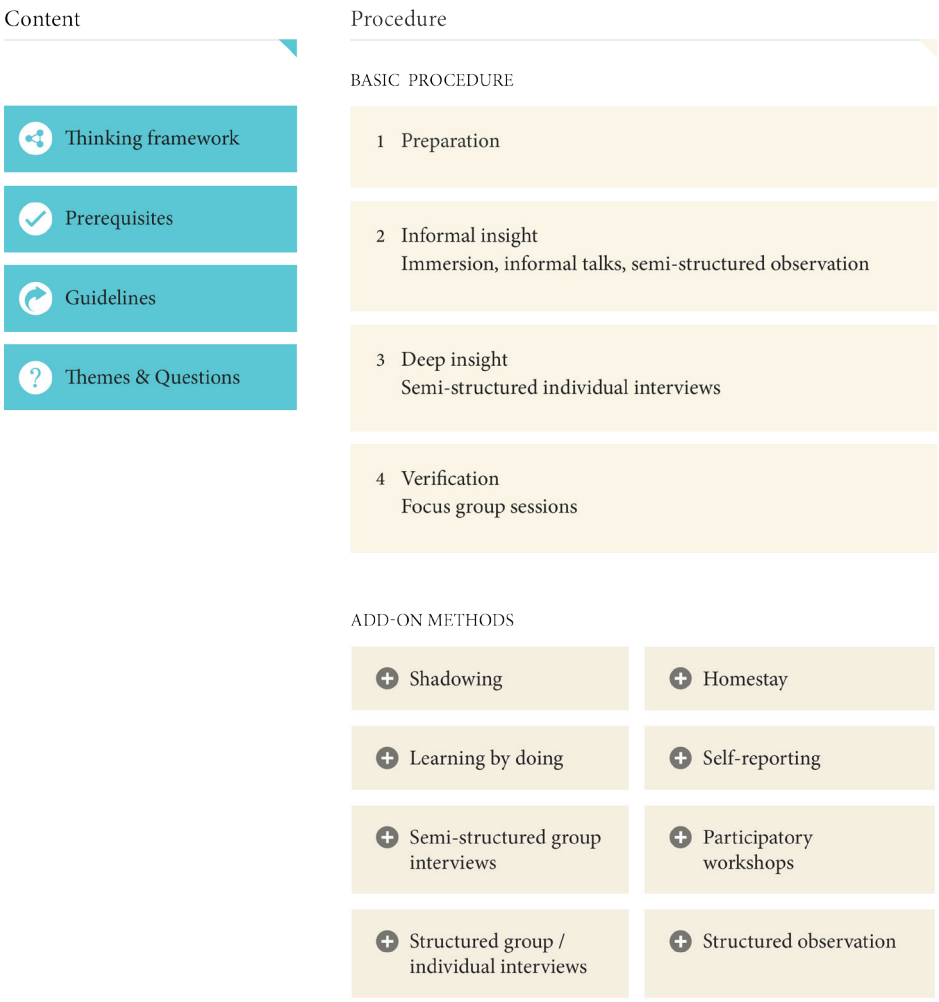


Figure 5-6: Basic procedure of Capability Driven Design as part of the total approach

Step 1-a: Establishing local partnerships

It is important to build relationships with governmental and non-profit organisations in order to obtain knowledge and information about the potential users, to get advice on the planned activities, to acclimatise quickly, to build trust and relationships in communities, to gain access, and to make arrangements to start learning.

Step 1-b: Team preparation and training

By attuning work practices and building a creative project space, a collaborative working spirit and an inspirational working environment are created. It is relevant to draw on existing knowledge from team members, literature and local partners. By deciding on a project's focus and goals, an appropriate approach can be chosen. The team should prepare themselves for

a possibly overwhelming experience, and preferably follow a qualitative research training course, or at least learn about what qualitative research entails, what an appropriate and ethical attitude and behaviour is, and how questions should be posed. In §3.2.4 a list of recommendations for researchers' behaviour and attitude has been presented, as well as a list of recommendations for questioning. The team members must furthermore get acquainted with the flow and structure of the activities, as well as with the topics and key questions. This can be done by roleplaying the activities in the team.

Step 1-c: Methods and materials preparation

For the comprehensive context exploration as aimed for in this research, themes and guiding questions have been developed as part of the CDD approach. The themes help the design team to obtain a comprehensive view of people's well-being. These themes should be taken into account during each activity. The themes are of significant value during interviewing, as they can serve as discussion topics to guide a comprehensive and deep dialogue with potential target users, specifying which topics to discuss. In the field, not only user context research needs to be conducted, information from other stakeholders should also be obtained, as well as information about local materials and production processes, and information concerning possible business models. Therefore, the team must decide how much time they will spend on user context research. For CDD, an essential set of methods have been selected, but the research team can also add methods to this set. The materials for conducting the activities should be prepared, and all supplies for the activities should be collected. The design team should check the planned activities with established ethical criteria.

Step 1-d: Plan activities

In order to use the time in the field efficiently, it is advisable to plan activities, documenting and data analysis beforehand. No more than three intensive activities should be planned for one day, and sufficient time should be kept free for documentation, analysis and for unexpected events, appointments or activities.

5.4.2 Capability Driven Design step 2: Informal insight

When going to the field, the team should first obtain informal insights. This involves: 1) meeting local partners; 2) selecting a research area; 3) building rapport with potential users; and 4) sharing, analysing and interpreting obtained insights within the team.

Step 2-a: Meet local partners

When local partnerships have been established (one of the prerequisites!), it is important to meet them and explain the intentions of the fieldwork in order to create proper expectations. Local partners can aid in selecting a translator, in selecting the area of research, and in selecting participants. They can also introduce the team in the selected area, provide knowledge and information about potential users, and give advice on the planned activities.

Step 2-b: Select the research area

The area of investigation should be selected depending on the purpose of the research and

availability, while carefully considering any biases: the design team should collect data that represents problems and realities, and not fall back on quick and short visits to easy to reach locations, or locations where activities are already taking place, during seasons with convenient climate conditions.

Step 2-c: Emerge and build rapport by immersion, observation and informal talks

After proper preparation, it is time for the design team to go into the field to explore the users and their context. The first step is to become immersed in the context and meet people where they live, work and socialise. By observing them and informally talking to them, rapport and empathy can be built. It is important to get familiar with potential users and their surroundings prior to conducting interviews. If required, a translator should be brought along. It is important to bring all required supplies: e.g., cameras, voice-recorders, notebooks etc.. These observations and talks should be conducted carefully and systematically and be fully documented. First the team should determine what to observe. Here, the list of themes can be used as a checklist. In §3.2.4, a list of aspects is provided, in general this includes everything that is seen, heard, smelled, felt and tasted. For guidance, an observation form and / or a checklist can be prepared.

Step 2-d: Analyse, interpret and reflect with the team

After the observations, the data must be discussed between the observers and be reflected upon, analysed, communicated and discussed within the design team. In this way a better distinction can be made between factual behaviour and a designer's own speculations. The information obtained after each immersion activity can influence the next one. This information can also influence the next step: obtaining deep insight. The activity of obtaining informal insight should preferably be ended when not much new information comes up and sufficient rapport has been built.

5.4.3 Capability Driven Design step 3: Deep insight

After building initial rapport and obtaining informal insight, specific participants can be selected to obtain comprehensive and deep insights into their life-worlds. To be able to obtain deep insights the following steps should be followed: 1) test and adjust the activities in the local context; 2) prepare the semi-structured interview; 3) select a variety of participants; 4) engage in deep dialogue; 5) share, analyse and interpret the obtained insights within the team.

Step 3-a: Test and adjust activities locally

Before conducting semi-structured interviews, it is advisable to test the length and content of the interview and to adjust it to the context. The content and wordings can be discussed with a local partner to adapt them to the context. The local partner can also point out possible sensitivities. By conducting a local pilot, the length of the interview can be tested.

Step 3-b: Prepare the interview: instruct the translator, assign roles

If a translator is required, he / she has to be carefully selected and instructed. The translator must be aware of the goals of the research and the rules of the interview. By assigning roles

for each interview executed, the roles of the design team members who conduct the interview has to be clear to the participants and the translator.

Step 3-c: Select variety of participants and decide on time and place

Based on the selection criteria, established in accordance with the project goals, a variety of participants should be selected. The established local network (e.g., local partners, participants of observation and informal talks, village heads) can aid in selecting participants. A broad range of participants with different characteristics should be included. These characteristics can be, for example, gender, social class, income, religion, age, ethnicity, occupation, adoption speed, access to resources, and community. Variation in gender, social class, and age are especially important. It is also vital to be clear about compensation, in order to set the right expectations for participants. To minimize bias, the design team should focus on the selection criteria and search for participants within the full targeted population, not only for easily accessible or familiar community members. Once the participants have been selected, a time and place for conducting the interview can be arranged. Preferably, the interview should take place in participants' homes, with no audience.

Step 3-d: Engage in deep dialogue

Semi-structured interviewing is the main activity within CDD. The interviews can verify what has been observed, and interviewing can deepen and broaden the insights obtained by informal talks and observations. The list of recommendations for researchers' behaviour, attitude and questioning should be followed by the facilitator, and the list of aspects to pay attention to should be followed by the note-taker. It is important to have all the required supplies available: e.g., cameras, voice-recorders, notebooks. These interviews should be conducted carefully and systematically and be properly documented. It is important to address all the themes and researchers are advised to follow the established guiding questions, but also to remove or add questions in order to be able to follow-up on the unexpected.

Step 3-e: Analyse, interpret and reflect with the team

As soon as possible after each interview, the data must be discussed between the team members, in order to reflect on any challenges that arose during the interview. The challenges of user context exploration methods have already been described in §3.2.3, however, the specific method of interviewing can result in additional challenges, especially when using a translator. These challenges cannot all be undone, but should be considered during the interviews. The design team should pay attention to them, note them down if they occur, and account for their influence when judging the outcomes. These challenges are the following:

- Quality of the facilitator. The quality, validity and authenticity of the information obtained via interviews greatly depends on the quality of the facilitator and the way this person conducts the interview (Narayanasamy 2013). The following aspects influence the participant, data collection, and data analysis, and therefore the quality of the obtained information:
  - The facilitator's skills and behaviour (Britten 1995; Barriball and While 1994; Hannabuss 1996; Hermanns 2004; Barab et al. 2004; Chambers 2004; Kies, Williges,

and Rosson 1998; Nesset and Large 2004; Van Boeijen et al. 2013; Larsen and Flensborg 2011);
  - The facilitator's bias and subjectivity (Britten 1995; Hannabuss 1996; Handwerker 2001; Barab et al. 2004; Birkett 2010; d.School 2013; IDEO 2008b; Johansson and Messeter 2005; Kies, Williges, and Rosson 1998; Martin and Hanington 2012; Smart and Whiting 2001; Von der Lippe 2012; Narayanasamy 2013);
  - The facilitators' terminology (Narayanasamy 2013; Martin and Hanington 2012; Handwerker 2001).
- Presence and goals of the design team:
  - The team members' presence and characteristics - such as class, ethnicity, gender and social distance (Britten 1995);
  - The design team's agenda and perspective (Barab et al. 2004; Beyer and Holtzblatt 1995).
- The participant. The following aspects affect the interview and its outcomes:
  - The participant's character: talkative or shy (Hannabuss 1996), having stage fright (Britten 1995) or lack of confidence (Kujala 2003);
  - The participant's motivation and interest (Barriball and While 1994; Knox and Burkard 2009; Handwerker 2001);
  - The participant's well-being, feelings and emotions (Knox and Burkard 2009; Handwerker 2001);
  - The participant's etiquette (Handwerker 2001), which might lead to socially desirable answering (Barriball and While 1994; Britten 1995; Hannabuss 1996; Kapborg and Berterö 2002);
  - The participant's availability (Hannabuss 1996; Handwerker 2001; Simanis and Hart 2008; FrogDesign 2012);
  - The participant's scepticism, distrust and suspicion (Hannabuss 1996; Simanis and Hart 2008);
  - The participant's prior experiences (Handwerker 2001);
  - The participant's cultural background and values (Knox and Burkard 2009).
- Audience present. The participant's answering might be influenced by the audience present during the interview (IDEO 2008b, 2008a; Larsen and Flensborg 2011) and by the setting of the interview, disturbances and distractions from outside (Britten 1995; Narayanasamy 2013; Handwerker 2001).
- The translator. If a translator is used, this person can also influence the outcomes (Larsen and Flensborg 2011):
  - The translator's interest in, and understanding of, the project influence the interview (Kapborg and Berterö 2002);
  - The translators' presence and characteristics - such as class, ethnicity, gender and social distance (Britten 1995);
  - The translator's biases and skills (Kapborg and Berterö 2002);
  - It is difficult to control the interview, as the interviewer does not exactly know if the translator adjusts the questions and / or answers (Kapborg and Berterö 2002) and there might be different interpretations of the terminology used (Kapborg and Berterö

2002; Britten 1995; Barriball and While 1994).

- Gatekeepers. If 'gatekeepers' are required to gain access to or approach participants, they also influence the results (Hannabuss 1996).
- Recording devices. Interview recording might limit people from speaking freely (Britten 1995; Hannabuss 1996).

In addition to reflecting on the above mentioned influences, the outcomes must immediately be analysed, communicated and discussed within the design team. Depending on the information obtained, the next interview can be adjusted to further explore anything surprising that arose.

5.4.4 Capability Driven Design step 4: Verifying insight

After obtaining informal and deep insight, the insights and interpretations need to be verified with participants and a larger group of potential users to improve data validity and generalizability. If the participants agree, the outcomes can also be shared with relevant stakeholders and other potential users. This improves data reliability and validity, and also leads to a feeling of joint ownership, transparency and involvement. Focus group sessions are selected to verify the obtained data. For the focus group session, many things are the same as for the interview: the session should be prepared, piloted, translator and participants should be selected, time and place must be decided upon, roles must be assigned, the activity has to be executed, and the outcomes discussed within the team and with the participants. The resulting information should be integrated in the design process and inspire designers. Therefore, the insights should be framed in a larger and future context. The insights can lead to design requirements, and can inform design decisions. However, the design decisions made should be checked with the potential users who should continuously be involved in the design process – following the CA and the spirit of human-centred design. It is also advisable to provide participants with a follow-up, as they have spent time and effort and shared their life stories with the researchers. Therefore, relationships with local partners and participants should be maintained, and they should be informed about the next steps and, where possible, be updated on the progress of the project at hand.

5.4.5 Capability Driven Design: Add-on methods

Above, the basic procedure for the CDD approach is specified in four steps. The add-on methods can be placed within these steps (see figure 5-7). The add-on methods for the different steps are the following:

- Step 2 'Informal Insight': shadowing, homestay, learning-by-doing and self-reporting. Designers can choose some of these methods to build additional rapport and understanding. These methods do not all have to be deployed, designers can choose the ones to use according to the available time and resources, their own preference, and the suitability of the method for the project and context.
- Step 3 'Deep Insight': semi-structured group interviews and participatory workshops. Designers can use those methods to obtain deep insight from groups of people. The group interviews and workshops are less suitable to discuss personal information and to go deep into every topic, but in a group also insight in social structures, issues and group

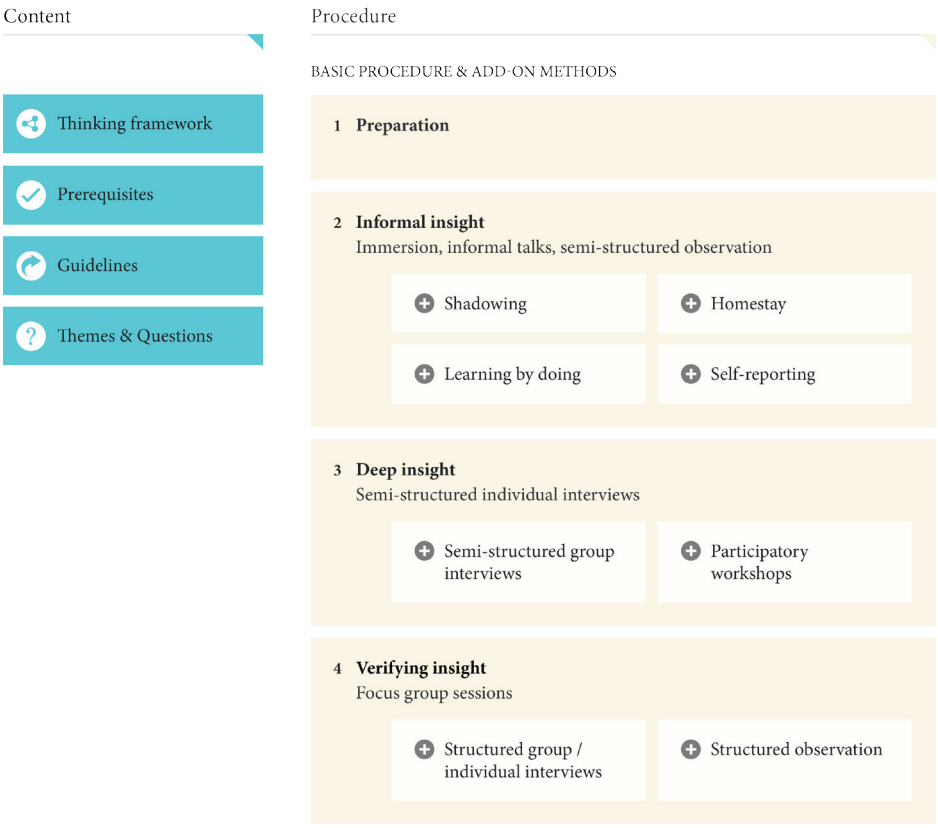


Figure 5-7: Capability Driven Design Approach

dynamics can be obtained, and a shared language can be build. The interviews are more focused on dialogue, the workshops more on conducting activities. Designers can choose either one of the methods, depending on available time and resources, own preference and their suitability for the project and context.

- Step 4 'Verifying Insight': structured interviews and structured observations. These can be used to deepen and verify the insights from step 2 and 3. Based on the information obtained during those former steps, an interview or observation schedule can be established and used to collect generalizable data from a more diverse and large set of participants. Again, designers can choose either one of the methods, depending on available time and resources, own preference and their suitability for the project and context.

5.5 Conclusions and next steps

In this chapter, a thinking framework, a set of themes and the guiding questions per theme have been proposed, forming the backbone of the CDD approach. An essential set of methods has been selected to serve as a basis for the CDD procedure. Conducting semi-structured

interviews is the foremost data-collection method within the CDD approach. This method needs most guidance in the field and it is particularly relevant to consider the themes and questions during the interviews. For these reasons, the intervention which has been developed focuses on conducting semi-structured interviews in order to obtain comprehensive and deep user insight in a designer-friendly and efficient manner. This intervention was called the 'Opportunity Detection Kit' (ODK) and its development is described in chapter 6. The ODK is part of the basic CDD procedure and not a stand-alone method for use by designers. It is a kit that helps the designer to obtain deep and comprehensive user insights in the field by means of semi-structured interviewing, using the backbone of CDD (see figure 5-8). In chapter 6 and 7, the ODK is developed and evaluated. As the backbone of the CDD approach is an important part of the ODK, by developing and evaluating this kit, the CDD thinking framework, prerequisites, themes and questions are also developed and improved upon.

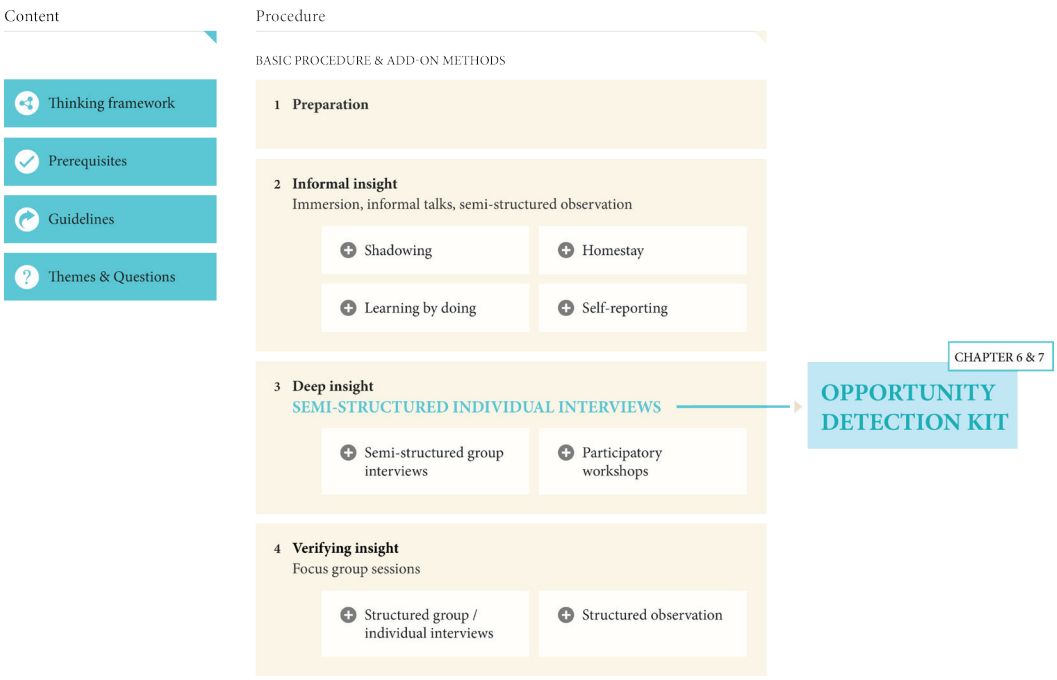


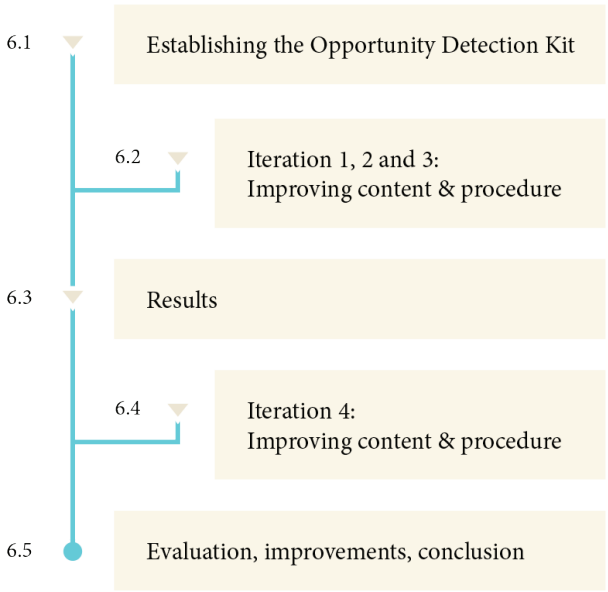
Figure 5-8: Capability Driven Design approach and the next step: development of step 3 (deep insight) into the Opportunity Detection Kit

CHAPTER 6

Developing the Opportunity Detection Kit

This chapter is partly based on: Mink, A., Van der Marel, F., Parmar, V., & Kandachar, P. (2014). Using the Capability Approach to Detect Design Opportunities. Paper presented at the Design for Sustainable Well-being and Empowerment, Bangalore, India. And on: Mink, A., Van der Marel, F., Parmar, V. S., & Kandachar, P. V. (2015). Approaching Design for Development from a Capability Perspective. Current Science, 109(9), 1639-1650.

In chapter 5, what has been written in the literature about the Capability Approach (CA), Rapid Ethnography (RE) and Product Design (PD) is translated into a 'Capability Driven Design' (CDD) approach, which includes a number of methods and techniques. Within the CDD approach, the method of conducting semi-structured interviews is essential for obtaining deep insight into the well-being of potential users. Conducting semi-structured interviews requires the most guidance in the field. Therefore, in this chapter the focus is on the development of a toolkit that guides product designers in obtaining comprehensive user insight by means of individual, semi-structured interviews. In §6.1, the concept of the Opportunity Detection Kit (ODK) is developed which has two parts: 1) the content (or: backbone) of the ODK, consisting of the CDD thinking framework, prerequisites, themes and questions and 2) the procedure of ODK, consisting of a set of methods, steps, guidelines, techniques and tools. In the following sections, the established ODK content and procedures have been improved by multiple iterations, using the formative evaluation methods described in the Design-Based Research (DBR) approach in chapter 4. In §6.2 two iterations are presented: a micro-evaluation and a micro-try-out. This resulted in a first set of changes to the ODK's techniques and tools, as well as to adjustments of the themes and questions. In §6.3 the improved version of the ODK is introduced, and it was considered necessary to conduct an additional iteration to further improve the ODK. Therefore, an extensive micro-try-out, a walkthrough and a consultation of experts were executed. The details and outcomes of this final iteration are reviewed in §6.4. Finally, in §6.5 the improvements made to the ODK as a consequence of this fourth iteration are described.



6.1 Establishing the Opportunity Detection Kit from literature

In this section a first version (prototype) of the Opportunity Detection Kit (ODK) is presented. The ODK is a proposed interview method to guide the designer to conduct semi-structured interviews efficiently, in order to obtain comprehensive and deep insight into people's well-being. As argued in the literature in chapter 3, it is important to detect information about changes in people's lives and their perceptions of change, in order to place the resulting information in context. Therefore, the ODK is meant to collect information about two points in time: the situation as it is now, and the situation some years before. A preliminary version has been derived from the literature, consisting of two parts (see figure 6-1):

- Content. In chapter 5, a CA-based thinking framework, prerequisites, themes and questions were established for the CDD approach. These form the backbone of CDD and therefore form an important part of the ODK;
- Procedure. The ODK offers steps, guidelines, techniques and tools, derived from the literature presented in chapter 3. They support the designer to conduct semi-structured interviews.

The ODK contents are presented in chapter 5. The determined techniques, tools, steps and guidelines are presented in this section.

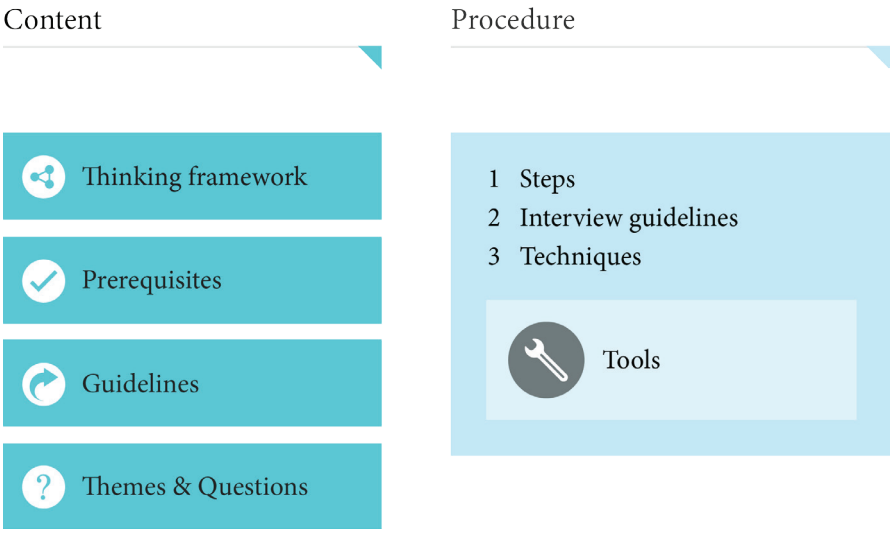


Figure 6-1: Elements of the Opportunity Detection Kit. Thinking framework, prerequisites, themes and questions from the CDD approach. Steps, guidelines, techniques and tools to be established from literature.

6.1.1 Selecting Opportunity Detection Kit procedure

Chapter 3 introduced different techniques and tools. For establishing the ODK procedure, some of these have been selected. Based on this selection and on the literature reviewed in chapter 3, the interview steps that need to be executed and the guidelines that designers are advised to follow have been established. The ODK procedure consists of 5 techniques, 3 tools, 13 steps and 9 guidelines; their selection and establishment are described below.

Selecting techniques

Chapter 3 introduced 19 techniques that suit the purpose of CDD. Five of these techniques have been selected to support the semi-structured interview:

- 'Observe and Ask' techniques: 'Touchstone Tour', 'Show Me' and 'Video / Photography Time Lapse'. The 'Touchstone Tour' and 'Show Me' were selected. As designers should preferably conduct interviews at the participants' homes or at places where they feel familiar, the environment, objects and tools present can be used as 'touchstones' for questions, leading to insight. A tour through the personal environment (e.g., home, work area) is an easy way to become acquainted with the participant, and the observations are good conversation starters. During the interview, designers can ask participants to show things they interact with ('Show Me' technique). The 'Video / Photography Time Lapse' technique takes too much time to combine with an interview, however it can be combined with different immersion activities.
- 'Creating' techniques: 'Drawing', 'Mapping', and 'Modelling'. The 'Drawing' and 'Mapping' techniques were selected. Participants can be attracted and actively engaged by creating things, e.g., mappings, drawings or models. In this way, they may be willing to share more during the interview, and by letting them create things, latent and tacit opportunities may also be detected. Letting participants create a simple map of their daily and weekly activities facilitates an easy start and aids in understanding local practices and people's lives. Making participants draw can result in deeper insights that cannot be easily expressed. If participants do not want to draw, the researchers can also draw for the participant. 'Modelling' was not selected, as this technique is more time and resource intensive, and difficult to combine with interviewing.
- 'Valuing' techniques: 'Scoring', 'Ranking', and 'Sorting'. The 'Scoring' technique was selected. Participants can be attracted and actively engaged by performing tasks, e.g., ranking, sorting and / or scoring. During 'Ranking' and 'Sorting', participants place elements in an order or in categories, comparing them to each other. The scoring task, however, provides the designer with insights in how participants value the different themes, independent from each other. A Likert scale from zero to seven was selected to explore how participants value each theme. Zero indicates 'not important' and seven 'very important'.
- 'Issue generating' techniques: 'Brainstorming', 'Bodystorming', and 'Brainwriting'. None of these techniques was selected as it is too time consuming to engage participants in a brainstorm, bodystorm or brainwrite activity for each theme. Thereby, the interviews should be engaging and interactive; as the interviews are conducted individually, these are techniques that stimulate the participant to individually think deeply about the different themes, reducing dialogue.
- 'Questioning' techniques: 'Five Why's', 'Directed Storytelling', 'Guided Speculation', 'What-if-scenarios', 'Sacrificial Concepts', 'Talking Diaries', and 'Thinking Aloud'. The designer can use all of these techniques during the interview to obtain deeper insight into the behaviour, aspirations, desires and reasoning of participants. Therefore, they have not been added as a specific technique, but are designated 'useful to consider'.

Selecting tools

Analysis of the literature presented in chapter 3, showed that activities in the field should be fun, attractive and simple for participants, in order to make them enjoy the activity, and to stimulate interest, motivation and dialogue. Thereby, creating things helps participants to share stories, experiences and insights about their lives. Tools have been developed for visualization, mapping and scoring in order to support the designer to stimulate dialogue and to make the activity engaging and interactive. These tools are: 1) a timeline; 2) drawing sheets, and 3) answering sheets.

Timeline

The timeline tool is presented in figure 6-2. It is a sheet of paper on which a line indicates the passing of time. On this sheet participants can draw what a day and a week in their life looks like. The timeline is meant to work as an icebreaker during the start of the interview, to provide starting points for discussion, and to give insights into daily activities and challenges.

Figure 6-2: Timeline for daily and weekly rituals

Drawing sheets

During the interview, the participants are encouraged to visualise their answers by drawing them. On a 'personal details' sheet (see figure 6-3), the participant can draw his or her own appearance and add personal information. This drawing sheet supports the designer during the introduction part of the interview. Four identical drawing sheets, as presented in figure 6-4, help participants to map their house, family, friends, and environmental context. By mapping and discussing these aspects of their lives, their community relations, networks, power structures, and perceptions of the community can be explored.

Answer sheets with scoring task

Finally, answer sheets were developed on which the participant or the researcher can note down the answers to the questions for two points in time (see figure 6-5). In order to obtain data about a participant's priorities, the participant has to indicate the importance on a scale from 0 to 7 for each theme, which the designer then notes on the answer sheet.

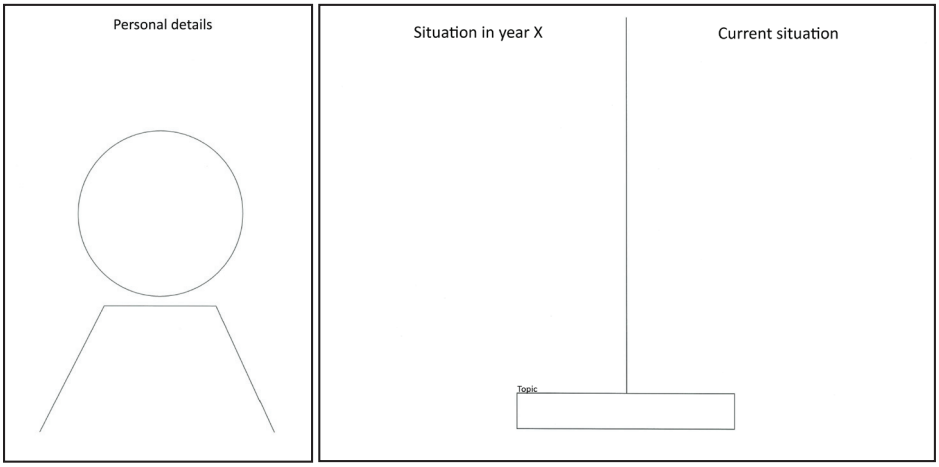


Figure 6-3: Drawing sheet 1 for personal details
Figure 6-4: Drawing sheet 2 for information about house, family, friends and context

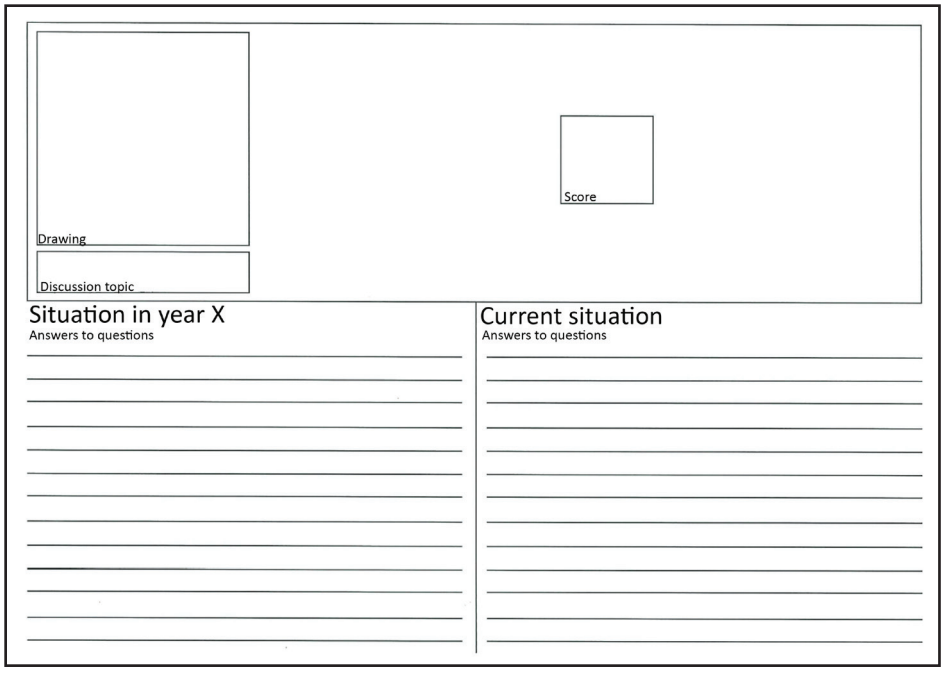


Figure 6-5: Answer sheet for information about the twelve different themes

Establishing steps

Following the above selected techniques and tools and the literature reviewed in chapter 3, in total 13 steps were decided on that need to be executed when conducting the semi-structured ODK interview. The first three steps need to be executed once, steps 4 to 13 should be repeated for each interview.

Prepare the interview:

1. Get familiar with the ODK. The team members must get acquainted with the interview flow and structure. This can be done by roleplaying the interview in the team, but also by conducting a local pilot in the field.
2. If required, select and instruct a translator. Share the goals of the research and explain the rules. It is wise to walk through all the themes and questions to get the translator acquainted with the interview flow and structure, the themes and key questions.
3. Select participants. A local partner can aid in selecting participants. See the guidelines.
4. Assign roles. Conduct the interview with at least two (a facilitator and a note taker / photographer) and a maximum of three researchers, and assign roles beforehand to clarify the purpose for each researcher.
5. Decide on time and place. Time and place of the interview should be convenient to the participants and preferably conducted in their local context.

Conduct the interview:

6. Introduce. Introduce the design project, the interview, the translator and yourselves. Participants should be informed about the research and its goals. It is important to be clear about the interview duration and compensation to set the right expectations for participants. Communicate openness and being non-threatening, stress that there are no wrong answers and that not all questions have to be answered. Make the participants feel relevant in their roles by sharing yourself, verbally or with help from pictures. Try to limit the influence of audience.
7. Ask for informed consent. Ask for consent to record the interview, to take pictures and to use the data. Stress that participants are not obliged to participate, and can withdraw from the activity at any time.
8. Ask for the participant's introduction. Asking participants to say something about themselves provides an easy start and shows interest.
9. Conduct a touchstone tour. Let the participant show you around in their home or the environment where the interview is conducted. Use the show me technique: let the participants show you objects, spaces and tools.
10. Sit down and…
    a. For the facilitator: …build dialogue. Start with personal details, continue with the timeline of a participant's day and week, and then start collecting answers for the themes and questions using the drawing/mapping sheets and the answer sheets.
    b. For the note-taker: …document. Record the interview, take notes and photographs.
11. Thank the participant. Thank participants for their invested time and effort and for sharing personal information. Bring a small gift to show appreciation.

Process the outcomes:

12. Document. Note down anything surprising directly after each interview.
13. Analyse, interpret and reflect with the team. Share all information with the full design team after each interview. Analyse, interpret and reflect on the insights with the full team, and use the outcomes during the following interviews.

Establishing ODK guidelines

In chapter 3, several guidelines, tips and tricks were distilled from the literature. These have been captured in the following four interview guidelines:

A. Flexible but focused conversations. The ODK provides steps, themes and guiding questions, but there is room for flexibility and unexpected turns in order to stimulate dialogue. There is no specific order indicated for addressing the themes. Questions should not be asked from a script, they can be added and changed. The interview should feel like an open-ended, dynamic conversation to make participants feel comfortable. It is important to continue dialogue regarding topics that seem to be of interest to the participant, and regarding surprising, idiosyncratic or contradictory responses or behaviour from the participant. It might be useful to hide the list of questions, to learn the key questions by heart or keep them out of sight. Some control over activity topics should be exerted.

B. Duration of interviews. As mentioned in chapter 5, the interview should be sufficiently long to make participants feel they are being heard, but should not continue too long resulting in participants becoming tired and disinterested. Different authors provide different guidelines for the duration of the interview. For individual interviews, Narayanasamy (2013) argues for a maximum of 45 minutes, Larsen and Flensborg (2011) for a maximum of 1 hour. Van Boeijen et al. (2013) state that interviews typically take 1 hour, and IDEO (2008) announce that in-context interviews often take more than 1.5 hours. Martin and Hanington (2012) and Smart and Whiting (2001, 2002) indicate that contextual interviews often take 2 to 3 hours, and Park (2011) even reports that her interviews took 3 to 4 hours. The ODK interview is scheduled to last approximately 1.5 hours, in order not to make the interview overly long, but to allow for sufficient dialogue to take place. The participants should be informed about the duration of the interview before agreeing to it. Activities should be ended when no questions are left, or when designers feel like delaying a participant.

C. Number of interviews. According to Van Boeijen et al. (2013), researchers can stop conducting interviews when no additional information is obtained. Martin and Hanington (2012) and Van Boeijen et al. (2013) both note that the number of people to be interviewed depends on the project scope and objective. Martin and Hanington (2012) note that multiple people with different characteristics should be interviewed. According to Handwerker (2001) information from a small number of informants (which he defines as 3 to 36) might result in good reliability and validity, depending on the level of agreement between the informants. The objective of the ODK interviews is to get to know people's available and valued beings and doings, and to become inspired. The main limitation will be the amount of time and resources available, but at least five interviews should be conducted to ensure some variety. This amount does not result in statistically relevant data, but this is also not the objective. The outcomes should, however, be verified in phase 4 with a larger group of potential users.

D. Consider using specific questioning techniques. These techniques are: 'Five Why's', 'Directed Storytelling', 'Guided Speculation', 'What-if-scenarios', 'Sacrificial Concepts', 'Talking Diaries', and 'Thinking Aloud'.

6.1.2 Overview and next steps

The ODK, as presented in figure 6-6, is based on the literature presented in chapters 2 and 3, and on the conceptual framework and the CDD approach developed in chapters 4 and 5. It constitutes the backbone of the CDD approach: a thinking framework, 10 prerequisites, 5 CDD guidelines and 12 themes with questions. This backbone forms the ODK's content. Thirteen steps, 4 interview guidelines, 4 techniques and 4 tools form the ODK's procedure. To further develop the ODK's content and procedure, the formative evaluation methods of the DBR approach, described in chapter 4, will be applied.

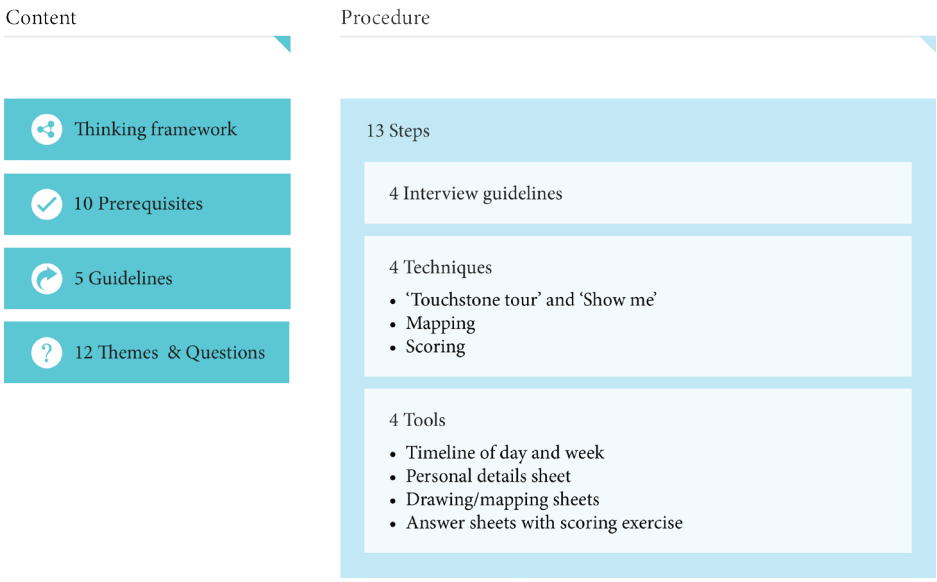


Figure 6-6: From literature to Opportunity Detection Kit 0.0

The ODK is developed further following several iterations, which are explained and described in §6.2 (iteration 1 and 2) and §6.4 (iteration 3). Each iteration led to adjustments of the ODK. The purpose of conducting these iterations was to further develop and refine the ODK. As can be seen in figure 6-7, different methods were deployed during the three iterations:

- Iteration 1 was a micro-evaluation. A small group of designers used the ODK outside its intended setting to test and refine the ODK's procedure.
- Iteration 2 was a micro-try-out. As the setting in this research is significant, a small group of designers used the ODK in its intended setting, to further test and refine the ODK's procedure.
- Iteration 3 was screening. During this iteration the ODK's content was checked by research team members who were not involved in developing the kit.
- Iteration 4 comprised three DBR methods. First, an extensive micro-try-out was held, where a small group of designers used the ODK extensively in its intended setting, to refine the ODK's procedure. Next, a walkthrough with designers and a consultation with DfD experts was conducted to refine the ODK's content. As the ODK has been developed

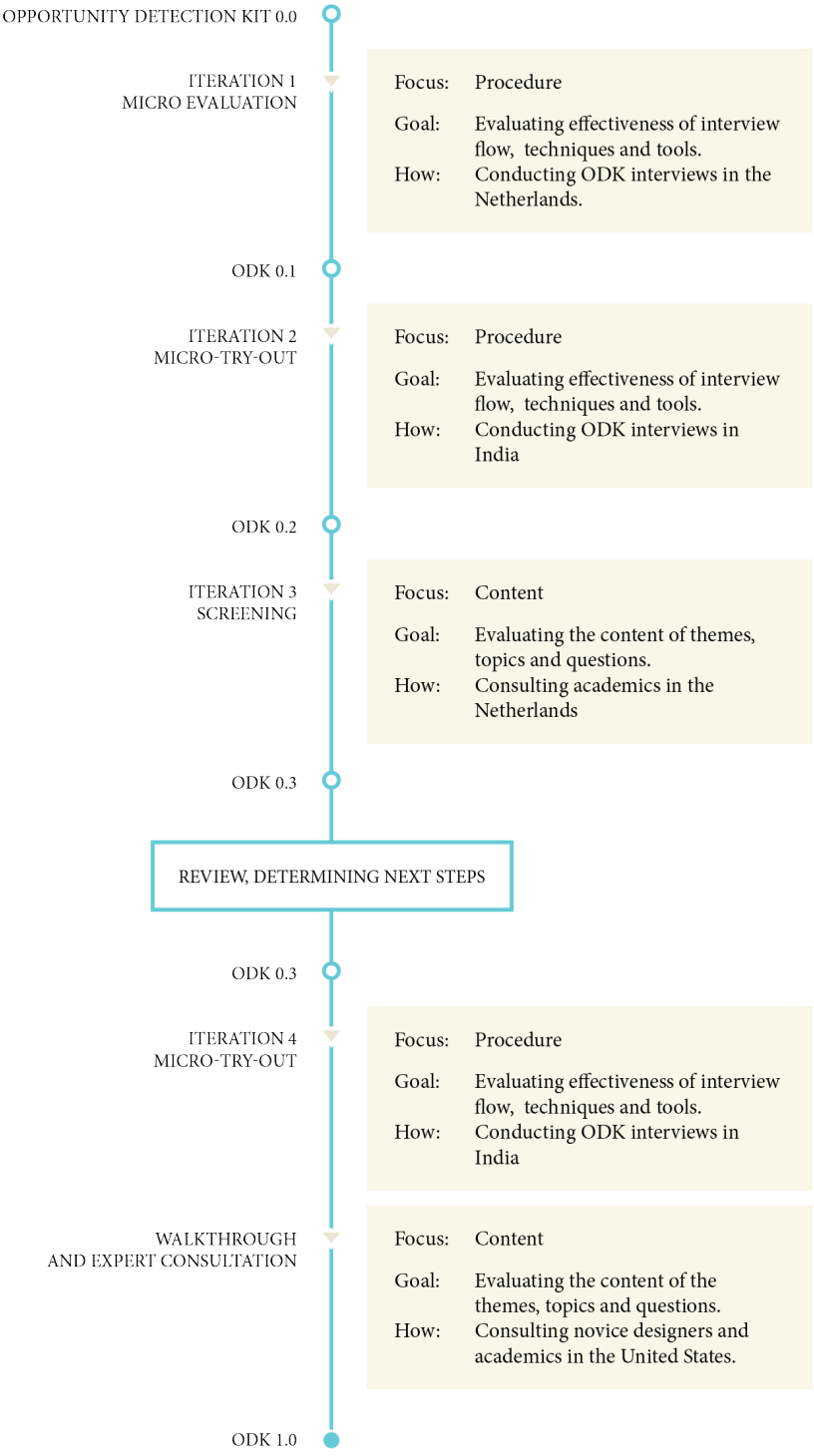


Figure 6-7: Prototyping the Opportunity Detection Kit

by a Dutch research team, the designers and experts included were from a different institution and country than the developers of the ODK, in order to prevent sticking to a specific worldview.

These four iterations resulted in the ODK 1.0.

6.2 Iteration 1, 2 and 3: Testing and refining the Opportunity Detection Kit

Three iterations resulted in a refined ODK. In this section it is described how these iterations were executed, what the outcomes were, and what changes to the ODK were made as a result of these iterations.

Focus

Both procedure and content of the ODK 0.0 were evaluated in order to test and refine the ODK:

- The ODK procedure was tested by designers using the ODK in the Netherlands (micro-evaluation) and in India (micro-try-out).
- The ODK content was checked by research team members (screening).

The outcomes of these three iterations are described below with respect to their specific focus (procedure or content). However, information obtained regarding the ODK's content during the micro-evaluation and micro-try-out, and regarding the ODK's procedure during screening, was also considered when improving the ODK. The full description of the results of all three iterations can be found in Appendix E1 to E3.

Limitations

The ODK procedure was tested by the same researchers developing the ODK, and not as was intended, by design teams in DfD projects. During this stage of development and refinement, the ODK was not yet ready to be deployed in DfD projects. The researchers therefore took on the role of designers. During the iterations, not all the prerequisites could be followed: the designers conducted some of the interviews individually, resulting in comparisons of interpretations, experiences and perceptions between interviews only, and not per interview. Moreover, the in-context interviews could not be conducted at participants' homes, making it difficult to evaluate the touchstone tour technique. Lastly, the ODK's content was tested by research team members who had prior knowledge of the ODK's first set of themes and questions.

6.2.1 Iteration 1: Micro-evaluation in the Netherlands

As a first evaluative step of the ODK a micro-evaluation was conducted: a small group of target users (designers) used the ODK in the Netherlands, mainly focusing on the interview flow (steps), the techniques and tools (see figure 6-8).

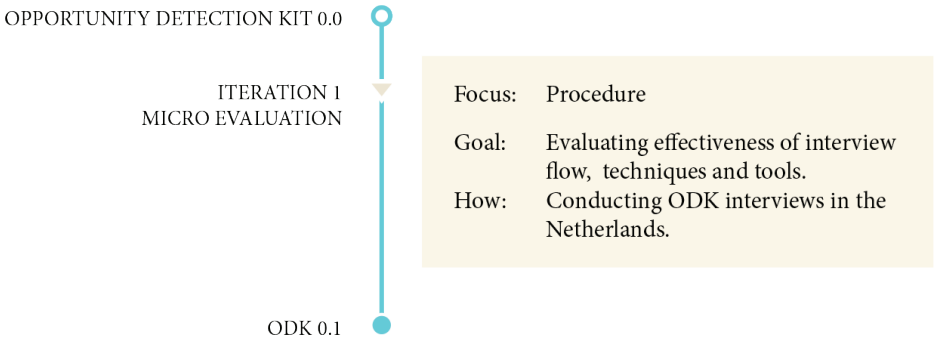


Figure 6-8: Iteration1 - micro-evaluation of the ODK's procedure

Evaluators of iteration 1

In this micro-evaluation, the lead researcher took on the role of designer and tested the ODK in the Netherlands with three Dutch participants. In addition to the lead researcher, industrial design engineering student Van der Marel (from here onwards called 'Researcher 1') took on the role of designer for this evaluative exercise. Researcher 1 was involved in developing the ODK as part of his Master graduation project.

Method of iteration 1

The aim of this micro-evaluation was to point out errors and to get a feeling for the adequacy of the themes, questions, techniques and tools used to obtain comprehensive user insights. The participants selected were people familiar to the designers to save time building rapport. The sessions were conducted in participants' homes at their convenience. Each session was conducted by one designer, so no roles had to be assigned. Before each session, the goals of the research and the interview were explained. The participants were asked to give consent for using the data in this research project, they were informed that the results would be used anonymously, that they did not have to answer all questions, and that they could withdraw from the study at any time.

The introduction of the participants was combined with the 'personal details' drawing sheet on which participants drew their appearance and noted their personal details. Subsequently, the participants were asked to fill in the timeline and the four mapping sheets regarding their 'Accommodation and Surroundings', 'Partner and Family', and 'Friends and Community'. Thereafter, questions were asked about the participant's situation regarding 'Health', 'Nutrition', 'Education', 'Meaningful Work', 'Leisure', 'Mobility', 'Self-determination', 'Safety and Security', and 'Products, Animals and Plants', for their current situation, as well as for their situation three years ago. They were also asked to give a score between 0 (indicating low importance) and 7 (indicating high importance) for each theme. After each session, the participants were asked to provide feedback on the flow, appeal and content of the interview. To end the interview, the participants were thanked for their time and effort. During and after each interview, the designers noted down anything surprising, and things that did and did not work out as anticipated. After each interview, the designers also shared and discussed

the information with each other. The notes, drawings and the participants' feedback were analysed to discover any errors and to improve the appeal and clarity of the ODK.

Interview characteristics of iteration 1

A miscellaneous set of participants were included; they varied in age, gender, place of residence and occupation. In total five participants were interviewed. Four participants drew themselves, one participant felt insecure about drawing and let the designer draw. In all five interviews, the themes and questions were all discussed, although the designers used their liberty not to pose all questions, and to combine or add questions.

Results of iteration 1

The issues noticed by the designers or indicated by the participants regarding the ODK procedure (steps, guidelines, techniques and tools) and the ODK's content (themes, topics and questions) are summarised (see Appendix E1 for a full overview of the results).

Interview flow and effectiveness

All steps could be followed without any issues. The average duration of the interviews was 2 hours and 15 minutes. Although the interviews took considerably longer than conveyed to the participants beforehand, and therefore consumed more of their time, none of the participants considered this to be a problem. The designers noticed that the longer participants had the time to reflect on themes and think about them, the more information was obtained. During the interviews, a good insight into the lives of the participants could be obtained by the designers. Three participants indicated that the interview gave them an interesting view on their own lives, and by looking at their lives in this way they gained insights in things they were satisfied and dissatisfied about, leading to willingness to change some of these (participant 1, 4 and 5).

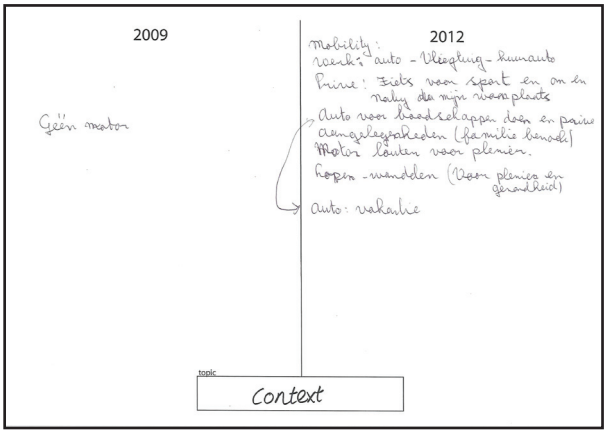
Procedure

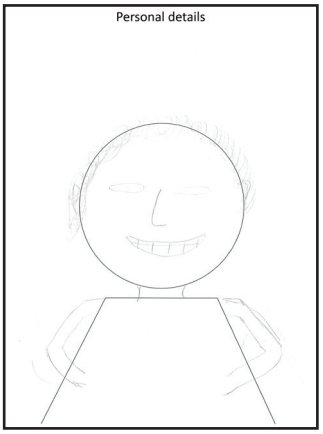
Two participants indicated to find the order of themes and questions somewhat random and did not know what to expect. The drawing and mapping encouraged participants to share information and to add more elements during the interview. It also provided them an overview of information. However, most participants felt insecure about what to draw and felt more comfortable writing (see figure 6-9 to 6-11). Thereby, if situations had not changed, the participants did not want to draw or write everything down again (figure 6-9). All participants had difficulty scoring the themes, as they found all of them important. Two participants therefore started ranking the themes (see figure 6-12). The designers were sometimes lost during the interview, but the drawing and mapping exercise helped them to keep an overview. The time-line was time-consuming and the answer sheets occupied a great deal of space (see figure 6-11 and 6-12). If the sheets were piled up to make space, it was more difficult for the designers to keep an overview.

Content

It was noticed that some themes were more time-consuming than others, that some questions

were not yet properly formulated - causing some confusion, that change was not always detected, and that some questions pre-defined participants' aspirations, which is not the intention.





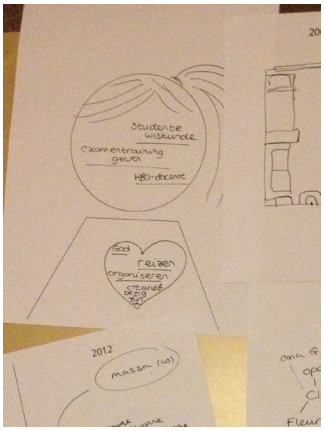


Figure 6-9: Participant writing instead of mapping, and describing the situation in 2009 by noting the changes
Figure 6-10 and 6-11: Participants' drawings and writing on the personal details sheet
Figure 6-12: Ranking the answer sheets

Conclusions of iteration 1

At the end of each interview, both the designer and the participant had obtained a comprehensive insight into the life of the participant. In general, the interview flow was good. However, some questions need improving, the scoring exercise appeared to be difficult to conduct and the number of answering sheets was somewhat overwhelming. It was sometimes difficult for both the designers and the participants to keep an overview of the interview. These aspects needed to be addressed.

Changes to the Opportunity Detection Kit resulting from iteration 1

Based on the feedback from the participants and the insights from the designers, several

changes were made to the guidelines (1 adjusted), techniques (1 changed), tools (all 3 changed), and questions (25 added, 13 adjusted). Based on this evaluation, no changes were made to the steps and themes. When a translator is required, the expectation is that the interview will take longer. Thereby, questions have been added to the interview, further extending the interview time. Therefore, the techniques and tools were critically reviewed and were made more efficient (see below) to consume less time. An overview of the changes can be seen in figure 6-16. An overview of the procedural changes can be found in Appendix C2, an overview of the changes in content can be found in Appendix D2.

Guidelines

Participants need to be properly informed before the interview about how much time the activity will take, before they give their consent. Participants can be compensated for their time, for example by providing food or compensation for expenses or time, and a gift can be provided. The interview time has now been set at 2 hours. If an interview takes longer, participants should be informed and asked for additional consent. The participants can be offered a compensation for continuing the interview. If the participant is not willing to continue longer, the interview should be concluded.

Techniques and tools

- Large answer sheet. Instead of multiple answer sheets, one large answer sheet was developed, as can be seen in figure 6-13. All themes are represented with a pictogram, and participants can draw and write their answers on the sheet. This sheet was developed to help visualise the interview structure for the participants, and to provide guidance to the designer, without taking up much space and consuming too much time. The pictograms used are kept as general and neutral as possible, in order to not direct participants into a certain direction, and to be able to apply the ODK to different contexts.

Figure 6-13: One large drawing sheet for all themes

- Question cards. For each theme cards with pictograms on the front and questions on the back were developed. These question cards are designed to aid the designer to keep track of the themes discussed. They may also help give the participants an idea of how far the interview has progressed. The question cards do not offer a rigid interview procedure, the cards can be presented in random order, and mainly offer an overview of the topics and the questions that can be used to start a conversation. The pictograms can be seen in figure 6-14 and an example of a question card can be seen in figure 6-15.

Figure 6-14: Pictograms for all themes. The pictograms represent the following themes (starting at the top, from left to right): 'Accommodation and Surroundings','Friends and Community', 'Products, Animals and Plants', 'Partner and Family', 'Nutrition', 'Mobility', 'Leisure', 'Meaningful Work', 'Education', 'Self-Determination', 'Safety and Security', and 'Health'

Meaningful Work

1. What are your day-to-day activities?
2. Do you like what you do?
3. Do you feel you are playing a useful part in your normal day-to-day activities?
4. To what extent do your day-to-day activities make use of your skills and talents?
5. Did anything change in the past years?

Figure 6-15: Front and back of question card for 'Meaningful Work'

- Introduction card instead of timeline. A 'question card' with introduction questions was developed to replace the time-consuming timeline. This introduction card is meant to warm up the participant for the actual questioning, and to obtain a view of the participant's social status.
- Ranking instead of scoring. As scoring was difficult for the participants, and two participants started ranking the themes towards each other, 'ranking' of the themes will be further investigated instead of 'scoring'.

Content

No changes to the themes were made based on this evaluation, but questions regarding 'Health', 'Safety and Security', 'Self-determination', 'Partner and Family', 'Mobility', 'Meaningful Work', 'Leisure' and 'Friends and Community' were reconsidered based on the participants' feedback. In total, 25 questions were added and 13 questions were adjusted. The questions that changed after this micro-evaluation can be found in Appendix D2.

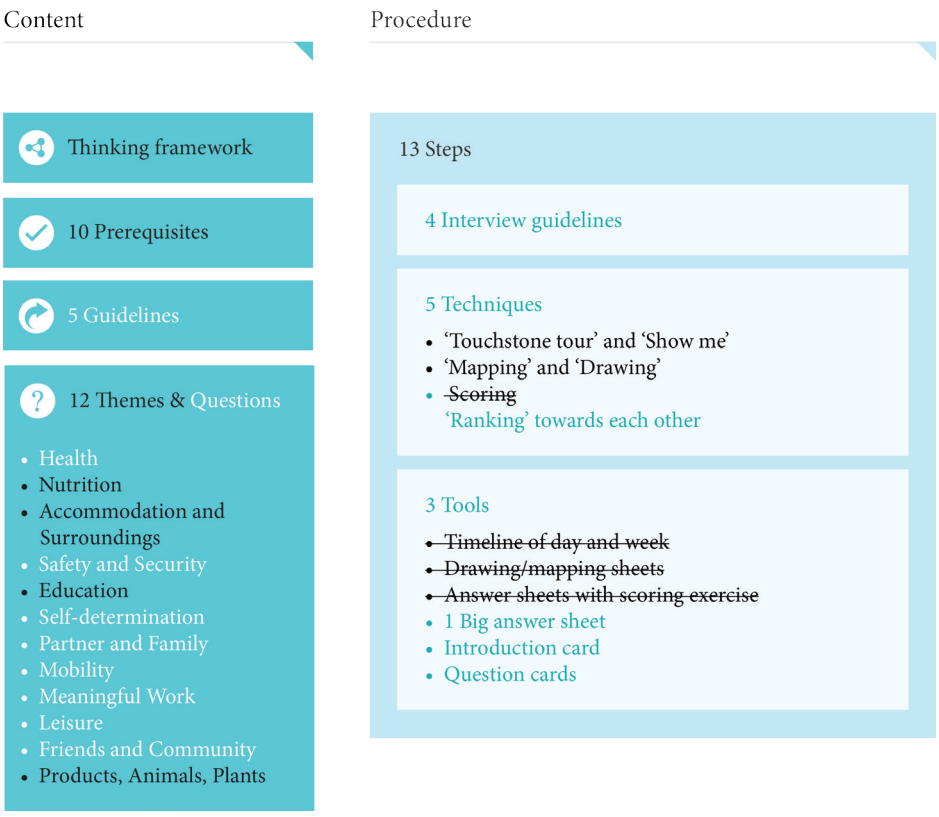


Figure 6-16: An overview of the changes to the ODK after micro-evaluation (changes indicated in grey)

6.2.2 Iteration 2: Micro-try-out in India

As the context of this research project is important, and radically different than that of the Dutch context, a micro-try-out in a DfD context was conducted (see figure 6-17). This micro-try-out was executed in order to get a feel for the appeal and adequacy of the tools and the designer-friendliness and effectiveness of the ODK. The ODK was used to obtain comprehensive insights into the lives of participants who are using a product that has specifically been designed for marginalised and disadvantaged people. This exercise enabled the evaluators to map the lives of the product users at two points of time: before and after obtaining the product, providing insight in the changes the product brought to the lives of the participants, and in opportunities for product improvement. It also allowed for asking product questions before and after the interview, to evaluate whether the ODK interview helps participants to open up and think deeper about the impact of the product on their lives.

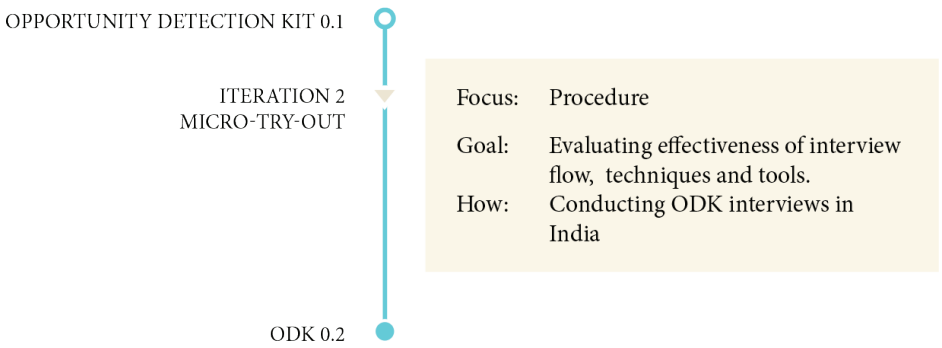


Figure 6-17: Iteration 2, a micro-try-out to test the ODK's procedure in context

The product selected was the Jaipur Foot Prosthesis (JFP) of the Jaipur Foot Organisation (JFO). The Indian Non-Governmental Organisation (NGO) JFO is situated in Jaipur, Rajasthan, India. The JFP is a low-cost prosthesis designed to enable amputees to walk and work again in the Indian culture and environment (see figure 6-18 to 6-22). This prosthesis enables its users to squat, sit cross-legged and walk on uneven grounds. It also withstands rain, dust and heat. The JFP is fitted and fabricated in one day, free of cost for its user. The material and labour costs are covered by fund raising.

Figure 6-18: Jaipur Foot prosthesis (picture by JFO)
Figure 6-19 and 6-20: Making the prosthesis. A mould for the foott and aplaster cast of a beneficiaries stump
Figure 6-21 and 6-22: Using the prosthesis. Employee putting it on and climbing a tree with it (picture by JFO)

Evaluators of iteration 2

In this micro-try-out, the Lead Researcher and Researcher 1 took on the role of designers in a design team, conducting five interviews together in an in-context field trial.

Method of iteration 2

A translator was selected and instructed about the research, the interview and the desired interaction. The two designers were assigned roles before each interview: one facilitated the session and therefore focused on establishing the dialogue, the other took notes and photographs and audio-recorded the session. The participants were selected from the waiting room of JFO, where beneficiaries can wait while their prosthesis is being made. Only those participants that came in for their second or third prosthesis were selected in order to be able to compare their lives before and after receiving the prosthesis. The interviews were conducted in the translator's office next to the waiting room.

First set-up

The ODK interview started off by asking participants to introduce themselves. Their details were noted down. Then, the facilitator and note taker introduced themselves in Hindi, and the translator further introduced the designers, the research project, and the activity. He also introduced himself, as he was not known to the participants. The participants were asked to verbally give consent for using the data in this research project and were informed that the results will be used anonymously, that they did not have to answer all questions and that they could withdraw from the study at any time. Thereafter, the designers showed some pictures of their family, hometown and country (see figure 6-23 to 6-26). Although pictures can lead to a strengthening of power differences influencing the participant's answers, it was still chosen to show personal pictures before the interview in order to open up to the participant and establish initial rapport.

Figure 6-23, 6-24, 6-25 and 6-26: Pictures shown to participants during the interviews (family, snow, city, home)

As mentioned above, each interview started by asking questions about the prosthesis. A separate question card had been made for these product questions. Then, the questions for each of the twelve themes were posed to the participants. There was no fixed order of question-asking and no obligation to ask all questions. The facilitator could therefore start off with any theme, but started with themes perceived to be not sensitive, in order to create a comfortable dialogue. Sensitive questions were asked later on, especially because no prior rapport with the participants had been built. After discussing all themes, the participants

were asked the product questions again and they were asked to rank the themes compared to each other. Lastly, the participants were asked if they wanted to share any more information. They were thanked for their participation and as a token of appreciation, they received a small set of ceramic clogs, typical of the designers' home town.

After each interview the designers and translator discussed the interview to note difficulties and to interpret the outcomes. Then, all interviews were transcribed in order to detect all changes to participants' lives, to identify relevant design opportunities for improving the JFP, and to obtain an overview of the time frame used to discuss each theme. Lastly, the answers to the product questions before and after each interview were analysed.

Initial changes after first interview

After the first ODK interview, the designers decided to change the interview flow, the drawing sheets, one theme, and some of the pictograms. The initial set-up of the interview was to start with questions regarding the participant's current situation for all themes, then regarding the participant's situation before receiving his first prosthesis, and lastly, regarding the participant's situation before amputation. For each situation, the participant could draw the answers on a separate drawing sheet. After this first interview, it was decided that this way of questioning was extremely time-consuming and that it caused confusion, as all the themes and questions were discussed three times. In addition, the pictograms on the drawing sheet also caused confusion, as participants did not know what they meant and why they were on the sheet. Therefore, the drawing sheet (as presented in figure 6-13) was replaced by a set of new drawing sheets, as shown in figure 6-27. In the new situation, three drawing sheets were placed next to each other and each participant was asked about one theme for the three time-situations; first the current situation, the situation before receiving the prosthesis, and then the situation before amputation. The participant could then draw what the situation at that point in time was like on each sheet. When changes for a specific theme were indicated, the participant was further questioned about reasons for that change.

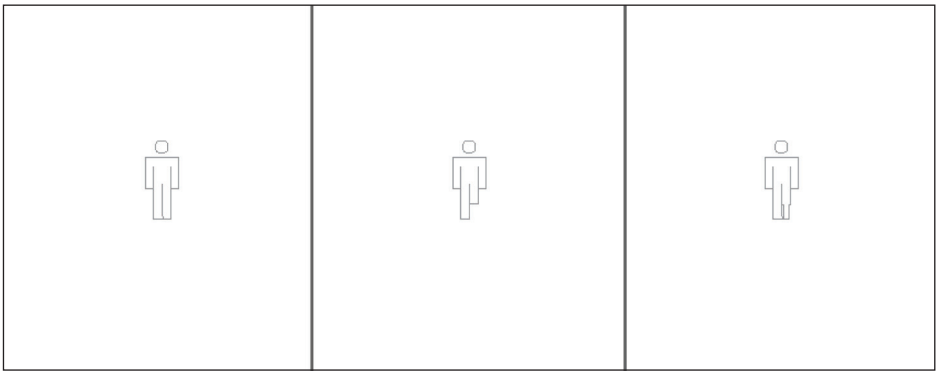


Figure 6-27: Three drawing sheets used after the first interview

Moreover, the translator and the first participant did not understand why the theme self-determination contained questions about politics and religion. These questions were therefore

placed in a separate theme called 'Cultural and Spiritual Life'. The pictograms for 'Safety and Security', 'Health' and 'Self-Determination' were changed because the translator indicated that the participant did not understood them well. Lastly, the colour of the theme 'Products, Animals and Plants' was changed from grey to green, as this theme is often discussed in relation with 'Accommodation', which is coloured dark green. The new set of question cards can be viewed in figure 6-28. After these initial changes, four other participants were interviewed.

Figure 6-28: New question cards for all themes after the first interview. From left to right and top to bottom: 'Accommodation and Surroundings', 'Friends and Community, 'Partner and Family', 'Leisure', 'Health', 'Safety and Security', 'Education', 'Mobility', 'Products, Animals, Plants', 'Nutrition', 'Meaningful Work', 'Self-Determination' and 'Cultural and Spiritual Life'.

Interview specifics of iteration 2

The participants varied in age, income group[16], occupation and place of residence. Unfortunately, no female amputees receiving a second or third prosthesis were present at JFO, so only male participants were interviewed. The translator was a male employee of JFO, who was not familiar to any of the participants. As the translator only mastered Hindi and English, participants who could not speak Hindi were not selected. In total, five people were interviewed.

Results of iteration 2

The issues noticed by the designers or indicated by the participants regarding the ODK procedure (steps, guidelines, techniques and tools) and the ODK's content (themes, topics and questions) are summarised (see Appendix E2 for a full overview of the results).

Interview flow and effectiveness

The themes and questions helped the participants to think deeper and share more: the designers noted that all the participants indicated the prosthesis to be fine when asking the product questions prior to the ODK interview. During the interview and when the product questions were again asked at the end of the interview, more details and problems were shared. The average duration of the interviews was 1 hour and 16 minutes. Most interview time was

16 *Based on a paper from the World Bank Development Research Group (Ravallion, 2010) a distinction in income groups was made for this research project. Ravallion (2010) defines the 'middle income group' as ranging from an income of $2 up to $13 a day per person PPP. For this research project the middle income group was subdivided into lower-middle, middle and upper-middle income group.*

spent discussing the themes (77% of the total time). The amount of time spent per theme was analysed (see boxplot figure 6-29). No statistical relevance could be assigned to the number of interviews conducted, but some themes were more time-consuming than others.

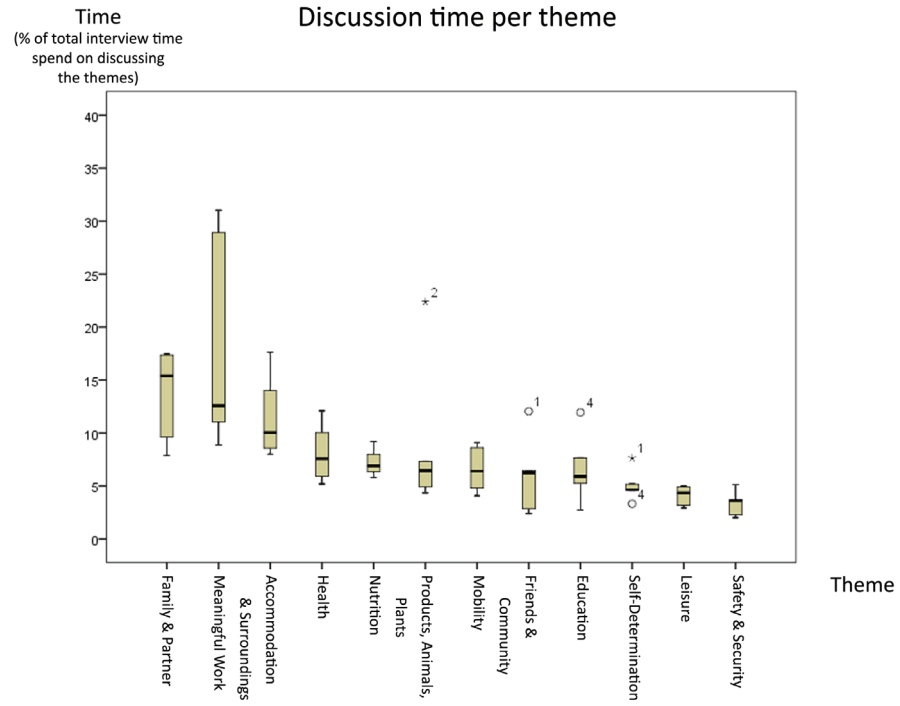


Figure 6-29: Discussion time per theme in percentage of total amount of time spend on the question cards

The first interview set-up resulted in a messy, overwhelming, and tiring exercise. As a consequence, the first participant became impatient and lost interest in the interview. The second set-up led to shorter interviews that were easier to follow. During the second set-up, one participant was shy, and shared limited information about his life. The three other participants opened up more and did express some inner emotions and thoughts. During the interviews, 'Accommodation and Surroundings' was evaluated as being a good starting theme: this theme was found easy to discuss and draw.

Procedure

The designers still had to become familiar with the flow of the ODK during the interviews, which consumed valuable interview time and led to confusion. The designers noticed that the translator refused to fully translate the introduction, did not want to ask the participants for consent, was impatient and rushed the interview, was not always neutral in his reactions, provided examples to the participant to clarify questions, and sometimes answered questions without asking the participant or provided a very brief answer where the participant had given an elaborate answer. The interview setting was not familiar to the participant, other people could observe the interview and the interviews were disturbed by people coming in

(see figure 6-30 and 6-31 for the interview setting). One participant was hoping to receive money. Working with a translator and the interview setting both diminished the rapport that could be built and influenced the participants' answers. The participants truly appreciated the designers' introduction in Hindi, and the ceramic clogs were well-received as a gift.

Figure 6-30: Interview setting: Facilitator (Researcher 1) and translator on one side of the table
Figure 6-31: Interview setting: Participant 5 showing his prosthesis

Participants were often reluctant to draw and therefore, Researcher 1 mostly drew the answers on the answer sheet (see figure 6-32 and 6-33). In this way the collaborative process of creation was lost and Researcher 1 had less time to take notes and to observe, but the drawings still aided in creating a more lively interview: encouraging participants to correct mistakes and elaborate on their stories. The drawings also provided a point of reference for the facilitator.

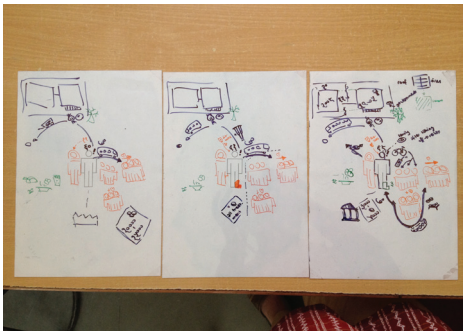


Figure 6-32: Answer sheet used during the first interview
Figure 6-33: Answer sheet used during the last four interviews

The three answer sheets representing the participant in three different situations (see figure 6-27) were easier to understand than the answer sheet used during the first interview (see figure 6-13). They also helped the designer to keep the overview. The topics 'Products', 'Plants'

and 'Animals' are different topics all belonging to one theme, just as the topics 'Religion' and 'Politics' in 'Cultural and Spiritual Life'. This caused confusion during the ranking exercise. During the ranking exercise, the participants also had difficulty relating to the pictograms and had difficulty placing them in an order. Therefore, they were asked to select the most important ones only (see figure 6-34).

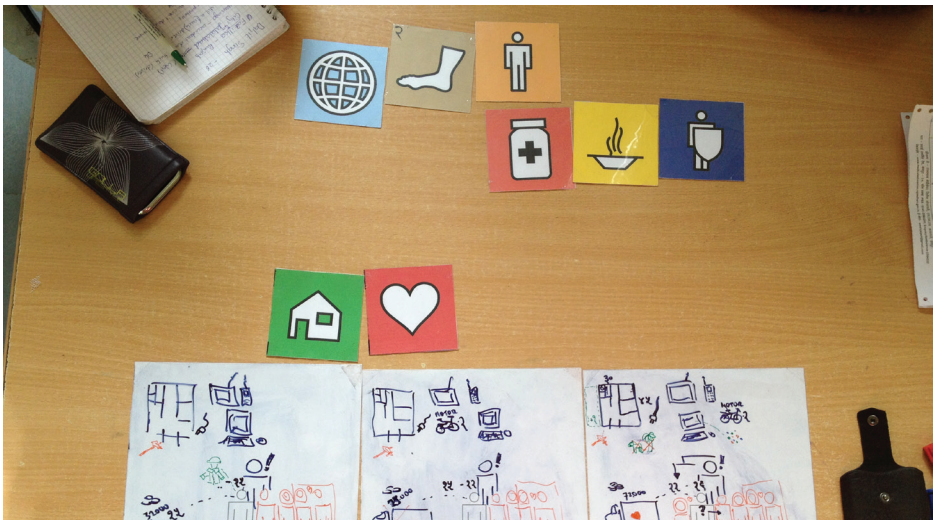


Figure 6-34: Ranking the themes in practice: the participant chose the two themes he found most important

Content

The content of the theme self-determination caused a great deal of confusion. Regarding the questions, issues regarding terminology and sensitivity were indicated. Thereby, some themes comprised questions that were too broad, others questions were too closed. Moreover, some topics seemed missing.

Conclusions of iteration 2

During this micro-try-out, the interviews took less than the anticipated two hours. By not using a timeline and letting participants rank instead of score, the interviews were completed in less time than during the micro-evaluation. However, the interviews were also less effective in generating deep and comprehensive insights. No prior rapport had been built and, due to working with a translator, less rapport could be built during the interview, resulting in less openness of the participant. The translator had a great influence on the interview results. When working through a translator, it is important to select someone who translates more than interprets, who understands the research activity, and who is able to build rapport with the participants. The drawings did help to communicate directly with the participants, and the participants did open up more during the interview, also resulting in more elaborate answers towards the product questions posed after the interview, but these interviews were less effective in obtaining deep insight than during iteration 1. Still, some surprising insights and possible product improvements were detected. For more information about the detected design opportunities per product, see TEXTBOX II on the next page.

The first interview demonstrated that the flow and structure of the ODK needed improvement. The adjustments resulted in better outcomes. Although the three life situations – before amputation, before the prosthesis, and after the prosthesis – still caused some confusion. The drawing activity was beneficial. The answer sheets did not encourage the participants to draw and thus 'create' themselves, as was intended, but visualizing the answers made the interview interactive and enjoyable for the participants, the translator and for the designers. When one of the designers drew the answers, this activity did not demand much from the participant. The drawings inspired the participants and functioned as a mnemonic for the facilitator. Thereby, they stimulated additional answering and mistake correction by the participants. The ranking exercise turned out to be difficult to understand and execute for the participants.

Changes to the Opportunity Detection Kit resulting from iteration 2

As a result of the obtained feedback from the translator and the insights from the designers, several issues regarding the flow, appeal and clarity of the ODK were made apparent. Therefore, changes were made to the prerequisite (1 adjusted), steps (4 adjusted), guidelines (2 added), themes (1 split into 2), questions (39 added, 4 adjusted), techniques (1 added, 1 adjusted) and tools (3 added and 1 adjusted). An overview of the changes can be found in figure 6-41. An overview of the adjusted prerequisites, steps and guidelines can be found in Appendix C3, an overview of the adjusted themes and questions can be found in Appendix D3.

Prerequisites

It is important for the designers to really understand the interview flow, the themes and the questions before starting the interviews, this causes less confusion during the interview and makes the interview easier and quicker to conduct. Therefore, prerequisite J changed from 'Keeping the themes in mind' to 'Learn the themes and questions by heart'.

Steps

The following adjustments were made regarding the steps:

- Step 2: If required, select and instruct a translator, was adjusted. Step 2 is changed to: 'Carefully select and properly instruct a translator (if required)'. The translator should be thoroughly informed about the task at hand and his or her role. Go through all the themes and questions before the first interview so that the translator is fully acquainted with the interview flow and structure, the themes and key questions. Share the goals of the research and explain the rules.
- Step 6 'introduce' was expanded. It was stressed that it should be very carefully explained to participants that they are free to participate and leave, and that they will not receive money for participation. People can be compensated for invested time or expenses, but if people start to ask for money, it is better to stop the interview. It must be noted that for some types of research it can be correct to pay participants, but for this type of research it is important that money does not become the incentive to participate. To this step it was furthermore added that giving an introduction in the local language helps to build rapport and to relax the atmosphere.

TEXTBOX II – Outcomes ODK interviews Jaipur Foot Prosthesis

The results of the ODK interviews are provided below and summarized in table 6-1. The impact of amputation is different for the participants, but they all pointed out that, due to amputation, they could no longer walk and work. This led to a severe loss of income, as well as the loss of savings due to treatment of the limb. Another impact noted by some participants was being perceived as a burden to their families, friends and / or community. The income group the participant belongs to seems to make a great difference here. One participant from the high income group, received continuous support from his family and friends. He also received part of his salary during recovery and continued his studies during this time. Two participants from the lower-middle income group, on the other hand, indicated that their family left them alone. A last impact of amputation is related to safety; one participant, who before amputation did not hesitate to go out during the night, noted that he did not dare to do so after amputation, not even in case of emergency. After receiving the prosthesis, most of the participants could work again, although three participants could not continue their old jobs, and / or still required help. Regarding family, in one case the children returned to their father who was no longer being perceived as a burden. And regarding safety, the participant who did not dare to go out at night, now indicated that he would go out in case of emergencies.

The prosthesis does therefore not only enable people to walk and work again, as indicated by JFO, it potentially contributes towards renewed acceptance by family, friends and community, and it might enhance people's feeling of safety. Detected design opportunities are that the foot might improve cultural acceptance and feeling of safety by an even better resemblance to a normal foot. Other aspects that can be further explored are comfort, strength, and movement of the prosthesis, as three participants could not or no longer fully engage in their old jobs, and one person specifically indicated not being able to lift heavy things.

Table 6-1: Experienced impact of amputation and experienced impact of Jaipur Foot Prosthesis

Theme	Impact amputation	Impact Jaipur Foot Prosthesis
Meaningful work	Continuously works (1), not able to work (4): sit idly (3) continue studies (1)	All able to work: old job (2), old job with help (1), different job (1), different job with help (1)
Mobility	Difficult to move around, sit idly (3), use crutches (1), rides motorbike (1)	Able to walk again
Family	Left by children (1), left by brothers (1), left by in-laws, but wife stayed (1), continues support (1), no family (1)	Children returned (1), for the others situation remains similar
Friends	Friend and community keep distance (1), no change in behaviour of friends / community (4)	Situation remains similar
Safety	Not daring to go out at night (1)	Daring to go out in case of emergencies (1)

- Step 10 'build dialogue' was expanded. It was added that when questioning the participant about the themes, the facilitator should start with the current situation for one theme or topic and immediately ask about changes in the past and aspirations for the future, before continuing to the next theme or topic.
- Step 11 'thank the participant' was expanded. It was added that providing a tangible gift at the end of the interview is well-received by the participants, as it allows them to show the gift to other people.

Guidelines

- A guideline was added to the CDD guidelines:
  - Tips and tricks for selecting a translator: A translator should be selected based on having knowledge of the area, the local language and English. The translator should not have a stake in the research, but be interested in it. The translator's gender should preferably match the gender of the potential participant. Often, translators have to be paid for their services. Exceptions for paying a translator are, for example, when translators are connected to the project or paid for by the partner organisation.
  - Tips and tricks for instructing a translator: Designers should insist that the translator: properly translates both the questions and the participants' answers; should not rush the interview; should not interpret questions or answers; should not steer the participant by providing examples or indicating desired answers by tone or body language. The translator should, however, try to build rapport and show empathy. Designers should stress that a proper introduction and asking for consent are required for each interview.
- A guideline was added to the ODK guidelines: Formulating sensitive questions was already part of the guidelines, as the tips and tricks provide information about dealing with sensitive questions, but as this turned out to be a point of attention 'sensitive questions' were added as an explicit guideline. Questions the designers felt hesitant to ask about are kept in the ODK. Sensitivity differs per culture, so in some cases questions that the designer perceives as being sensitive, are not sensitive to the participants. Their own assumptions and feelings towards questions should not be leading. The guideline now recommends that designers should discuss the questions beforehand with a local partner to identify sensitivities and that they should be sensitive towards potential psychological harm for the participant. They can try to rephrase a question when the participant is hesitant to answer it, or that they can ignore the question if it leads to an uncomfortable situation.

Techniques

- Sorting instead of ranking. As ranking the themes towards each other turned out be difficult for the participants, it was decided to change the technique to a sorting technique. During sorting, participants have to sort the different themes into four different categories. Purposively there is no 'middle' category, obliging participants to make a choice instead of providing the ¬option of an 'average category'.

- Pre-made visualizations added. To reduce the amount of time spent on drawing the answers, visualization has been added as a technique. Pre-made cards represent possible answers which the participants can place on the answer sheet to map their lives. The participants can also still draw on this sheet. Visualizing was added to stimulate participants' answering and to form a direct line of communication between the facilitator and the participant. The visualizations and drawings also aim to guide the facilitator to keep an overview of the topics discussed, and to show the interview progress to the participant and translator. If the participant does not want to map or draw, the note taker can do so.

Tools

- The question cards have been adjusted. After the first interview, some pictograms and colours changed. Colours were changed again, as the colours of certain themes were very similar. The new colours are shown in figure 6-35.

Figure 6-35: The new question cards with the new colours.

- Visualization cards were created. These cards were designed to stimulate participants to create their own mappings and drawings and in that way help the participants visualise their answers (see figure 6-36 and 6-37).

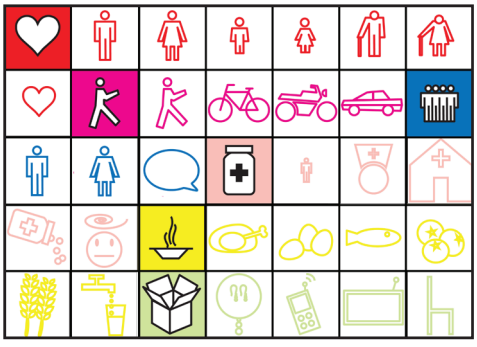


Figure 6-36 and 6-37: A selection of the visualisation cards for 'Partner and Family', 'Mobility', 'Friends and Community', 'Health', Nutrition' and 'Products'. The card for house is four times larger than the other cards.

- Large 'Accommodation' cards. As 'Accommodation' turned out to be an easy conversation starter, different visualizations of houses were made that are four times the size of the other visualization cards (see figure 6-37). The most representative visualization of 'Accommodation' for the context of investigation can then serve as a starting point for that interview.
- An 'importance sheet' has been added. This sheet contains the four possible categories in which participants can sort the themes: three exclamation marks for 'very important', two exclamation marks for 'important', one exclamation mark for 'less important' and a dot for 'not important' (see figure 6-38).
- Ranking cards. For the sorting exercise small cards were made, containing the pictograms of the themes (see figure 6-39). Separate ranking cards were made for the topics of 'Products', 'Animals' and 'Plants'.

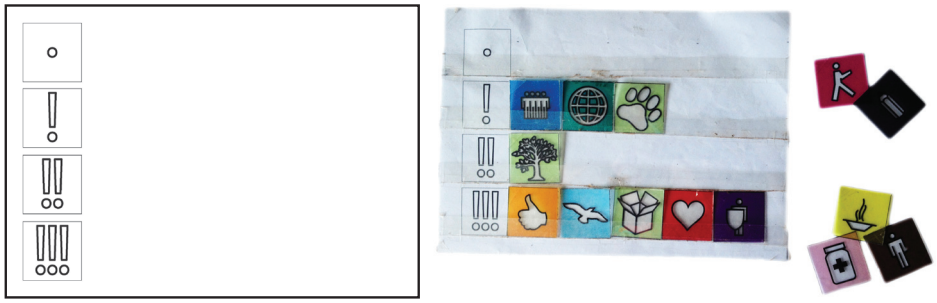


Figure 6-38 and 6-39: Importance sheet and importance sheet with sorting cards. The sheet comprises four categories, from top to bottom: not important, less important, important and very important

- Timeline added. The timeline of a day in the participant's life was added again (see figure 6-40). It consumes time, but it allows for building rapport during the interview by starting with simple questions and showing interest in people's day-to-day lives. It also provides the designer with starting points for further conversation. The themes that come up during the discussion of the timeline can be drawn on during the interview. The timeline is visualised by a line and by the sun and moon rising and setting, in order to indicate the passing of time. The visualization cards can also be used on the timeline, and the timeline is covered with plastic, so it can be drawn on with erasable markers.

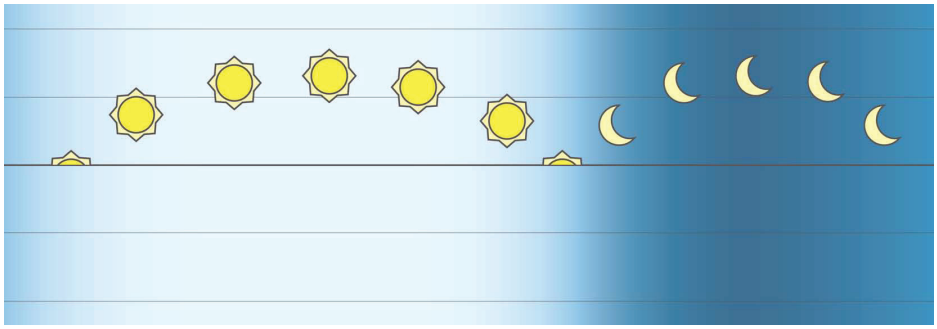


Figure 6-40: Timeline representing one day in a participant's life

- Empty drawing sheet added. This sheet (A3 size) was added to help visualise the answers of participants. This sheet can be drawn on with marker pens, and the visualization cards can be placed on it.

Content

After the first interview, the theme 'Self-determination' was split into 'Self-determination' and 'Cultural and Spiritual Life' to avoid confusion regarding the meaning of 'Self-determination'. No more changes were made to the themes, as the number of themes was already overwhelming for both the participants and the designers. Questions regarding all themes were reconsidered based on the feedback from the participants and the translator. Thirty-nine questions were added and four questions changed. Thereby, the sentence: *"Continuously ask: 'and then?', 'why?', 'anything more?'"* has been added to each question card in order to stimulate follow-up questioning by the designer.

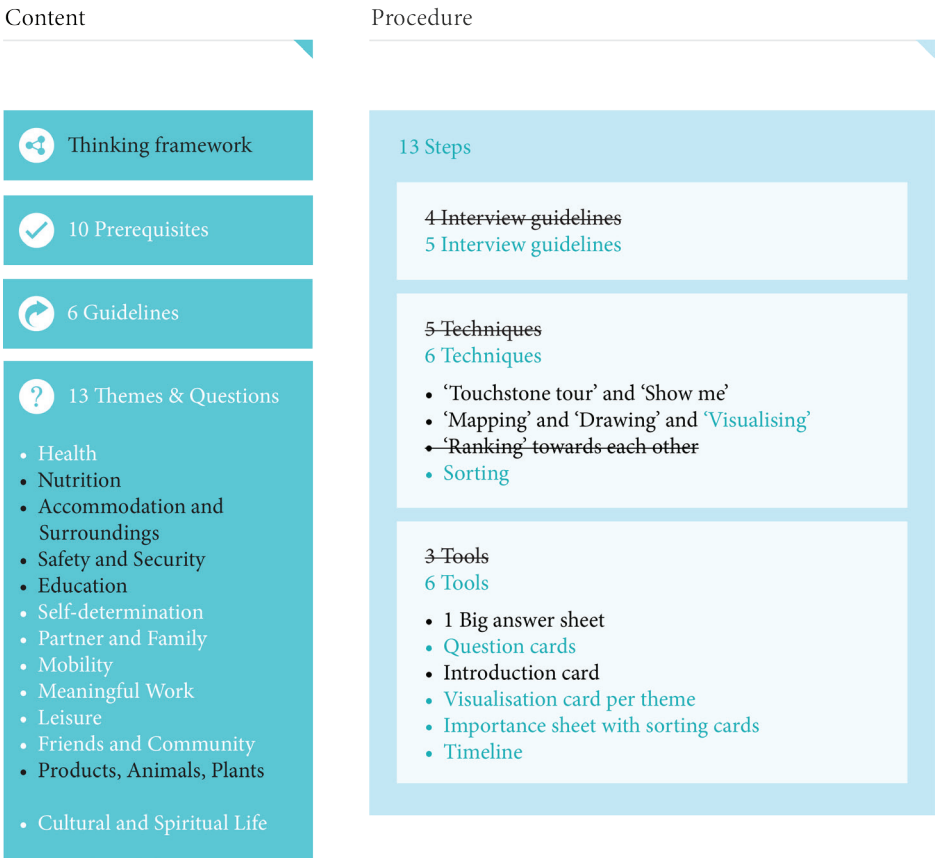


Figure 6-41: An overview of the changes to the ODK after micro-try-out (changes indicated in grey)

6.2.3 Iteration 3: Screening by research team

To refine the ODK's content, research team members checked the themes, topics and questions (see figure 6-42).

Evaluators of iteration 3

During this third iteration, research team members Prof. Kandachar and Dr. Parmar (from here onwards called: Researcher 2 and Researcher 3) critically screened the ODK's contents.

Method of iteration 3

The ODK was shared with Researchers 2 and 3 for content screening. The researchers were involved in the initial establishment of the themes, but not in the changes made to them, neither were they involved in establishing the prerequisites and questions. Researchers 2 and 3 judged the different elements individually, and discussed the identified issues with the Lead Researcher.

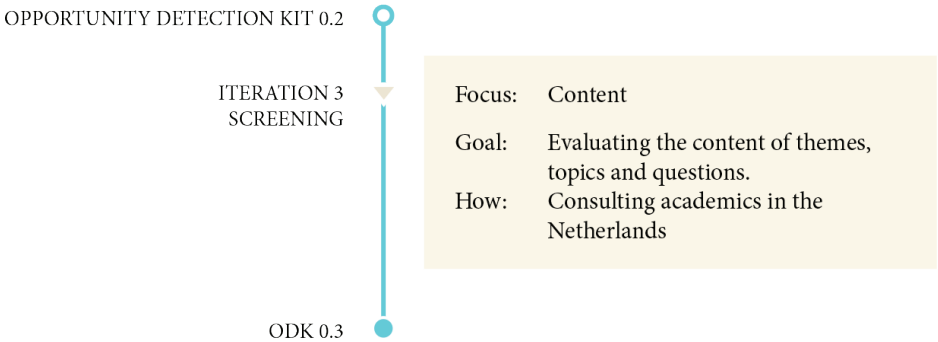


Figure 6-42: Iteration 3, screening to check the ODK's content

Results of iteration 3

In this section, a summary of the screening results is presented. In Appendix E3 the detailed results regarding the content and procedure can be found.

Content

The researchers commented that the theme names should be short and understandable for the designer, and that tests must be carried out to check whether some themes are too long or include too many topics. Additional questions came up and some questions were adjusted. Sensitive were made less direct, general questions were made more specific. Regarding nine themes some suggestions concerning the topics or the way of questioning were made. Furthermore, researcher 2 indicated that more insights about the participants' social status should be generated and that questions derived from the literature should be separated from the actual 'conversation starters'.

Procedure

The evaluators mainly commented on the pictograms of the question cards and the visualization cards, on the required amount of interviews that needs to be conducted and on the required time per interview.

Conclusions of iteration 3

The research team members mainly commented on the questions. The researchers were

asked to critically review the questions to stimulate a deeper dialogue, as during the micro-try-out it was noted that the participants did not fully open up. One topic especially deserves more attention: 'social status'. Moreover, the researchers expressed some doubts about the time taken for the interview and the number of interviews to be conducted. This resulted in changes being made to the ODK, as presented below.

Changes to the Opportunity Detection Kit resulting from iteration 3

Based on the feedback from the evaluators, several changes have been made to the ODK elements. An overview of the adjusted prerequisites, steps and guidelines can be found in Appendix C4, an overview of the adjusted themes and questions can be found in Appendix D4.

Themes

The theme names were slightly adjusted to: 'Health', 'Nutrition', 'Accommodation', 'Safety', 'Education', 'Self-determination', 'Cultural Life', 'Family', 'Mobility', 'Meaningful Work', 'Leisure', 'Friends', and 'Belongings'.

Questions

The following changes were made to the questions:

- The suggested changes for the questions of the themes 'Health', 'Accommodation', 'Education', 'Meaningful Work', 'Mobility', 'Friends', 'Self-determination', 'Cultural Life' and 'Belongings' (Products, Animals and Plants) were agreed and changed.
- To provide the designer with additional guidance to keep track of the interview and questions, a set of 'ideal questions' and 'pragmatic questions' was developed. The ideal questions represent those that are derived from the literature. They are more abstract, and do not have to be asked directly, although the aim is to have them answered. They are intended to guide the designer. The pragmatic questions represent conversation starters that trigger dialogue and help the designer to find answers to the ideal questions. The exact framing of the questions is up to the designer. The ideal questions are in bold typeface (see figure 6-43).

Procedure

A new step was added to stress that the pictograms can be replaced with local visualizations, which should be carefully selected, in order not to steer participants into a certain direction. Step 10 has been adjusted to include an explanation of how the tools should be used and in which order, and to emphasise that the pictograms or local visualizations used should be explained. The ODK guidelines have been adjusted to explain that each interview is scheduled to last between 1.5 and 3 hours, and to mention that the amount of interviews that need to be conducted depends on the context, the results and the variety of participants to be included. No changes were made regarding the techniques and tools. However, the question cards have been improved, showing the 'ideal questions' and the 'conversation starters' / 'pragmatic questions', and a sentence was added to stimulate the designer to ask follow-up questions (see figure 6-43).

Do you feel you can enjoy your normal day-to-day activities?
Do you feel you can use your imagination and or reasoning in your day-to-day activities?
Do you feel you are playing a useful part in your normal day-to-day activities?
Do you feel you make enough use of your skills and talents in your day-to-day activities?
Do you feel you are appreciated in your normal day-to-day activities?

What kind of work do you do during the day?
When do you work (time/day)?
Do you work together with other people?
What kind of activities do you have to do?
What are the things you are good at in your work?
Why do you do this?
Do you like what you do?

and then? why? any more? changes?

Figure 6-43: Question card for 'Meaningful Work' with ideal questions (bold) and pragmatic conversation starters

Content

- Thinking framework
- 10 Prerequisites
- 6 Guidelines
- 13 Themes & Questions
  - Health
  - Nutrition
  - Accommodation ~~and Surroundings~~
  - Safety ~~and Security~~
  - Education
  - Self-determination
  - Cultural ~~and Spiritual~~ Life
  - ~~Partner and~~ Family
  - Mobility
  - Meaningful Work
  - Leisure
  - Friends ~~and Community~~
  - ~~Products, Animals, Plants~~ Belongings

Procedure

~~13 Steps~~
14 Steps

5 Interview guidelines

6 Techniques
- 'Touchstone tour' and 'Show me'
- 'Mapping' and 'Drawing' and 'Visualising'
- Sorting

6 Tools
- 1 Big answer sheet
- Question cards
- Introduction card
- Visualisation card per theme
- Importance sheet with sorting cards
- Timeline

Figure 6-44: An overview of the changes to the ODK due to screening (changes indicated in grey)

6.3 Review and next steps

After the micro-evaluation, micro-try-out and screening, the ODK has been adjusted significantly. An overview of the changes made to the ODK is given in figure 6-45.

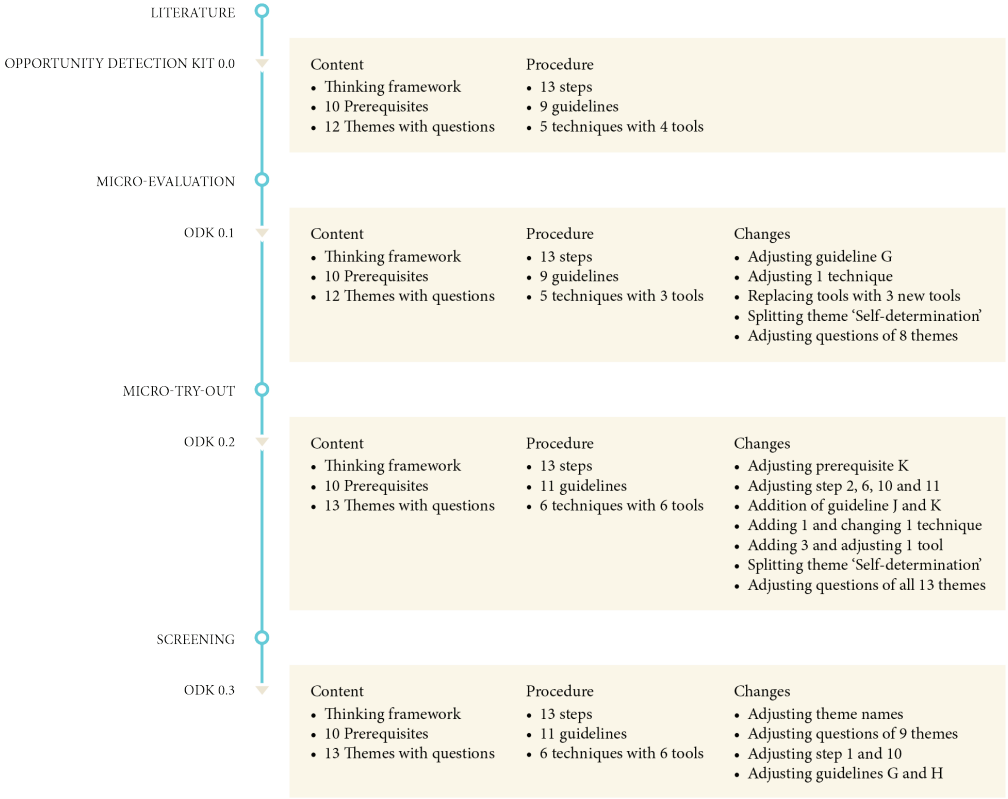


Figure 6-45: An overview of the changes made to the ODK after each iteration

6.3.1 Tools and supplies of the Opportunity Detection Kit 0.3

The ODK was improved and refined, resulting in ODK 0.3 and comprising different tools and supplies, as can be seen in figure 6-46. The ODK now consists of:

- The backbone of Capability Driven Design (CDD). This backbone includes ten prerequisites, six guidelines (which include 'tips & tricks' on how to select participants, how to select and instruct the interpreter, how to select participants, the right behaviour and attitude, and which supplies to take), a set of thirteen themes, and 'ideal' and 'pragmatic' questions for each theme. This backbone is the main guide for all activities that can be conducted within CDD, and therefore it functions as a guide for the ODK interviews.
- Thirteen steps. These steps need to be followed to conduct an ODK interview.
- Five ODK guidelines. These guidelines help the designer to complete the interview steps.
- A set of six tools. The following tools support the semi-structured interview:
  - A timeline to map a day in the participant's life to gain an understanding of how the

participant lives, and to build rapport.

- A set of thirteen question cards and an introduction card. Each card contains a pictogram that symbolizes the theme on one side and the related questions (both ideal and pragmatic) on the other. The question cards guide the facilitator throughout the ODK interview, but can also be used to show participants and the translator how the interview is progressing.
- Visualization tools. A set of visualization cards, sorting cards, an empty answer sheet and a set of erasable markers can be used to stimulate the participants to create mappings and drawings of their lives, resulting in richer stories about experiences, behaviour, dreams and hopes.
- An importance sheet with sorting cards. The importance sheet consists of four categories of importance, indicated with exclamation marks. Participants can sort the different themes using this sheet, resulting in insights into what and how participants value. The pictograms used on the question cards are also used on the sorting cards, so participants can relate to them.

A full overview of the ODK's contents and procedure can be found in Appendix C4 and D4.

Figure 6-46: The contents of the Opportunity Detection Kit 0.3

6.3.2 Determining the next steps

The ODK underwent a significant number of changes as a result of the three iterations. Not all these adjustments have yet been evaluated, especially the visualization cards and the sorting exercise. There has also been discussion within the research team about the ideal amount of time for conducting the interview. Moreover, the themes and questions have only

been reviewed by academics from Delft University of Technology. It would be valuable to include views of academics from different universities in order to reduce bias. It was therefore decided that another iteration was required to test and further refine both the procedure and content of the ODK in order to establish the first version of the ODK, ODK 1.0. To test the ODK's new procedure, it was decided to use the ODK in the field again. To check the ODK's contents, it was decided to have its contents reviewed by academics from another university outside the Netherlands, to prevent the bias of Delft's specific worldview.

6.4 Iteration 4: Optimizing the Opportunity Detection Kit

In this section, the testing and refinement of the ODK 0.3 is described. Three formative evaluation methods were used to improve the ODK, resulting in ODK 1.0 (see figure 6-47).

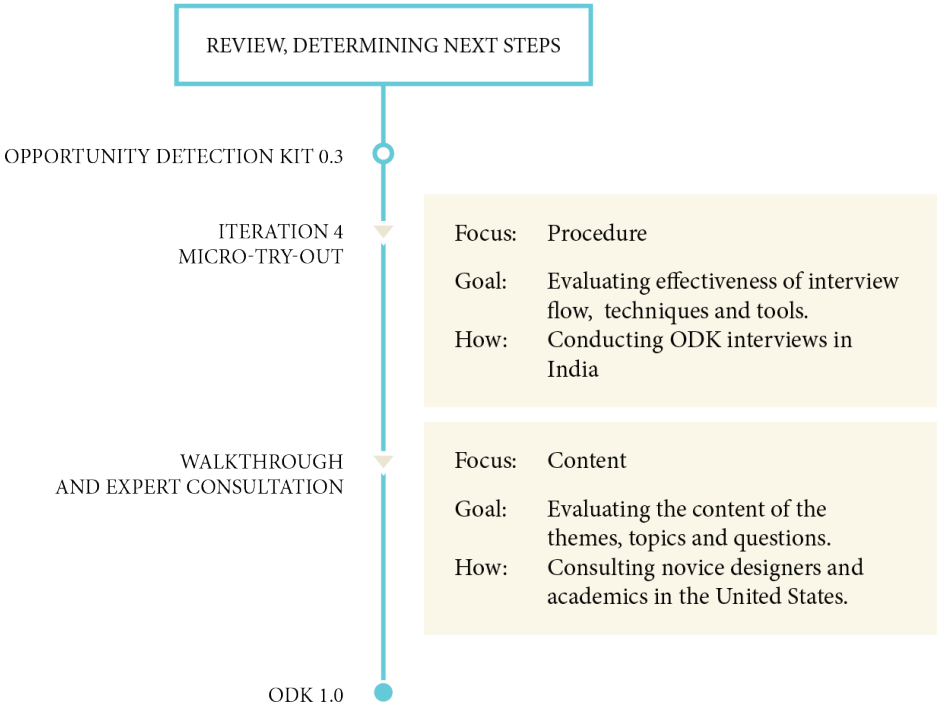


Figure 6-47: Iteration 4, a micro-try-out to test the ODK's procedure in context and a walkthrough and expert consultiont to check the ODK's contents

Focus

Both procedure and content of the ODK 0.3 were reviewed:

- The procedure - guidelines, steps, techniques and tools - were tested in a micro-try-out in India. The ODK developers again took the role of designers and conducted 42 interviews with a variety of participants using the ODK;
- The content – the thinking framework, prerequisites, themes and questions - were tested

by conducting focus group sessions with novice designers[17] and interviews with DfD experts of D-Lab at the Massachusetts Institute of Technology (MIT).

Below the results of the three methods used during this iteration are described. While they had their own focus (procedure or content), during the micro-try-out also feedback was generated regarding the content of the ODK, and during the walkthrough and expert appraisal also feedback was generated regarding its procedure. This information is also considered when improving the ODK. The full description of the results can be found in Appendix E4.

Limitations

During these iterations, the focus was on developing the ODK, not on evaluating it. During this prototyping stage, the ODK procedure was therefore tested by the researchers developing the ODK taking on the role of designers and not yet by design teams in DfD projects. During the procedure testing, not all prerequisites could be followed: the designers conducted the interviews individually, resulting in comparisons of interpretations, experiences and perceptions between interviews only, and not per interview. Thereby, not all interviews could be conducted at participants' homes, making it impossible to fully evaluate the touchstone tour technique. Some of the interviews resulted in less openness due to suspicion or time limitations, and mainly women were interviewed, as the selected products were mainly used by women. The participants varied by occupation, place of residence, and income. Lastly, although the selection criteria for translators were followed, in some cases the time was too limited to find one who met all the criteria. The selected translators influenced the building of rapport and the outcomes.

During the content testing, the novice designers and academics consulted were all from the same institution, following one and the same design methodology. The sample of novice designers was not random; the designers volunteered to participate, indicating interest in the topic of research or in the voucher that they received in return. Furthermore, they were novice designers: they had taken a limited number of design courses and had only executed one DfD project.

6.4.1 Micro-try-out: Four cases, forty-two interviews

As a first optimization effort the ODK was taken into the field for in-context testing. After the interviews at JFO, it was decided that the ODK should be used in the field, at participants' homes. The Lead Researcher and Researcher 1 conducted forty-two interviews with product users in India to test and refine the procedure of the ODK 0.3. The interviews were conducted with participants using a product that was specifically designed for marginalisedand disadvantaged people. This allowed the designers to map the lives of the participants at two points in time, and to ask product questions before and after each interview to see if participants open up due to the ODK interview.

17 *'Novice designers' is used to distinguish the consulted designers from design professionals. This distinction is made as 'novice designers' are still being educated to become a design professional and are therefore allowed to make more mistakes, have more time to complete their projects, and have more guidance. 'Design professionals' can be designers just starting as a professional, being guided by more experienced designers, but they do have to deliver output under significant time pressure and are allowed to make less mistakes.*

To get a good sense of working with the ODK in different situations with different products the selected participants were users of products developed by foreign, domestic, multinational and small companies or organizations. The products were implemented in different areas and were used in different application domains. Moreover, two types of study were conducted. Study 1 focused on generating a comprehensive and deep insight into the lives of a limited number of users, lasting approximately 2 to 3 hours. Study 2 focused on conducting many interviews in a short time span, lasting approximately 0.5 to 1 hour. In this way the amount of time needed for the interviews could be compared to the volume of insight gained. The following four products were selected:

- The Mitticool refrigerator[18]. Mitticool is a company started by a local Indian clay craftsman and entrepreneur: Mr. Prajapati. The Mitticool refrigerator (figure 6-48 to 6-51) is made of clay and was developed to make cooling available to people who do not have electricity or cannot afford electric products. The cooling capacity depends on the outside temperature and humidity, but the refrigerator is able to cool water and preserve fruits, milk and vegetables for 3 to 7 days. Its current retail price depends on the size and decoration. Currently, the 50 litre size is mainly sold, weighing 22 kg. The refrigerator is produced in Wankaner, Gujarat, India and sold throughout India and overseas.

Figure 6-48 and 6-49: Mitticool Refrigerator (picture by Mitticool)
Figure 6-49: Different prototypes of the refrigerator in Mitticool's office
Figure 6-50 and 6-51: Mitticool Refrigerator at a participants' homes, placed on the work top and on the floor

- The ChotuKool refrigerator.[19] The Chotukool refrigerator (figure 6-52 to 6-54) was developed by the Indian multinational Godrej. It is a light-weight cooling box developed to provide a cooling solution to low-income consumers and to be able to deal with power outages. The refrigerator is thereby also marketed for middle and upper income groups as an easy to carry cooling device for e.g., parties, trips and offices. The latest model at the time of this study was 35 litres, weighing 7.3 kilograms. Its current retail price depends on the artwork chosen. The box cools up to 28 degrees below room temperature, it requires less electricity and is cheaper than an electric refrigerator. The refrigerator is produced in Mumbai, Maharashtra, India and sold throughout India.

18 *www.mitticool.in*
19 *www.chotukool.com*

Figure 6-52: ChotuKool Refrigerator (picture by Godrej)
Figure 6-53 and 6-54: ChotuKool Refrigerator at a participants' homes

- The Anna Tasar Reeling Machine (ATRM)[20]. The ATRM (figure 6-55 to 6-57) was developed by the Lead Researcher during her master graduation project for the faculty of Industrial Design Engineering of Delft University of Technology in collaboration with the Indian non-governmental organization (NGO) PRADAN, and was further optimised by PRADAN. This design replaced an older version of the reeling machine. The reeling machine is developed to provide rural, marginalised and / or disadvantaged women in rural eastern India a livelihood opportunity to not only provide them with income, but also to empower them. The machine is produced by different manufacturers in India, and is mainly used in the states of Jharkhand, Bihar and Chhattisgarh.

Figure 6-55: The old reeling machine in use in a reeling centre
Figure 6-56 and 6-57: Anna Tasar Reeling Machine in use in a reeling centre. Placed on a worktop (picture by PRADAN) and placed on the floor

- The Philips Chulha[21]. The Philips Chulha (figure 6-58 to 6-60) is a clay stove developed by the Indian branch of Dutch multinational Philips in close collaboration with the Indian NGO ARTI. The stove offers its users a smokeless cooking solution that is easy to use and maintain. Philips does not produce and sell it, they provide the instructions for making the Chulha free of cost to anyone who wants to start a local stove business anywhere in the world. The price of the Chulha is up to the entrepreneur taking up the stove business. This study focused on the stoves implemented in the Bandipur area, Karnataka, India, where the stove has been specifically installed for its low fuel use, to reduce deforestation in that area.

20 *www.pradan.net and www.annemariemink.nl*
21 *www.designboom.com/design/philips-philanthropy-by-design-chulha-smokefree-stove*



Figure 6-58: Philips Chulha in use
Figure 6-59 and 6-60: Philips Chulha installed on the floor and on the work top

Evaluators of micro-try-out

In this micro-try-out, the Lead Researcher and Researcher 1 again took on the role of designers. To minimise the influence of their own skills and behaviour, both designers followed a course on interviewing techniques, and conducted ODK pilots to train their skills and align their interviewing techniques. As the designers were both familiar with the ODK, the themes and the questions, they conducted the studies individually. The Lead Researcher conducted study 1, Researcher 1 conducted study 2. During the interviews, they acted as facilitators and they brought along a voice-recorder as a 'note-taker'. They also noted down details and insights immediately after each interview, and discussed the results together as soon as possible after the interviews.

Method of micro-try-out

During this micro-try-out, the designers again mapped the lives of the participants at two points in time and asked product questions before and after each interview. The interviews were conducted in the local language by using a translator familiar with both the local language and English. A number of translators were selected and instructed. Participants were selected based on their variation in gender, age, occupation and living area, and the interviews were conducted at participants' homes where possible.

The ODK interview started off by an informal introduction and a tour through the participant's home. Then, the interview officially started by asking participants to formally introduce themselves. Their details were noted. Then, the designer gave a short introduction in Hindi and the translator further introduced the designer, the research project, the activity and him- or herself, if required. The participants were asked to verbally give consent for using the data in this research project and were informed that the results would be used anonymously, that they did not have to answer all questions, and that they could withdraw from the study at any time. Thereafter, the designer showed some personal pictures. As mentioned above, each interview started by asking questions about the product. Then, the timeline was used to obtain general insight in the participant's life, and the questions for each of the thirteen themes were asked. There was no fixed order of asking questions, but 'Accommodation' was used as a starting theme, following the results of the first micro-try-out. After discussing all themes, the participants were re-asked the product questions and then asked to score

the themes on the importance sheet. Lastly, the participants were asked if they wanted to share any more information. They were thanked for their participation and as a token of appreciation, they received a set of ceramic clogs, typical of the designers' home town.

After each interview, the designer and translator discussed the interview to interpret the outcomes and note any difficulties. The designers also discussed the results with each other twice a week via Skype or email. Then, all interviews were transcribed in order to identify relevant design opportunities for improving the products, and to obtain an overview of the time frame used to discuss each theme. Lastly, the answers to the product questions before and after each interview were analysed.

Changes of ODK for study 2

Before conducting study 2, Researcher 1 discussed the ODK interview with the translator and with one of the stove installers who was highly trusted by the villagers. After some initial adjustments, a pilot was executed with five participants, leading to additional adjustments of the ODK interview:

- The translator and installer considered questions regarding affection, the possibility of choosing a partner, happiness, procreation, and life expectation to be offensive or too strong a taboo to bring up, and they were therefore removed from the interview content;
- During the pilot, some questions appeared to be difficult to understand and were therefore simplified;
- During the discussion and the pilot, sensitivities in the area were pointed out, such as an ongoing conflict with the government due to which questions about 'Politics' and 'Accommodation' could not be asked. As 'Accommodation' could not be used as a starting point, the timeline was used to stimulate drawing and the placing of cards (see figure 6-61).

Figure 6-61: Timeline as used during Study 2: the Philips Chulha

Lastly, three themes were changed:

- The theme 'Health' turned out to be too broad, and was divided into 'Health' (physical and mental) and 'Healthcare';
- The theme 'Belongings' was divided into three separate themes 'Animals', 'Plants' and 'Products' as they were discussed as separate topics during the pilot;

- The theme 'Cultural Life' was changed to 'Religion & Culture', as politics could not be discussed.

Interview specifics of micro-try-out

In total 42 interviews were conducted. The participants were mostly female (33 interviews), in six cases the participant was male, in three cases a couple was interviewed. The participants varied in age, occupation, income group and place of residence. For both studies some additional explanation is given below.

Study 1: Mitticool refrigerator, ChotuKool refrigerator and Anna Tasar Reeling Machine

The Lead Researcher visited several places in India in 5 weeks to conduct 11 interviews. For most interviews, an employee of the company or organization was selected as translators. They were selected for their knowledge of English and the local language, familiarity with the participants, and their interest in the ODK. When participants are aware of the presence of employees, this might result in socially desired answers. Therefore, the translators were instructed and specifically asked to explain that no wrong answers could be given, and that participants could be open about their opinion of the product. At each interview the designer, the translator and the participant were present, and in five cases family or community members were also present. Details for the different interviews are provided below. For an overview of all interview characteristics, see Appendix E4.

1. Mitticool (5 interviews in 2 weeks' time). The first two interviews were conducted in a rural area in Gujarat with families belonging to the middle income group, the third in a city in Gujarat with a high income group family. These interviews were translated by a male employee of Mitticool. During one interview, the participant indicated that she was not used to speaking and so she did not. The other two interviews ended up in long conversations with a great deal of chitchat. The last two interviews were conducted in Bangalore with participants belonging to the high income group. A male PhD student from the Indian Institute of Science was selected as a translator, but his services were not required as both participants spoke fluent English. Without translation time, it was too much for the designer to focus on both the dialogue and the mapping and drawing exercises. Therefore, the visualizations and drawings were not used. One participant gave short and quick answers, resulting in a 35-minute interview. The other interview ended up in a long conversation with a great deal of chitchat.
2. ChotuKool interviews (2 interviews in 1 week time). These interviews had to be conducted in limited time due to time and accessibility constraints of the participants. Therefore the visualization exercise was not used. Both interviews were conducted in a slum area in Mumbai and were translated by a male employee of Godrej. All themes could be discussed during these interviews, but due to the time available, not all themes were scored.
3. Anna Tasar Reeling Machine (4 interviews in one week time). There was limited time to build rapport with participants, but the users of the ATRM were already familiar with the Lead Researcher, who had worked in this area for 1.5 years. The interviews were conducted in rural areas in Jharkhand. The translators were both employed by PRADAN.

All topics could be discussed in detail in all interviews. During these interviews both the visualization and ranking exercises were used.

Study 2: Philips Chulha

In total, 31 interviews were conducted with Chulha users from four different villages. Researcher 1 stayed in the Bandipur area for four weeks, enabling him to discuss the ODK contents with local people, and to build rapport with and observe the Chulha users. An Indian PhD student from Mysore, Karnataka, who had conducted an impact study on the Chulha one year before, was selected as translator. The designer, the translator and the participant were present at each interview, and family and / or community members were also present at 23 interviews. In each village, one of the installers first had to give an introduction to encourage people to participate, as people were sometimes suspicious and unwilling to participate due to a conflict with the government, and a recent local prophecy that predicted a close relative would suddenly die if a stranger crossed a person's doorstep.

Results of micro-try-out

The results of the micro-try-out on the interview flow, procedure and content are summarised. See Appendix E4 for the detailed results.

Interview flow and effectiveness

As acknowledged and integrated in CDD, it turned out that establishing relationships with the participants prior to the interview was essential for obtaining deep insight. During the ATRM and Chulha interviews, the designers were familiar to the local people, leading to more information being shared, and more dialogue. However, the ODK also helped in building rapport during the interview. During both studies, curious family members or community members stopped by or interfered during the interviews, which may have influenced participants' answers. Generally, the ODK made it possible to learn a great deal about the participants' lives in a relatively short period. It provided the designers with a way to let participants think deeply about their lives, and it encouraged them to communicate their experiences. Insights did not only concern explicit needs, insights were gained in issues of which the participants themselves did not seem to be consciously aware. One translator expressed his view that the ODK might also be a useful method for himself, as an indigenous social worker. The interviews also revealed several design opportunities for each product, see TEXTBOX II - V. However, the interview did not reveal underlying reasons for missing services, political influences, and socially accepted behaviour, neither information about collective capabilities, and social and environmental conversion factors. This type of meta-data should be gained before starting the interviews to limit the explanation time needed.

From a detailed time analysis it was found that the extra interview time noted in study 1 was mainly used to discuss the different themes (question cards) and to score the themes. The additional time for the question cards turned out to be important for deeper insight and detecting underlying reasons. However, these interviews were often less focused and were more interrupted, resulting in long interview times. In figure 6-62, a boxplot shows the

average percentage of the time that each theme was discussed for all interviews. No statistical relevance can be assigned to the number of interviews conducted, but the boxplot provides a good overview of not only the average interview time spent on each theme, but also on the dispersion of time spent on each theme in the different interviews. Important findings from the data analysis are that no large deviations from the average discussion time of the themes per participant were indicated, that some themes take more time to discuss than others, that the discussion time of the themes varied based on the product focus and that the discussion time per theme also depends on the attention the designer paid towards the different tools and themes.

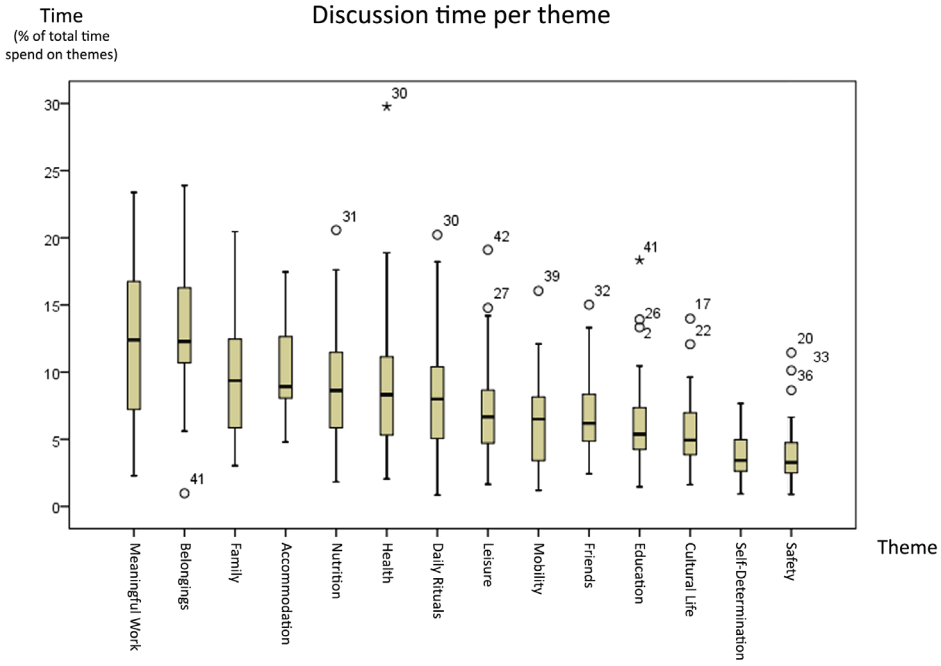


Figure 6-62: Overview of discussion time per theme in percentage of total amount of time spend on the question cards for all 42 ODK interviews

Procedure

Both designers noted that the interviewing tasks were too much for one designer. Conducting the interview individually led to not always asking follow-up questions when contradictory answers were given, or unintentionally skipping certain topics. Thereby, they could not discuss their interpretations of the interview afterwards. The designers' differences in prior experience in India influenced the interviews; the Lead Researcher had better knowledge of meta-data, which was helpful, but may also have led to biases and / or assumptions. Furthermore, the designers noted that matching the terminology with the local language improves understanding of the interview content by the translator and participants, that it is not always feasible to conduct the interview at participants' homes, that directly noting down

key insights, observed characteristics and behaviour during or after the interview helped when interpreting the data and detecting design opportunities, that conducting a local pilot before the study is valuable, and that the more interviews were executed, the easier it became to conduct them, as the themes and questions were more familiar making switching between topics easier.

Data analysis indicated that based on location (rural or urban), gender, income and occupation of participants, their interpretation and scoring of the themes and questions differed. The sample of participants is small and spread over different locations, and therefore no firm statements can be made, but this indicates the value of including a variety of participants. Then, lack of choice could be easily detected, but all opportunities available to a person and which options a person prefers above another are more difficult to detect, and identifying adapted preferences and how they influence people's use of choice proved difficult. Furthermore, the designers noted that observations, and participants' body language and tone during the interview also revealed valuable information, and sometimes triggered follow-up questioning, and that forcefully asking sensitive questions does not serve the goal of entering into dialogue, and that it is difficult to decide which topics might be sensitive. The influence of participant's characteristics and behaviour on the interview is not easy to ascertain. Only contradictions in answers could be noticed and questioned further. The differences between the designers, the translators and the participants was difficult to detect, but it was noticeable that the translators characteristics and behaviour influenced the rapport being built, the length of the interviews, the answers given by the participants, and the openness of the participants. It was found that the 5 to 10 minutes lasting instructions given prior to conducting the first interview were not sufficient for the translators to be thoroughly acquainted with the interview flow, that bringing pictures of life in the Netherlands generated interest and helped establish a relaxed conversation and did not worsen power relations, and that there was not always sufficient time to ask follow-up questions like *"why?", "how?"* and *"what else?"*

The designers noted that the 'touchstone tour' and 'show me' techniques provided an indication about the social status of the participants and the things they value. Thereby, the things seen during the tour could be used to start a conversation, stimulate dialogue, and to crosscheck some of the participants' answers. The timeline, mainly used during the Chulha interviews, turned out to serve as a good conversation starter, especially when not much prior rapport could be built. The participants often found the pictograms difficult to relate to, which resulted in additional explanation time. Incidentally, they also led to misinterpretation. Therefore, the neutrality and appropriateness of the pictograms need a critical review. The mapping and drawing exercise stimulated discussion and story sharing and also took the rush out of the interviews. It formed a direct line of communication between the designer and the participant when a translator was used, it offered the designer a way to check with the participant if the answer was correctly understood, and it provided an overview of the discussed items. However, while the designers did encourage the participants to map and draw, during most of the interviews, the designer had to place the visualization cards or do the drawing. The visualizing exercise was mainly confusing, as the number of visualization

cards was overwhelming, and it was difficult to find the 'answer' between all those cards. Finally, while there were only four importance categories, the scoring exercise gave a good view of people's priorities. Often it supported their answers, but it also led to additional questioning and dialogue when it did not. The pictograms used for the scoring exercise needed explanation, but all participants could quickly categorize the different themes when they were reminded what the pictogram represented.

Content

For an extensive overview of results regarding themes and questions, see Appendix E4. Regarding the themes, it was found that the discussion time per theme greatly varied, and that some themes comprised unconnected topics, which made the designer switch between cards often. It might therefore be better to separate some topics into new themes to stimulate the flow of the interview, provide a better indication towards the participants about the interview progress, and to aid the designer to be flexible when switching between the question cards. The terminology of the theme names did also not always match the contents. Regarding the questions, not all questions were properly understood by the translator and/or participant. The themes 'Cultural Life' and 'Education', and the topics 'Income', 'Products', 'Information' and 'Decision Making' deserve more attention regarding stimulation of dialogue, they comprise either too few questions or too many closed questions. The themes 'Accommodation' and 'Health' missed out on some topics about which questions need to be added. The questions should also be critically looked upon regarding relevance, and even distribution in order to manage expectations and to reduce the length of the interview.

Conclusion of micro-try-out

The extensive micro-try-out revealed several areas for improvements to the ODK, both regarding the procedure and the content. Generally, the interviews led to comprehensive insights for the designer and new insights for the participant. Most translators were enthusiastic and interested in the ODK. During the study 1 interviews, focus was occasionally lost, leading to interviews lasting more than 3 hours, which included a great amount of chitchat. The study 2 interviews were too short to pose follow-up questions, and did not provide deep insight. Therefore, the interviews should neither be too short, nor too long. These findings resulted in changes being made to the ODK, which are presented in TEXTBOX III, IV, V and VI.

TEXTBOX III - Outcomes ODK interviews Mitticool refrigerator

The results of the ODK interviews regarding the Mitticool refrigerator are provided below. Some interview details are provided in table 6-2 and the outcomes are summarized in table 6-3.

Table 6-2: Interview details

No. of interviews	Duration (min.)	Average duration (min.)	Place of interview
5	35 to 142	102	4x home, 1x office

The participants indicated a longer food preservation time - which saves time as participants do not have to buy fruit and vegetables daily, a better taste of the food, and improved health as product impacts. It must be mentioned that the two participants who indicated a better health stated that this cannot be ascribed purely to the refrigerator, as the use of a water filter and the purchase of healthier food can also be reasons for improved health. Nevertheless, all participants ranked health/healthcare and nutrition as very important, which indicates they are concerned with these topics. In addition to this impact of the Mitticool refrigerator, it turned out that friends and family are important regarding the requirements of the refrigerator. The lower-middle income group participant desired an electric refrigerator as her –richer- friends and family had one, and because she would like to serve them cold drinks and ice cubes. The opinion of guests also came forward in another interview, where the participant was very concerned with healthy and hygienic food and serving it to guests. Furthermore, what came forward is that the refrigerator is generally perceived as an ecological, hygienic refrigerator and not emitting 'harmful gasses', and therefore aspired by high-income families. It is cheaper than an electric refrigerator, and does not require – and is therefore not dependent on – electricity.

Currently, Mitticool's marketing is mainly focused on the fact that the refrigerator does not require electricity, preserves food, and is able to store and cool drinking water. However, the refrigerator could also be marketed as a means to preserve nutrients, to serve healthy and hygienic food to family and guests. Another important aspect regarding marketing is the decision making. The buying decisions are mainly made by the husbands or the husband's father, sometimes in consultation with their wives, while the female family members actually use the product. Only one participant indicated that the whole family decided together. Marketing should therefore also be targeted at the male family members, and the benefits it brings them. In addition to these insights generated from the ODK questions, specific product questions were asked which also revealed some opportunities for improvement. First of all, participants use the refrigerator in different ways, as its use is not self-evident. Two participants were uncertain which products they could keep in the refrigerator. Some stored milk and medicines, others thought these items needed an electric refrigerator. Two participants initially struggled with the amount of water that needed to be applied, and two participants indicated water leakage. Mitticool does follow up with its users by asking for feedback and providing assistance, but a manual or use instruction, either visual or in words, could be of added value here. Second, two participants indicated their desire for a larger refrigerator. Therefore, the development of several sizes and/or shapes of the refrigerator would be of value to provide the user a choice. Third, one participant indicated that for the price of two Mitticool refrigerators one electric refrigerator can be bought. Price could therefore also still be a point of attention. Finally, some comments were made about the attractiveness and finishing of the product, which could be improved.

Table 6-3: Experienced impact of Mitticool refrigerator

Theme	Impact Mitticool refrigerator
Products	Natural food preservation besides electric fridge (2), natural food preservation (1), still desire for electric fridge (1)
Nutrition	Longer food preservation (3), less rotten/spoiled food (1), more natural and nutritious food (2)
Health	Improved health of children / husband in which the refrigerator might have played a role (2)
Time	Less often shopping (3)
Family	Decision making often by male family member (4)
Friends/Guests	Able to serve hygienic food (1), desire to serve guests cold drinks and ice cubes (1)

TEXTBOX IV - Outcomes ODK interviews ChotuKool refrigerator

The results of the ODK interviews regarding the Chotukool refrigerator are provided below. Some interview details are provided in table 6-4 and the outcomes are summarized in table 6-5.

Table 6-4: Interview details

No. of interviews	Duration (min.)	Average duration (min.)	Place of interview
2	32 to 55	43	2x home

One of the indicated impacts of this cooling box is the possibility to preserve food longer and thus spend less time on shopping. One family noted that they liked the portability of the refrigerator as they switched places every two to three years. Thereby, their current house only had one room, and the little space required for keeping the fridge was, in that respect, an advantage. The second family also indicated the size as a plus, and sufficient for a small family. The ChotuKool changed the participants' food habits; of one family the intake of dairy products increased, the other family now drink cold water. During the ranking exercise, both families indicated nutrition to be very important. Health was unfortunately not ranked during these interviews, but no health differences since the acquisition of the ChotuKool refrigerator were indicated by the participants.

Godrej already paid attention to portability, but no specific attention has been paid to people who are moving from place to place for work. This group can specifically be targeted by marketing, and the Godrej can look into the requirements of this group to see if they require a different design. Questions about decision making were only asked during one interview, so we cannot indicate who to address with the marketing strategy; male or female users. This aspect can be further investigated. Another opportunity might be to look into different sizes and shapes for different families. Its current size was considered by one family to be 'sufficient for a small family', but different families might have a different preference for size, shape and also the kind of products they want to keep cool.

Table 6-5*: Experienced impact of ChotuKool refrigerator*

Theme	Impact ChotuKool refrigerator
Nutrition	Longer food preservation (2). More dairy intake (1), more cold water intake (1). Nutrition is ranked as very important (2)
*Time**	Less often grocery shopping (2)
Mobility / Products	The cooling box is extra property, so they have to additionally move it along. For people who move often the cooling box is easier to move than an electric fridge (1)
Products	Sufficient for a small family (1)
Accommodation	Requires only little space in the house (2)
Friends/Guests	Able to serve hygienic food (1), desire to serve guests cold drinks and ice cubes (1)

* *Time is a resource, not a theme. Participants were not specifically asked about their use of the extra availability of this resource*

TEXTBOX V - Outcomes ODK interviews Anna Tasar Reeling Machine

The results of the ODK interviews regarding the Anna Tasar Reeling Machine are provided below. Some interview details are provided in table 6-6 and the outcomes are summarized in table 6-7.

Table 6-6: Interview details

No. of interviews	Duration (min.)	Average duration (min.)	Place of interview
4	72 to 170	129	2x reeling centre, 2x NGO office

All participants indicated that their productivity improved, thereby increasing their income and/or their available free time. They have less back and leg pain, because they no longer have to pedal. However, as the machines are currently placed on the floor instead of on a platform, they still suffer from physical problems. They also stated that the further processing of the yarn has become more difficult due to the different reeling process. As the NGO indicated that the reelers prefer to work in the reeling centres instead of at home, three participants were questioned specifically about this preference. All three of them indicated that they like working in the reeling centre with other women. Two of them stated they would like to have both options, so they can change workplace. The participants also commented on the look and feel of the machine. One participant indicated liking the small size of the machine, which is useful for cleaning and taking home. However, another participant clearly stated that the former machine was better looking, as its size enabled you to see it from a distance. No further questions were asked on this topic, and it needs further investigation, but status might play a role here. Mastery of a large machine might give this participant a sense of accomplishment and/or a certain status in the village.

The ODK questions provided insights into the participants' lives and the ATRM's impact. First of all, they all indicated that they made new friends. After becoming members of Self-Help Groups (SHGs) and working as reelers, they all made new friends in the SHGs, in the reeling centre and/or in other villages – which they did not go to before. Friends were ranked important or very important by the participants. A consequence for new reelers, who only work at home, will be that they are denied the daily encounters with other reelers. A second impact for all reelers is an increase

in income, which they use to improve their accommodation and nutrition, buy more products, mortgage additional land, buy more plants, buy a shop and / or save money. One participant indicated they could sell their cattle as they no longer need them as a source of income. A higher income has the additional advantage that it makes the reelers more valued by their husbands and family members. The participants indicated being more involved in decision making, and one indicated a better relationship with her brother and sister-in-law with whom she lives. Family was ranked as very important by all participants. Third, due to the instalment of solar panels to run the machines, electricity is also available for the households. Two participants were recently connected to the grid, but indicated that the solar panels are more reliable. Fourth, concerning mobility, all participants indicated that they travel more and even sometimes alone, which was previously not allowed by their husbands and / or family members. Mobility was ranked by three participants as being 'a little bit important'. Fifth, two participants have less fear of going out in the dark, although one of them is still afraid of the questions she might get from family members if she stays out late. Lastly, one participant mentioned that they are also able to visit other doctors in places further away. Possible other impacts, mentioned in Mink, Parmar, et al. (2014), such as colour preferences and higher risk of child labour due to ease of use were not detected during these interviews. These topics were discussed with the other stakeholders. The final choice of the machine colour was chosen to be brown, because that contrasts best with the yarn. Daughters do sometimes take over their mother's work in the reeling centre, but only after school.

Concluding from the above, design opportunities for the ATRM mainly concern the preference of working space (at home or in the reeling centre), which is associated with friends and convenience. The look and feel of the machine deserves further attention, especially the importance of status the machine gives the reeler is worthwhile investigating. Moreover, mechanical improvements might make the further processing of yarn easier. A last point of attention is the reelers' working situation, as the current placement of the machines does not facilitate an optimal working posture.

Table 6-7: Experienced impact of Anna Tasar Reeling Machine

Theme	Impact Anna Tasar Reeling Machine
Products and Services	Reliable electricity from solar panels for reeling machines, personal usage is not free of cost (4), bought additional products (4), such as television, mobile phone, clock, bicycle, gas, light bulb, water pump, clothing
ATRM product	Like the small size for cleaning and moving (1), like the former size as you could see the machine from a distance (1)
Meaningful Work and Animals	Some animals sold that take too much work (1), additional animals were bought (2)
Nutrition	Better quality / variety of food (3), more often meat (4), can now eat what they want (2)/ can eat sufficient food (2)
Accommodation	Further improved houses (3): better walls, better roofs, more rooms. Build a new house (1)
Land	Able to purchase land (2), take mortgage on other people's land (2), able to cultivate own paddy (1)
Plants	Increased amount of trees (2), like to plant more trees, but own no land to do so (2)
Income	Improved (4) and used to improve accommodation, nutrition, buy more products, mortgage additional land, buy more plants, buy a shop and/or save money for e.g. education of children, life insurance policy
Leisure time	Improved due to faster reeling (1)

Mobility	Travel more and more – not specifically due to the new machine, gradually they are allowed more by their male family members (4). The women dare more and are allowed more, their travel gradually increases: travel out of state (1), travel out of district (2), travel by motorbike with family or PRADAN (2), travel by bus with other women or PRADAN (2), travel by train with other women or PRADAN (2)
Health	Able to visit doctors further away (1), ATRM is less tiring for the legs (4) and back (1), but placed on the floor it is still causing physical problems
Safety	No safety problems (2), less to no fear to go out at night (2)
Family	More involved in decision making due to earning money (3) – not specifically due to new machine, also due to former machine. More valued by brother and sister-in-law due to earning more money (1). Family is ranked very important by all participants
Friends	More friends due to reeling activity and / or SHG meetings, but same number of friends after shifting to new machine (4). Friends were ranked important or very important

TEXTBOX VI - Outcomes ODK interviews Philips Chulha

The results of the ODK interviews regarding the Anna Philips Chulha are provided below. Some interview details are provided in table 6-8 and the outcomes are summarized in table 6-9.

Table 6-8: Interview details

No. of interviews	Duration (min.)	Average duration (min.)	Place of interview
31	16 to 54	33	31x home

When asking the participants about how satisfied they are with their Chulha, and if they see any possibilities for improvements, most indicated they were satisfied and did not want to make any adjustments. However, when asking the ODK questions, most of them opened up. It turned out that five participants could no longer use their smaller vessels as the holes of the Chulha are larger than those of their old stove, and one other participant had to buy new vessels. Five participants use more firewood than before instead of less, as they fill up the stove's fuel compartment. Several participants indicated that water enters the chimney when it rains, and others that smoke enters the house due to a broken chimney or via the second pothole. Furthermore, one participant indicated desiring a larger stove, another participant would like a stove that is easier to clean, and three participants made decorations to make the Chulha look better. What also became apparent is that the stoves of these participants were often implemented without their proper consultation, and often free of cost (sixteen participants were given the Chulha for free, four participants paid, and for eleven participants it is unknown whether they paid or not). The main reason for implementation of these stoves is to reduce the deforestation of the surrounding forest – a local government priority. As not all of the participants specifically chose to purchase the Chulha, they might not be aware of its intended use and benefits, which most certainly influences the way the stove is used.

The ODK questions revealed the main impact of the Chulha, which is time gain due to quicker food preparation, less firewood collection, and less washing of the less blackened vessels. This time is spent in different ways. Most participants indicate they do more household work, take up

extra paid work, spend more time with family and friends and/or relax more. Some participants indicated spending more time on caring for plants, trees and animals, religion, or more study. Taking up extra paid work results in extra income, which is mainly spent on food, education or religion. In one case, it also resulted in more friends due to a better status. Another impact concerns health: sixteen participants indicated they suffer from fewer health problems. Five participants indicated no change in health or a change not due to the Chulha. Third, the collection of firewood is experienced as being unsafe by some participants due to wild animals in the forest. Seven of them indicated an improved feeling of safety as they have to collect less firewood. Fourth, due to the Chulha, four families now prepare new types of food, three prepare special food more often, and one participant indicated that the taste of the food has improved.

The interviews indicated several areas for improvement. The size of the potholes in different implementation areas is a point of attention, a solution to cover the potholes can be added to prevent smoke entering the house, and a solution to prevent rain from entering via the chimney can be developed. Moreover, the fuel compartment can be made smaller, different stove sizes can be developed, cleaning can be made easier, and possibilities to decorate the Chulha can be facilitated. Lastly, marketing and implementation is also a point of attention. Decisions are made by the husband (7), wife (6), both (1), or the husband's father (1). In one case, a student who lives with and takes care of his grandparents makes the decisions. The marketing should thus not only be targeted towards female users, but towards the whole family. Thereby, there are benefits of the Chulha that can be emphasised during marketing: the advantages do not only concern less smoke and less firewood collection, but, depending on the former type of stove and the cooking fuel, it generates heat quickly - which saves cooking time and allows people to cook different types of food, and it blackens the vessels less - which saves washing time.

Table 6-9: Experienced impact of Philips Chulha

Theme	Impact Philips Chulha
Family	More time to spend together (14)
Friends	More time to spend together (8), more friends (3), better status due to more money (1)
Meaningful work	More time for household activities (16), paid job (9), taking care of animals (2), study (1)
Plants and trees	More time to take care of plants and trees (1)
Leisure time	More time to relax (8)
Religion	More time to spend on spirituality (1), more money to buy items for worship (1)
Nutrition	Able to prepare new types of food (4), more often preparation of special food (3), extra money to spend on food (5), better taste of food (1)
Health	Less eye burning, coughing and headache (16), no change in health or change but not due to Chulha (5)
Safety	Safer due to less firewood collection in the forest (7)
Products	New vessels (1), cannot use smaller vessels anymore (5)
Education	More money to spend on children's education (2)

6.4.2 Walkthrough: Group discussions with D-Lab students

The ODK was reviewed by novice designers from D-Lab at the Massachusetts Institute of Technology (MIT) in order to obtain insights into their perception of the ODK's effectiveness and relevance, but mainly to discuss the contents of the ODK – the themes and topics that the ODK addresses.

Evaluators of walkthrough

D-Lab stands for 'Development through Discovery, Design and Dissemination' and offers courses to encourage MIT students to develop technology targeting global poverty issues[22]. Eight D-Lab students took part in the walkthrough evaluation. Students who were taking classes at D-Lab at the time of the research project, were asked to participate. The requirements set were: having executed a Design for Development (DfD) project and having been into the field during this project. To stimulate participation the students were offered a voucher. There were twelve applicants of which eight were selected, based on the diversity of projects that they had worked on. For a full overview of participant characteristics, see Appendix E4.

Method of walkthrough

After selecting the eight students / graduates, each evaluator individually received a 'sensitizing package'. As explained by Sleeswijk Visser et al. (2005, p. 6) such a package comprises activities to prepare evaluators *"to access their experiences and to express and discuss these in the group sessions"*. The sensitizing packages (see figure 6-63) consisted of:

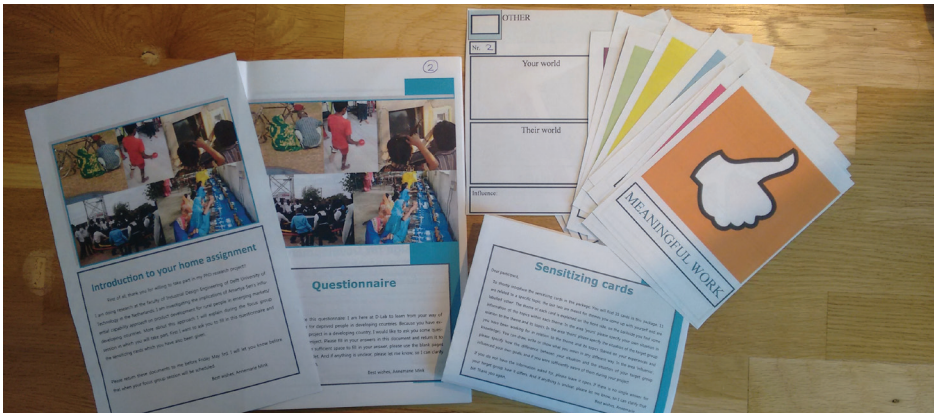


Figure 6-63: Contents of the sensitizing package

- An introduction about the research and the goals of the activity;
- A questionnaire containing questions about the evaluator's background, view towards DfD, and experience in DfD projects. For one specific project, they were asked to think deeper about the things they encountered (challenges, recommendations, unique conditions of the people), in order to make them refer back to this project.
- A set of 'sensitizing cards' with the thirteen themes on it and a short description of what

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each theme entails. They were asked to think of how things are regarding each theme for their own world and for the world of the people they designed for in the developing region. They were also questioned about the influence of that theme on the project they executed. Two blank cards were added which the evaluators could use to add topics that they thought of themselves.

The sensitizing package and more specifically the sensitizing cards, were meant to make the evaluators think about their own projects specifically before the focus group session, and to acquaint them with the themes. The questionnaire was designed to obtain insight regarding the evaluators' perceptions towards the themes and topics.

After receiving the completed sensitizing packages from the students, the researcher read through all the information in order to prepare for the focus group sessions. The eight students were divided into two focus groups. Students who had been working on the same project or who had taken part in the same class with different projects, and male and female students were divided across the two focus groups. The focus group session comprised:

- A short introduction of all projects and evaluators, to get them acquainted with each other and each other's projects;
- A discussion about if, when and why designers should go into the field, and what they should do there;
- A discussion about user context research and what is required when conducting that research;
- An individual exercise where the evaluators had to rank the themes in order of importance for their design project as view at their projects now, and which they considered during their project. The differences were discussed in the group;
- A discussion about the completeness of the themes and the effectiveness of using them.

All outcomes were analysed in order to judge the adequacy and completeness of the themes and their perceived usefulness for DfD projects.

Results of walkthrough

An extensive overview of evaluators' comments on the ODK's content and procedure, and on the effectiveness of the themes can be found in Appendix E4. The sensitizing package acquainted the evaluators with the themes and topics; the questionnaire provided insight into evaluators' perceptions towards the themes and topics (see figure 6-64 and 6-65).

Figure 6-64: Filled in sensitizing package
Figure 6-65: Filled in sensitizing cards

The focus groups (see figure 6-66 and 6-67) resulted in the evaluators' perceptions regarding the procedure of conducting user-context research, the evaluators' opinions regarding the themes and topics, and the effectiveness of using them during the different phases of the design process.

Figure 6-66: Individual exercise during focus group session 1

Figure 6-67: Group discussion during focus group session 2

Content

All evaluators pointed out that a proper understanding of the problem and consideration of the design's impact are key. For seven evaluators, reflecting on their own projects with the themes in mind, shed a new light on their projects, broadening their perspective (WT 2, 3, 4, 5, 7 and 8). Evaluator 4 indicated that during the project *"I was more focused on the, like, parameters of the technology"*. Only evaluator 6 was not fully convinced of the relevance of considering the themes for her project specifically, although she did indicate to have *"picked up a lot from this"*. Table 6-10 presents the themes the participants considered during their project and the themes they considered relevant when looking back at their projects.

Table 6-10: Themes considered during the project and themes considered relevant looking back with hindsight

	WT1	WT2	WT3	WT4	WT 5	WT 6	WT 7	WT 8
Amount of themes considered to be relevant at this point in time	8	9	7	5	10	3	13	9
Amount of themes taken into account during the project	2	9	5	3	8	1	5	2

All evaluators agreed that it is relevant to consider the themes during the analysis phase. Evaluator 2 stated: *"It is good to have an understanding of all these things"* in order to "*get to know people better"*. Evaluator 3 argued: *"These are things that you could talk to people about."* Evaluator 8 commented that *"This is just a really clear way of looking at things that are easy to be chaotic"*. The evaluators mentioned several new topics related to all thirteen themes, and also specifically added two topics apart from these themes:

- Environment: pollution
- Finances: income, investments, savings, taxes, money at hand, choices

For a full overview of all topics mentioned, see Appendix E4.

Three evaluators (WT2, 3 and 6) expressed their concern about the time it would take to get to know the ODK content, and to question potential users about all these themes: *"It is like a whole project in itself to get the information"* (WT2). Evaluator 4 thereby pointed out that after gathering the information, it also needs to be transformed to a usable form for incorporation in the design process, which also takes time. Moreover, evaluator 4 argued that not all themes can be addressed in every project and that not everything can be foreseen in advance.

Procedure

Regarding the prerequisites, the evaluators stressed the importance of having a community partner and agreed that it is important to go into the field, preferably throughout the full project. Regarding the steps, the evaluators agreed that it is important to gather information in the analysis phase of the design project, before going into the field, as well as in the field. Regarding the guidelines, the evaluators noted the language barrier and working with a translator being a frustrating issue, and pointed out several political and planning obstacles they encountered in the field. They also stressed the importance of proper phrasing of questions, of being aware of how you are perceived by the potential users, and of proper compensation for participants' time. They also noted that *"A lot of things become everyday life, making me unaware of stuff"* (WT6).

Conclusions of walkthrough

The ODK helped the evaluators to look at their projects with different eyes. They broadened their views beyond parameters relevant for their project and realised that it would have been useful to look more into the cultural and social impacts of their technologies. They all agreed that it is relevant to look comprehensively and to consider all themes, especially during the phase of information gathering, before problem framing. However, they also indicated that this broad approach is time-consuming, and that this time is often not available. In most projects, not much time can be spent in the field, mainly due to time pressure of the curriculum. Thereby, the evaluators acknowledged that not all themes can be addressed by one project and that not all consequences can be foreseen beforehand.

6.4.3 Expert consultation: Interviews with D-Lab staff

Staff members from D-Lab were interviewed to gain insights in their perception of the ODK's effectiveness and relevance, but mainly to discuss the contents of the ODK – the themes

and topics that the ODK addresses. As explained above, D-Lab stands for 'Development through Discovery, Design and Dissemination' and offers courses to MIT students to develop technology directed at targeting global poverty issues.

Evaluators of expert consultation

Twelve staff members of D-Lab took part in the expert consultation. They had different roles within D-Lab at the time of the interviews and gave different classes, such as D-Lab Design, D-Lab Development, D-Lab Energy, and D-Lab Scale-Ups.

Method of expert consultation

The expert appraisal focused on the ODK's themes and topics. During the interviews, the participants were asked to introduce themselves, and share some of their experiences, before being asked to reflect on the resources and conversion factors mentioned in chapter 4. They had not been given the set of themes and topics, in order to keep their minds open and not to fix their thoughts on these themes. By questioning them about resources and conversion factors, they were stimulated to share stories about topics they encountered during their own projects, and that they considered relevant in the lives of the potential users. The evaluators were specifically asked about their experiences with DfD projects. All interviews were structured, individual interviews, following a predetermined list of questions. The interviews were voice-recorded, transcribed and analysed in order to judge the adequacy and completeness of the themes and their perceived usefulness for DfD projects.

Results of expert consultation

A mix of evaluators took part in the expert appraisal. The evaluators differed in gender, background, experience and expertise. An overview of participant characteristics and their suggestions for the list of themes and topics can be found in Appendix E4. The interviews lasted on average 103 minutes, with the shortest interview lasting 70 minutes and the longest interview over 186 minutes.

Content

Due to avoiding steering of thoughts of the participants, many themes and topics came up. Many of these are already part of the ODK, but others were not. For all existing 13 themes new topics were mentioned (see Appendix E4). Besides those, new themes also came up:

- Environment: climate and climate change, environmental sustainability, habit of throwing things away, waste, contamination, weather (sun, rain, rainy season, humidity, dust, drought, heat, cold, wind), proneness to natural disasters (earthquakes, hurricanes, flooding, volcanoes, seismic activity), presence of sea / ocean/ water;
- Energy: Energy, electricity source (solar, wind, diesel), reliability and stability of power;
- Land: ownership, size, soil quality;
- Finances: income, money at hand / ability to pay / purchasing power, financial resources, expenses, spending, financial constraints, economic situation / standard of living / financial structure, willingness to pay, dignity / pride, investments, capability of investing, access to credit / financing mechanisms, financial literacy, risk adversity;

- Time: available time / lack of time, number of activities to do in a certain amount of time, priorities, value of time, time management, time spending, options / choice, flexibility of time;
- Spirituality & Beliefs: religious / spiritual differences, religious constraints, beliefs: legends, curses and their origins, perception of going to church, conviction, respect towards other religions and perceptions, sacredness, prescriptions, time consumption of religious activities;
- Government & Rules: Government tasks / facilities / programs, legal and political situation and structure, political environment, regulations, access to legal system, government focus, quality of policies, political requirements, clearances, power of politics, failing systems, bribes / corruption / healthy political and legal institutions, public officials, amount of bureaucracy, co-operation, subsidies / programs, support, approval, protection, danger of sharing information.

Procedure

Regarding the prerequisites, all evaluators acknowledged the importance of going into the field for understanding the user. It was indicated that it is important to consider who to approach in order to gain access to participants. Regarding the steps, the experts noted the challenge of dealing with different meanings and words, and provided tips for improving the introduction and building dialogue. They also indicated that the gift to be given to participants is context dependent. Regarding the guidelines, they stressed that it is relevant to be aware of the way that outsiders are perceived in the community. Furthermore, most experts indicated that there are differences in opportunities due to gender, age or class. It is therefore important to include a variety of participants. Moreover, evaluators mentioned the challenges of obtaining access to an unbiased sample of users and the difficulty of putting aside own beliefs, assumptions and biases. Lastly, the importance of building trust, respecting participants' knowledge and time, and truly listening, was indicated.

Conclusions of expert consultation

These experts mentioned several topics that are relevant for consideration in the ODK. They all agreed that it is necessary to obtain comprehensive user insights and to really get to know the potential users, but some also acknowledged that budget and time often constrain the time in the field.

6.4.4 Changes to the Opportunity Detection Kit resulting from iteration 4

Based on the feedback from the evaluators of the micro-try-out, walkthrough and expert consultation, several changes were made to the ODK elements. These are presented below. Figure 6-70 gives an overview of the changes made to the ODK in this fourth iteration. An overview of the adjusted prerequisites, steps and guidelines can be found in Appendix C5, an overview of the adjusted themes and questions can be found in Appendix D5.

General

Before conducting ODK interviews, it is important to establish relationships with the

participants. This makes the interviewing easier and results in more story-sharing and dialogue. After conducting ODK interviews it is useful to discuss the insights in a larger group of potential users and with different stakeholders to validate the findings, to distinguish between incidents and generalizable insights, and between rational and irrational desires. Both these points are part of the CDD approach, but their importance came forward during this fourth iteration and is therefore stressed here.

Prerequisites

Three prerequisites were distinctly mentioned by the evaluators, and were adjusted accordingly:

- Prerequisite B: Activities should be conducted in pairs. ODK interviews should be conducted with a minimum of two persons. It was added to this prerequisite that, even when researchers are familiar with the ODK procedure and content, and bring a voice-recorder, it is difficult to focus on the questions while visualizing.
- Prerequisite C: In the field. It was added that it is important to go to the field, preferably throughout the whole project, but if that is not possible, at least at the beginning, prior to problem definition, and during prototyping, in order to obtain feedback and make adjustments to the design.
- Prerequisite F: Local partnerships. Requirements for and benefits of the community partner are added: a community partner should be someone who understands local things and is respected by the people, in order to figure out what to do, help provide access to an unbiased selection of participants, and to be properly introduced to the local people as professionals. The community partner can explain the best way of obtaining access to a community and about hierarchical structures.

Steps

The following steps were added:

- Obtain meso and macro data beforehand. To get out the most from the ODK interviews, it is important to become familiar with general information about the potential users and their context, such as political systems, and social systems, such as healthcare and education systems. Getting to know more about social and environmental conversion factors saves time during the interview. The information can be gathered from internet and literature searches, by consulting people from the area, people who have worked in the area, and people who are familiar with the area, or by consulting local partners. However, designers must be aware that other people have their own bias and interpretation. It therefore remains important to actually go into the field to experience the situation. Thereby, by collecting information designers have to be aware not to become biased and take along assumptions and preconceptions.
- Conduct a local pilot in the field. By conducting a pilot, the designer becomes familiar with the ODK content and procedure. This pilot can be done in the home country, but by conducting a local pilot, sensitivities and terminology becomes clear. Especially when using a translator, it is relevant to conduct the pilot locally, as in this way the translator also becomes familiar with the ODK content and procedure.

The following steps were adjusted:

- Step 1: Get familiar with the ODK. It was added that by being familiar with the themes and questions, it is easy to switch between them, offering flexibility which improves dialogue building.
- Step 2: Localize the content, if time permits. The following text was added: locally discuss the ODK contents beforehand. As accents, words, expressions, dialects and pronunciations might be different, and words might mean different things in different regions, it is important to make sure the translator and the participant have the same understanding of themes and questions. To adjust wordings to local dialects and to become aware of sensitivities, it is important to discuss the themes and topics with people familiar to the potential users and their context.
- Step 3: Carefully select and instruct a translator (if required). It was added that it is important to get the translator acquainted with the ODK content and procedure. If a local pilot cannot be conducted, make sure the translator is properly introduced to the ODK.
- Step 7: Introduce. During the introduction, it is important to clarify how much time the interview will take in order to manage participant and translator expectations. The amount of time can be estimated based on the duration of the local pilot.
- Step 11: Sit down and build dialogue. The following aspects will be added: by bringing pictures of their lives in their home country, designers can share themselves, resulting in a more relaxed atmosphere. However, the designers should be aware that the pictures can also emphasise power differences, and therefore carefully select their pictures. It is important to connect to the local people and become comfortable with each other. The tips & tricks for appropriate behaviour and attitude should therefore be followed. It is useful to start with themes and questions that the participants find important, and it is truly important to have an open mind and not assume anything.
- Step 12: Thank the participant. In the ODK guide, the need to think about appropriate compensation for the time participants invest has been emphasised. It will be added that: compensation, food and gifts, depend on the context, and on the duration of the interview. It is important to find out what the people in the area find valuable. This can be decided on in collaboration with local partners.
- Step 13: Document. It was added that: before *"things become everyday life making [the designer] unaware of stuff"* (WT6 of the Walkthrough), it is important to note down key insights and specifics directly after the interview. As designers do not have the time to fully transcribe all interviews, these notes aid in detecting design opportunities and communicating outcomes to team members. Tips and tricks are provided regarding what to pay attention to when documenting.

CDD Guidelines

The following guidelines were added:

- Schedule more time than planned. The evaluators mentioned several reasons for things taking more time in the field. Reasons added to the guideline are: dependency on other people, differences in punctuality, religious breaks, unavailability of electricity, internet access or the required materials, limited infrastructure, and limited access to stakeholders.

- Be aware of your position. Local people perceive the designer in a certain way. Because the designer is an 'outsider' it can be dangerous to walk around and talk to people, the designer might be perceived as interesting to talk to, as professionals or experts, or can be distrusted or not being taken seriously. It is important to be aware of the influence of age, gender and clothing, and how these are perceived by participants.

The following guidelines were adjusted:

- CDD guideline A: Select a variety of participants with different characteristics for a broad range of insights. This guideline was emphasised. The fact that it is not always possible to talk to an unbiased sample of participants, as some people are difficult or even impossible to reach was added; what is possible often depends on the community partner.
- CDD guideline B: Appropriate behaviour and attitude. During the expert consultation it was stressed that it is important to have an open mind, to build trust, to respect participants and their time, to treat them as experts and to truly listen without beliefs, biases, and making assumptions. These aspects have been stressed.
- CDD guideline D: Observe, listen and document everything. Step 12 already prescribes that the outcomes must be immediately documented after each interview. This guideline offers tips & tricks about 'what to pay attention to'. Additions to these tips & tricks following from the evaluations are:
  - Observations during the interviews are a useful means to check and interpret answers, and valuable when starting and continuing the dialogue. Observe during the touchstone tour, but also observe the participant's behaviour and body language.
  - Keep an eye on intonation.
- CDD guideline F: Instruct and select a translator. For this guideline, it needs to be stressed that not all translator characteristics can be controlled, but with a proper selection and instruction, the translator can be guided to reduce the translator's influence on the outcomes. Besides tips & tricks for selecting and working with a translator, it is also good to be aware of the challenges. The following challenges were incorporated in guideline J:
  - The translator forms a disconnect between researcher and participant, as participants often focus on the translator which limits the building of rapport
  - Translators differ highly in motivation, understanding and skills.
  - Some additional tips & tricks were added about working with a translator:
  - It is difficult to decide at whom to look. Do not forget that the participant is the one being interviewed, not the translator!
  - Be aware of the way the translator is asked questions, especially if the translator directly translates everything said.

ODK Guidelines

The following guidelines were added:

- Time and place of the interview. It is useful to conduct interviews at homes to combine interviews with observation and to create a comfortable setting.

The following guidelines were adjusted:

- ODK guideline C: Duration of interviews. It was added to the guideline that interviews

should not be too short to enter into a dialogue and make participants open up, but also not too long as then it becomes more difficult to keep focus. The time for the ODK interview was set at 1.5 to 2.5 hours.

- ODK guideline F: Dealing with sensitive questions. The following information was added to this guideline: sensitive questions should not be forcefully asked, just because they are in the ODK. It is not always possible to obtain answers to all questions, but that is also not required. Participants must be free to share what they want and remain comfortable. An unwillingness to answer questions also provides valuable information.

Themes

The 13 themes have been divided in 21 themes, and several theme names were changed. These changes are clarified below. An overview of all themes can be found in Appendix D5.

- In order to come to a more even distribution, the five themes that took longest to discuss were split into different themes, and the themes that took very little time were expanded. Some topics still consume more time than others, and this might change depending on the project purpose, but a more even distribution of conversation time per theme makes the ODK interview more comprehensive for the designer, as it is easier to switch between different question cards. Thereby, it improves the translators' and participants' expectations and stimulates a more flexible dialogue. The following changes were made:
  - the theme 'Health' was divided into 'Health' (mental and physical) and 'Healthcare';
  - the theme 'Belongings' was divided into 'Products', 'Plants' and 'Animals';
  - the theme 'Meaningful Work' was divided into 'Meaningful Work' and 'Finances';
  - the theme 'Family' was divided into 'Nuclear Family' and 'Kindred Family'. Thereby, the topic of decision making was placed under a new theme 'Speaking Up';
  - The theme 'Accommodation' was divided into 'Accommodation' and 'Land';
  - the themes 'Safety' and 'Self-Determination' were expanded, mainly by adding questions that stimulate dialogue (see under 'questions').
- The theme 'Cultural Life' was not much discussed, but this theme comprised very different topics. It was therefore split into 'Spirituality' and 'Politics'. Questions were added that stimulate dialogue for both themes. The topic 'Habits' was moved to the 'Timeline Tool'.
- 'Religion' was changed to 'Spirituality' as spirituality is broader than religion, leaving more room for dialogue.
- 'Plants' was changed to 'Nature' as nature is broader than plants, leaving more room for dialogue. It also includes pollution.
- 'Speaking Up' was added as a theme, not only to include speaking up in a family situation, but to broaden the theme to speaking up in public as well.
- To guide designers in the topics some of the names were changed:
  - 'Safety' was changed back to 'Safety & Security' as it includes more than safety.
  - 'Self-Determination' changed to 'Dreams and Plans' to better fit the content and to reflect 'everyday language'.
- 'Income' was added as a theme, including income, savings and expenditure.

Questions

The number of questions has increased from 87 to 275, in order to cover all the topics indicated by the micro-try-out, walkthrough and expert consultation. Not all questions have to be asked, but they help when starting a conversation. An overview of all questions can be found in Appendix D5.

- It is important to ask follow-up questions to probe deeper in order to reveal existence and sense of choice, choice making behaviour, adapted preferences and underlying reasons. It will be clearly pointed out that designers need to keep on questioning *"why?"*, *"what for?"*, and *"what else?"*.
- All questions were reconsidered to ensure unambiguous formulation in order to prevent misinterpretation. The right wording and sensitivities have to be discussed locally (see 'steps').
- Questions about change were added to each theme.
- Questions were added to the timeline in order to obtain more information about perception of time and activities during the day.
- Questions were added to 'Land, 'Education and Information', 'Leisure', 'Dreams and Plans', 'Safety and Security', 'Politics' and 'Spirituality' in order to open up more dialogue.
- Areas in which information can be obtained were added to 'Education and Information' and areas about which decisions can be made to 'Speaking Up' (e.g. information about education, transportation, and decisions about family, household). These areas can be used by the designer if the participant is unable to give an answer.
- Questions about when participants go for treatment and a question about obtaining medicine and medical devices were added to 'Healthcare' in order to obtain information about affordability, and comprehension of diseases. Questions about the presence, distance and accessibility of a dentist and hospital were also added to 'Healthcare'
- Questions about hygiene, sanitation, and prevention of illnesses were added to 'Health'.
- Questions about feeling hungry, food preferences, having a refrigerator, and where participants get their food were added to 'Nutrition'.
- Questions about schools, languages, devices that aid in obtaining information and usefulness of obtained information were added to 'Education and 'Information'.
- Questions about law enforcement and conflicts were added to 'Safety and Security'.
- Questions about safety to travel, time and distance of travel were added to 'Mobility'.
- Questions about location, legality, ownership, use and fertility of land were added to 'Land'.
- Questions about perception towards outsiders, value of friendships and acceptance in the community were added to 'Significant Relationships'.
- Questions about communication and family pressure were added to 'Nuclear Family' and 'Kindred Family'.
- Questions about 'Products and Services' were made to focus more towards household products, communication products and transportation products and services. Questions about preferences towards these different products were added, as well as a question about available energy sources.

- Questions about the reason for keeping animals and having sufficient food for animals were added to 'Animals'.
- Questions about pollution, waste, climate and natural dangers were added to 'Nature'.
- To obtain more information about why certain work activities are executed, the following questions were added to 'Meaningful Work': what participants dislike about their activities, why they choose to do this type of work and how they learned to do that work. A question about the work that family members execute was also added.
- A question about feeling free to do nothing was added to 'Leisure'.
- Questions about feeling free to express political views and to participate in political activities, as well as questions about government support were added to 'Politics'.
- Questions about people's perception about other religions and about religious rules were added to 'Spirituality'.
- Questions about feeling in charge of their own lives, deciding themselves what they want to do and satisfaction with their lives were added to 'Dreams and Plans'.
- Questions about income, expenses, money at hand and savings were added to 'Income'. To obtain information about social status and getting to know more about the money people have at hand, a question about choosing what to spend money on was also added.
- Questions about speaking up and confidence were added to 'Speaking Up'.

Techniques

All the techniques were kept the same, only the visualization technique was discarded as it consumed too much time and was perceived as being overwhelming and confusing. The drawing and mapping techniques will remain so as form a direct line of communication with the participant.

Tools

- The timeline was given a more prominent role during the ODK interviews, in order to obtain information about daily rituals, habits and customs.
- The visualization cards were discarded. They generated interest, but were found confusing during the interview, and directed the participants towards certain answers.
- The pictograms were critically reviewed and adjusted to be more neutral and appropriate. Additional pictograms were developed for the new themes (see figure 6-68).
- The question cards were adjusted for the new themes and additional questions. Figure 6-69 provides an example of the question card for 'Meaningful Work'.

Figure 6-68: The new themes visualised

MEANINGFUL WORK

Do you feel you can enjoy your normal day-to-day activities?
Do you feel you play a useful part in your normal day-to-day activities?
Do you feel appreciated in your normal day-to-day activities?

What kind of work do you and your family members do during the day?
Who does the household work?
When do you work (time/day) and what kind of activities do you do? Why?
How did you choose your work? Where did you learn to do your work?
What do you like best about your daily activities? What do you dislike?
What are you good in at your work? Do you feel appreciated in your work?
If applicable: Do you have a boss/co-workers/employees? / Do you have a good contact with them? / How long do you know them? / Do you meet your colleagues also outside working hours? / Do you feel accepted at work?
Did anything change recently in your job of the jobs of family members?
Do you like the activities that you do in a day?
Is there anything else that you would like to do or like to change?

Continue to ask: WHY? WHY NOT? ANYTHING ELSE?

Figure 6-69: New question card for 'Meaningful Work'

Content	Procedure
Thinking framework	~~14 Steps~~ 16 Steps
10 Prerequisites	~~5 Interview guidelines~~ 6 Interview guidelines
8 Guidelines	~~6 Techniques~~ 5 Techniques • 'Touchstone tour' and 'Show me' • 'Mapping' and 'Drawing' and ~~'Visualising'~~ • Sorting
~~13 Themes & Questions~~ 21 Themes & Questions • Health • Nutrition • Accommodation • Mobility • Meaningful Work • ~~Cultural Life~~ • ~~Family~~ • ~~Belongings~~ • ~~Safety~~ Safety & Security • ~~Education~~ Education & Information • ~~Self Determinaion~~ Dreams & Plans • ~~Leisure~~ Leisure Time • ~~Friends~~ Significant Relationships • Nuclear Family • Kindred Family • Products & Services • Animals • Income • Nature • Healthcare • Speaking Up • Spirituality • Politics • Land	~~6 Tools~~ 5 Tools • 1 Big answer sheet • Question cards • Introduction card • ~~Visualisation card per theme~~ • Importance sheet with sorting cards • Timeline

Figure 6-70: An overview of the changes to the ODK due to iteration 4 (changes indicated in grey)

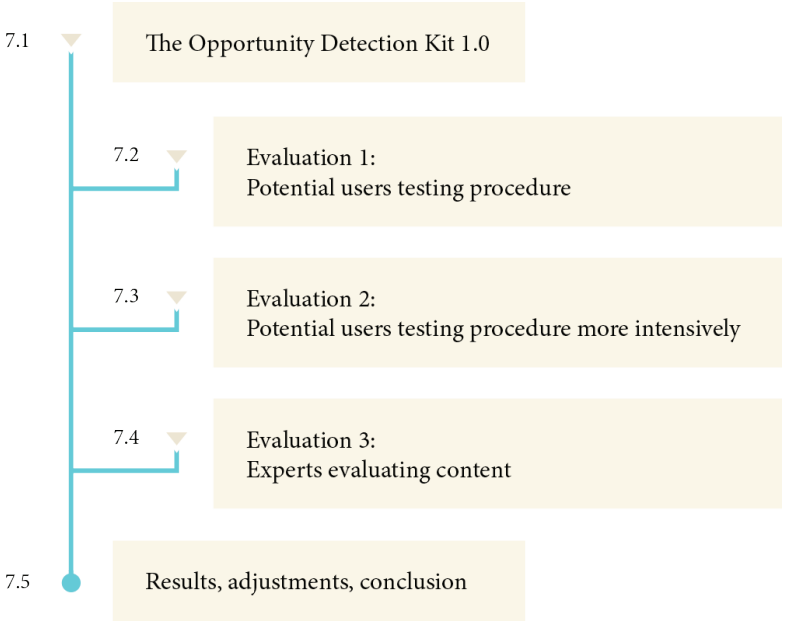
6.5 Conclusions and next steps

In this chapter the development of the ODK has been described. The ODK's content and procedure were defined and evaluated in four iterations focusing on either the procedure or content. The ODK underwent a significant number of changes to eventually result in the ODK 1.0. The ODK 1.0 consists of 16 steps, 6 guidelines (and 8 CDD guidelines), 21 themes with questions, 5 techniques, and 5 tools. As the aim of the ODK 1.0 is to help designers explore the user context and users' valued beings and doings by detecting capabilities, functionings, underlying resources and conversion factors, preferences, desires, needs, habits, values and choice making behaviour, the next step is to let design teams deploy the ODK during actual design projects in order to obtain feedback on its clarity, appeal, designer-friendliness and efficiency.

CHAPTER 7

Evaluating the Opportunity Detection Kit

In chapter 6, the Opportunity Detection Kit (ODK) was changed and developed to offer an interview method that guides designers to obtain comprehensive and deep contextual insights at the start of their design projects. However, until now this method has only been deployed by the researchers who developed it, to obtain insights at the end of design projects. This means that the ODK has not yet been deployed as intended: for use by design teams in order to inform the design process. Therefore, eight design teams were selected to use the ODK interview method during their Design for Development (DfD) projects. These projects provided insight in the designer-friendliness and efficiency of the ODK procedure. To evaluate the contents of the ODK, 53 experts were consulted in focus group sessions. In §7.1 the ODK 1.0 is presented, it is the result of the developments and refinements described in chapter 6. In §7.2 results are presented of the ODK evaluation by five novice design teams. Another try-out was conducted with three novice design teams who could and did use the ODK more intensively during their DfD projects. In §7.3, this evaluation and its results are described. In §7.4 the expert appraisal and its outcomes are presented. The evaluations led to adjusting the ODK to improve and refine the method. The main findings and adjustments resulting from the three evaluations are presented in §7.5.



7.1 The Opportunity Detection Kit 1.0

This section introduces the Opportunity Detection Kit (ODK) 1.0. Its main characteristics are described below. The full overview of the ODK's procedure (steps, guidelines, techniques, tools) can be found in Appendix C5 and of its content (thinking framework, prerequisites, themes and questions) in Appendix D5.

7.1.1 ODK Content

The content of the ODK 1.0 consists of the following elements which guide the individual interviews:

- Thinking framework. The CA-based thinking framework guides designers to focus on expanding people's capabilities (the real opportunities they have reason to value) as the end goal of their DfD project. It also guides designers to think holistically by considering people's resources, conversion factors and personal choice.
- Ten prerequisites. These prerequisites need to be in place in order to be able to conduct rigorous field activities.
- Twenty-one themes and questions. Table 7-1 gives an overview of the themes and the related topics.
- Questions for each theme. A set of 'ideal' and 'pragmatic' questions has been developed for each theme, covering all the themes' topics. Moreover, questions have been added to discover recent changes in people's lives, and their desires for life-changes. These questions function as conversation starters, not as a list to be strictly followed.

Table 7-1: Themes and related topics

Theme	Topics
Daily rituals (Timeline)	Daily rituals, daily activities. Customs. Freedom to live or to not live according to culture and habits. Time perception and spending.
Healthcare	Distance to doctor, hospital, dentist. Type of doctor. Ability to visit the doctor, hospital, dentist when required, frequency of visiting, doctor, hospital, dentist. Ability to obtain medical care and medicine when required.
Health I	Health problems, also in family. Health problems that obstruct daily activities. Use of medicine. Ability to fulfil wish for children. Availability of sanitation. Perception of hygiene. Perception of life expectation. Adequacy for valued beings and doings.
Health II	Amount of worries, stress, loneliness. Ability to sleep well. Happiness, proudness, perception of self. Receiving love, care, support. Ability to express and share feelings.
Nutrition	Diet, eating and cooking habits. Ability to sufficiently feed themselves and their family, ability to enjoy a meal and drinks when needed and/or wanted. Ability to eat sufficiently varied, and to eat sufficient meat, chicken, fish and vegetables. Food source. Ability to keep a stock of food, having a refrigerator. Ability to drink sufficiently healthy drinks. Adequacy for valued beings and doings.
Accommodation	Type of house, number of rooms. Time of acquisition. Ability to pay for the house. Sense of ownership / possession. Involvement in choosing the house. Freedom to move to another house. Changes made to the house, adequacy for valued beings and doings.
Land	Possession of land. Amount and type of land. Location of land. Time of acquisition. Sense of ownership. Ability to pay for the land. Adequacy for valued beings and doings.

Education & Information I	Amount of formal and informal education of family. Desire to obtain more education, following courses / training programmes. Availability and type of schools. Ability to read, write, count. Having a signature. Knowledge of languages. Ability to be educated. Adequacy for valued beings and doings.
Education & Information II	Possession and achievement of skills and knowledge. Ability to apply skills and knowledge in daily activities. Possession of talents. Problems encountered. Ability to solve problems and to find information. Access to knowledge and information. Adequacy for valued beings and doings.
Meaningful Work	Type of work conducted by family members (income-generating, household and other). Time of work. Type of activities. Ability to choose type of work, perception of work. Possession and obtainment of work skills. Feeling of appreciation, usefulness. Colleagues, contact and interaction with colleagues. Acceptance at work. Adequacy for valued beings and doings.
Income	Earnings, spending, saving, taxes. Adequacy of income for valued beings and doings, difficult choices. Aspired income.
Leisure	Availability of time to do nothing, perception of doing nothing. Ability to enjoy free time. People to spend free time with. Free time activities. Desire for more free time, other activities. Adequacy for valued beings and doings.
Mobility	Ability to go out whenever and wherever desired. Places being visited, distance travelled. Safety to travel. Type of transportation used and operated. Favourite type of transportation. Adequacy for valued beings and doings.
Significant Relationships	Having friends, type of friends. Enjoyment of friendships. Meetings, activities and interaction with friends, neighbours/ community members. Acceptance by friends / community. Fitting in the community. Community perception of outsiders. Adequacy for valued beings and doings.
Dreams & Plans	Dreams and plans for doings and beings in life. Desired achievements, passions. Ability to decide what to do. Being in charge of own life. Satisfaction with life. Advice from others.
Spirituality	Type of religion of family. Time spend on religion / spirituality. Ability to practice spiritual activities. Important spiritual rules. Ability to choose to not be spiritual. Ability to change religion. Perception of other religions. Inner harmony and peace.
Politics	Ability to express political views and participate in political activities. Ability to vote. Government support. Familiarity with public officials, political situation.
Nuclear Family	Nuclear family composition. Household composition. Ability to choose and leave partner. Happiness with family. Time, activities and interaction with family members. Appreciation from nuclear family members.
Kindred Family	Other than nuclear family members: parents, siblings, in-laws. Distance to kindred family. Time, activities and interaction with kindred family members. Family pressure. Appreciation from, acceptance by, and happiness kindred family members.
Safety & Security	Safety and security in the living area, during day and night. Quarrels, fights and crime in the area. Involvement in conflicts. Availability of law enforcement. Anxiousness, insecurity. Being discriminated or bullied. Adequacy for valued beings and doings.
Products & Services	Availability of light, electricity, gas, transportation, communication services. Way of cooking. Ownership of products (household, transportation, communication, other). Ability to purchase anything desired. Attachment to products and services. Adequacy for valued beings and doings.
Animals	Ownership of animals and purpose for owning them. Ability to provide food for animals. Ability and desire to purchase new animals. Attachment to animals. Adequacy for valued beings and doings.

Nature	Ownership of plants and trees and purpose for owning them. Presence of plants and trees in the area. Attachment to nature. Climate and weather conditions. Amount of pollution. Disposal of waste. Dangers from nature. Adequacy for valued beings and doings.
Speaking Up	Ability to make own decisions. Family decision making. Involvement in decision making. Confidence. Ability to speak up freely, to express emotions and aspirations.

7.1.2 Procedure

The ODK 1.0 procedure includes the following elements which offer designers support when conducting the interviews:

- Sixteen steps. These need to be followed step by step when conducting an ODK interview.
- Eight CDD guidelines. These guidelines are important for the design team to consider when conducting any context exploration activity, and also when conducting the ODK interviews. They help the designer to conduct the steps by guiding the design team in selecting participants, selecting, instructing and working with a translator, and explaining appropriate behaviour and attitude, what to pay attention to, and which supplies to bring along. Several 'tips & tricks' are provided in line with these guidelines.
- Six ODK guidelines. These guidelines help the designer to conduct the interview steps, by explaining the required number and duration of the interviews, the preferred time and place of the interview, questioning techniques and dealing with sensitive questions. Several 'tips & tricks' are provided in line with these guidelines.
- A set of five techniques with five tools. The following tools support the semi-structured interview ('ODK'):
    - A touchstone tour through the home and / or surroundings of the participant helps to build rapport and provides topics for starting the dialogue. By asking the participant to show how they perform certain tasks or activities ('show me' technique), designers can observe how participants actually behave.
    - A timeline to map a day of the participant's life in order to start understanding the participant's life and to build rapport. It also indicates topics for starting the dialogue.
    - A set of twenty-one question cards and an introduction card. Each card contains a pictogram that symbolizes the theme. On the other side, the related questions (both ideal and pragmatic) are printed. The question cards guide the facilitator throughout the ODK interview, but they can also be used to show the progress of the interview and the topic that is being discussed to the participants and the translator. It is recommended – if time allows – that local visualizations be made for the question and sorting cards, so that participants can better relate to them.
    - Visualization tools. An empty answer sheet and a set of erasable markers which can be used to stimulate the participants to create mappings and drawings of their lives, resulting in richer stories about experiences, behaviour, dreams and hopes. The visualizations also form a direct line of communication with the participant, and shows the progress of the interview. If the participants do not want to draw, the note-taker can also draw for the participant, or an additional person can be involved.

- An importance sheet with sorting cards. The importance sheet consists of four categories of importance, indicated with exclamation marks. Participants can sort the different themes on this sheet, resulting in insights in what and how participants value. The pictograms used on the question cards are also used on the sorting cards, so participants can relate to them.

7.1.3 Composition of the kit

As the ODK 1.0 has been developed for designers' use in the field, a manual has been developed, to get them acquainted with the ODK and to provide background information and tips & tricks for conducting rigorous fieldwork. This manual follows the field guide rules suggested by Beebe (2014): it includes an introduction, provides knowledge that is accessible for people without specialized skills, and helps in identifying context. The manual therefore contains a short theoretical background of the Capability Approach (CA), Design for Development (DfD) and Rapid Ethnography (RE). Two project examples illustrate how comprehensive user insights and the CA can support the design of products and / or services. Moreover, it presents a succinct overview of the ODK contents, which are taken from the Capability Driven Design (CDD) approach. Furthermore, it introduces and explains the ODK procedure in a coherent and concise manner. The ODK's tools and this manual together comprise the visible and tangible ODK 1.0 (see figure 7-1).

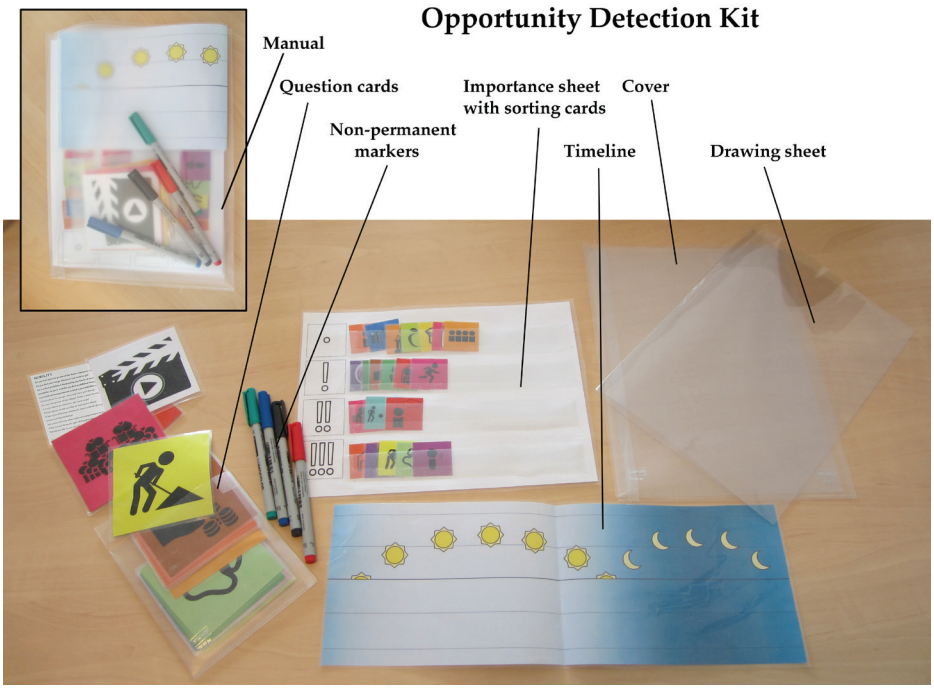


Figure 7-1: An overview of the components of Opportunity Detection Kit 1.0

7.1.4 Next steps

The development process of the ODK 1.0 is described in chapter 6; it is based on the literature review and the results of four iterations. These iterations focused on either the ODK's procedure or its content. The ODK's procedure was developed based on iterations executed by members of the research team themselves. To evaluate this procedure, the next step was to have the CDD approach and the ODK used as they are meant. Therefore, the ODK was handed over to design teams who used it at during their DfD projects (§7.2 and § 7.3). The ODK's content was developed based on iterations involving the research team and academics and designers from D-Lab. To evaluate its contents, the next step was to have the contents reviewed by a broader group of experts from different backgrounds and affiliations (§7.4). These evaluations (visualised in figure 7-2) resulted in adjustments to the ODK which are described in §7.5. The ODK 2.0, the practical outcome of this study, is presented in chapter 8.

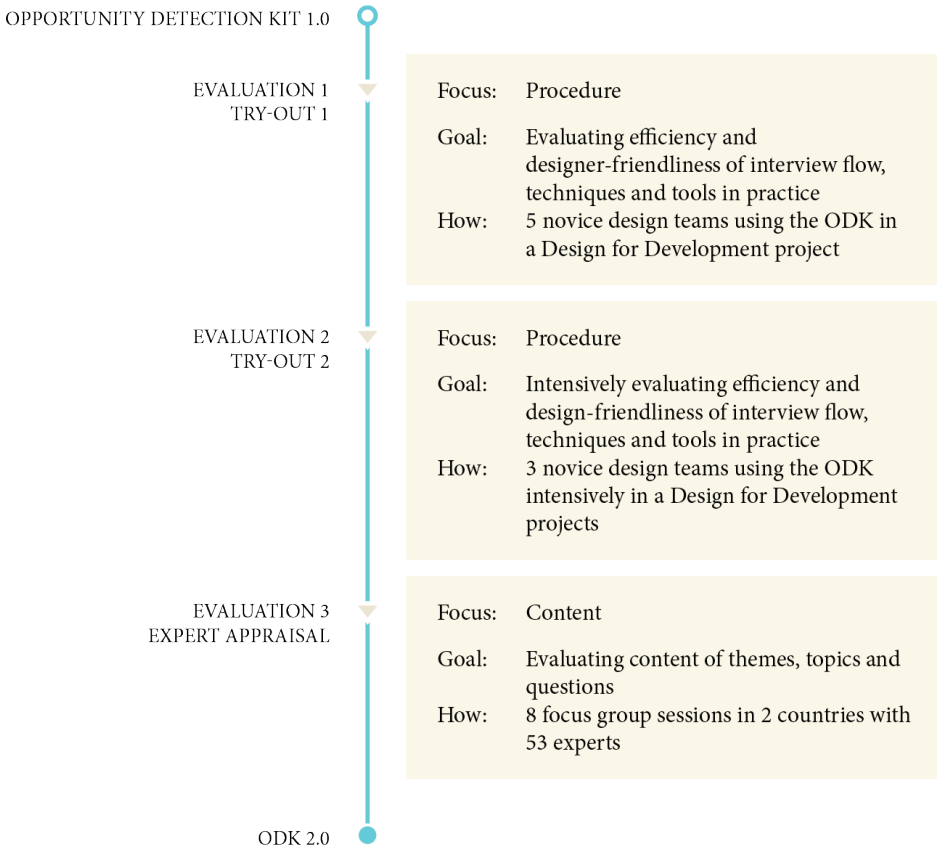


Figure 7-2: Evaluating the Opportunity Detection Kit

7.2 Evaluation 1: Try-out 1 by potential users

This section describes the first evaluation of the ODK procedure: a try-out during which five novice design teams used the ODK in a DfD project. Figure 7-3 illustrates the focus and goal of this first try-out.

Focus

The focus of this try-out was on the ODK procedure: the steps, guidelines, techniques and tools. To obtain insights in the ODK's efficiency and designer-friendliness, its intended users used and evaluated the ODK by deploying it during a DfD project. For this try-out, five novice design teams from Delft University of Technology deployed the ODK[23].

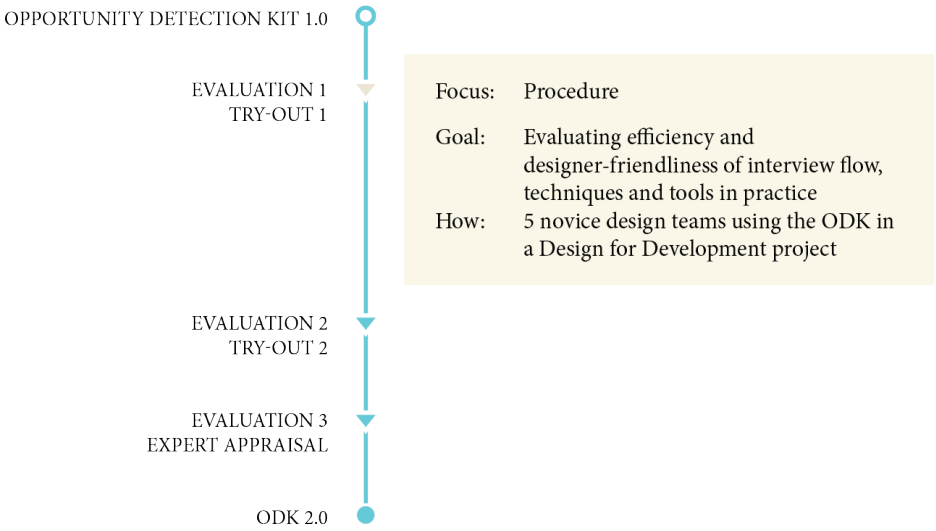


Figure 7-3: Procedure testing of the Opportunity Detection Kit by a try-out

Limitations

The design project teams who used the ODk during this try-out had six months to go through the full design process, from beginning to end, which is longer than an average DfD project. While this extended period is a good means to evaluate the ODK, the time frame does not correspond to the 'common' time frame of design projects. Other limitations are that not all design teams went into the field at the beginning of their projects, when the ODK is most useful, and that the teams went to different regions in the world at the same time, so they could not be observed while conducting the ODK interviews.

23 *As during the development of the ODK, during the ODK's evaluation also a distinction was made between 'novice designers' and 'design professionals / experts'. This distinction is made as 'novice designers' are still being educated to become a design professional and are therefore allowed to make more mistakes, have more time to complete their projects, and have more guidance. 'Design professionals' can be designers just starting as a professional, being guided by more experienced designers, but they do have to deliver output under significant time pressure and are allowed to make less mistakes.*

7.2.1 Try-out 1 by five novice design teams

At the faculty of Industrial Design Engineering (IDE) of Delft University of Technology (DUT), the final master project before graduating is the 'Joint Master Project' (JMP)[24]. During this project design students from the three master programmes of the faculty work together on a design project. The three master programmes are:

- Design for Interaction (DfI): Focuses on the interaction of the product with its user and making this interaction relevant by understanding the user and user-product interaction[25].
- Integrated Product Design (IPD): Focuses on the synthesis and evaluation phase of the design process, taking into account the user, business and society[26].
- Strategic Product Design (SPD): Focuses on the business context by understanding company strategies and market opportunities[27].

In this project, all three phases of the design process (as described in chapter 1: the analysis, synthesis and evaluation phase) have to be completed in 6 months resulting in a prototype and a process report. For successfully completing the JMP project each student is accredited 12 ECTS, which equals 336 hours of study per student. The JMP course starts twice a year, in February and September. Each year, 60 to 70 teams consisting of four to six students follow this course. Of these teams, around 15-20% execute a so-called 'JMP BoP' project: a project executed for people living at the Base of the Economic Pyramid, on less than $1,500 a year.

By selecting JMP BoP projects, certain prerequisites have been fulfilled in advance: the teams consist of multiple team members from different design specialisms, with different backgrounds, skills and knowledge (prerequisite A). In addition, these teams go into the field to meet their potential users, either once or twice (prerequisite C). And finally, they co-operate with local partners in the targeted areas (prerequisite F).

Evaluators and projects of try-out 1

The five design teams comprised 4 to 6 members, and each team consisted of MSc students from different master programmes of IDE, with different gender (except for Team C) and of different nationality (except for Teams C and D). For a full overview of participant characteristics, see Appendix F1. Their projects took place in India (Teams A and E), Colombia (Team B), Uganda (Team C), and Kenya (Team D). Their topics were related to energy (Teams A and C), healthcare (Team B), farming (Team D) and sanitation (Team E). They visited the target-country twice: at the beginning and during prototyping, except for Team C, who went to the field once, at the middle of their project.

Method of try-out 1

The integration of the ODK usage in the JMP BoP projects was discussed with one of the course coordinators, Dr. Diehl (from here onwards: Researcher 4). Researcher 4 critically screened the ODK manual to make it better fit the design projects. It was decided to first

24 See: www.io.tudelft.nl/en/cooperation/student-projects/group-projects/joint-master-project

25 See: www.tudelft.nl/en/study/master-of-science/master-programmes/design-for-interaction

26 See: www.tudelft.nl/studeren/masteropl/masteropleidingen/integrated-product-design

27 See: www.tudelft.nl/en/study/master-of-science/master-programmes/strategic-product-design

introduce the ODK to all JMP BoP teams in a presentation, in order to acquaint them with the ODK, its background, its value for DfD projects, its procedure and its contents. This presentation was held at the start of the JMP BoP projects. Each team was handed over the ODK (see figure 7-1). Next, all teams were scheduled for a team instruction during which the ODK was explained in more depth, and the team members could ask questions.

The team instruction consisted of an explanation of:

- The goal and added value of obtaining a comprehensive picture of the lives of potential users, beyond product-user interaction. The intention to discuss all themes, not to ask all questions, and to obtain a variety of insight in a variety of users, not to obtain generalizable insight;
- How the tools work and in which sequence they are intended to be used;
- Questioning (as in the manual), stressing the flexibility of the interview structure and building rapport during the conversation;
- The intention of the 'ideal' and 'pragmatic questions';
- The prerequisites. Specifically about using local partnerships, learning about and training interviewing skills, conducting the interviews in pairs, knowing the themes and topics, keeping the interview engaging, iterative data analysis, critical reflection on limitations, and sharing and checking the outcomes;
- The steps to take before conducting the ODK interview (rapport building, observation, contextualizing content and visualizations), during the interview (from introduction to thanking the participants, stressing the need to note anything surprising down immediately) and after the interview (analysing and interpreting interview outcomes, verifying insights, sharing them in a larger group);
- Things to pay attention to during interviewing (as in the manual);
- Behaviour, attitude, ethics (as in the manual) and the influence of clothing and different characteristics of participant, translator and themselves;
- The relevance of bringing gifts, pictures of themselves and their lives, and learning some local words for building rapport;
- How to deal with a translator and with an audience.

After all the teams had been in the field, they were interviewed about their experiences with and use of the ODK. During these evaluative interviews, the teams were questioned about:

- To what extent and in which way they used the ODK;
- Which obstacles and benefits they experienced when using the ODK;
- What they thought about the ODK's effectiveness and designer-friendliness;
- What they found beneficial / lacking regarding themes, topics, techniques and tools.

The interviews were transcribed. The transcripts, final project presentations and reports were analysed by matching the design teams' answers with the themes, questions, prerequisites, steps and guidelines of the ODK using colour-coding. The results of the analysis were sent to the design teams to allow them to correct any errors.

7.2.2 Results try-out 1

The results of the data analysis of try-out 1 are summarised below. For an overview of all results, see Appendix F1.

Results meeting before field visit

The teams were specifically interested in understanding the benefits the method offers as it takes time and they wanted to spend their time in the field effectively and efficiently. Two teams indicated that they planned to use the ODK (Teams C and D), two teams noted that they wanted to investigate the ODK more before deciding to use it (Teams B and E), one team was more sceptical about using the ODK.

Regarding the ODK's use, the teams asked about the benefits and relevance of the ODK (Team A), the possibility of integrating product and project related questions in the ODK interviews (Teams A and E), the required time for conducting ODK research (Teams A, B and C), the type of dialogue aimed for by the ODK (Teams A and E), and its use and benefits when addressing multiple contexts (Team E). Regarding the ODK's procedure, the teams asked about how to give a proper introduction (Team C), which gifts to bring (Team D), what is appropriate behaviour and clothing (Team E), how many interviews should be conducted (Teams C and E), how to work with translators (Team A), the value of pretending to be married (Team C), and which restrictions might be encountered regarding video- and photography (Teams A, B and E). Regarding the ODK's content, one team wondered whether all themes should be discussed and if the pictograms would be understood in different contexts (Team A), and one team asked questions about using the sorting sheet and the bold questions (Team D).

Results meeting after field visit

Table 7-2 provides an overview of the interviews conducted by each team.

Table 7-2: Details of ODK usage by design teams

	Team A	Team B	Team C	Team D	Team E
No. of interviews	7	6	0	12	> 10
Interview time (hours)	< 1	2-3	-	2-3	0.5 – 1
Designers present	2	3	-	3	2 or 1
Themes and questions					
Themes	Selected those project related	Used all, added theme 'Body'	-	Selected and adjusted them	Addressed all themes
Questions	Used a selection, changed them every day	Added, adjusted and removed some, used all	-	Selected and adjusted, posed most relevant ones	Replaced all questions with project-related ones
Techniques and tools					
Timeline	-	5 times	-	12 times, simple version	-
Question cards	-	-*	-	-	-
Sorting	For different purpose	-*	For different purpose	-	-
Drawing, mapping	-	By facilitator	-	By participants	-

** Team B adjusted the pictograms and questions of the ODK and wanted to deploy all its techniques and tools, but before they could conduct the interviews, the bag in which the ODK was kept was stolen. The three team members did not replace the stolen tools. One team member wanted to do so, but the other two team members found it would take too much time.*

Uptake

Of the five design teams which received the ODK, two teams (Teams B and D) used it as intended. Both Team A and C indicated that in JMP projects there is not much room for such extensive user context research. Team C indicated that their supervisor advised to not use the ODK, but to learn from others about the context as so much research has already been done. Teams B and C experienced that for the ODK to work the method needs to be accepted by everyone: the full design team, the client and the translator. They commented that if not everyone is convinced of the ODK's value, it is difficult to start using it in the field. Team B noted that a professional-looking kit that can be shown to others could help to trigger attention and conversation. The DfI student of Team B thinks that *"with a kit that looks professional and serves as a point of attention*" she would have been better supported in her decision to use the ODK. Team A would have wanted to use the ODK to a greater extent, but had difficulty reaching participants and having them participating.

Interview flow and effectiveness

Teams B and D expressed that there is not sufficient time during the interview to explore both the user context and discuss project-related questions. Team B suggested splitting the interview into two: an ODK part and a project part, but also acknowledged that combining the two parts would be valuable. Team E noted that their insights did not only result from asking the questions, they also arose from observations.

All the teams that used the ODK indicated to have obtained useful insights from the interviews. The insights obtained by Team A were not new to the company, but they argued that it was the only way to obtain that knowledge themselves: *"Because the company was not able to transfer that information to us*." Team B stated that *"when conducting the interviews you are learning and understanding so much at the same time*." According to the DfI student of Team B, most outcomes depend on a person's personality and openness, not necessarily on using the ODK and its tools. Team D indicated that they looked more comprehensively and obtained useful insights, but that the ODK also brought up many non-project related issues, causing frustration, as they could not address them all. They indicated that the ODK resulted in "*too much context and not sufficient that we could use to actually design*". Team D and E obtained insights that they attempted to include in their design. In addition to providing relevant insights for the design team, according to Teams B and E, the ODK assisted in keeping a comprehensive view and, according to Team B, the ODK helped participants to reflect on their own lives.

Designer-friendliness

The ODK questions were noted being useful as guidance (Team A and C), and the timeline and drawings helped offering a good grip for a conversation (Team D), and keeping an overview of the things discussed (Team B). Team C noted that they liked the ODK's adaptability: *"What I also liked is that for our own project we could make our own cards. So that the thought is there, but that we can use the ODK in our own way."* However, some teams experienced a lack of time (Teams A and D), and a lack of space to display and use the ODK tools (Teams A, B and D).

Team B further indicated that so much data resulted from the interviews, that they found it difficult *"to have the full, rich picture conveyed to others."*

Procedure

The four teams that executed ODK interviews followed most prerequisites, except for prerequisites D (following an interview training course), H (sharing and checking outcomes), and G (only one team collected data iteratively), and only two teams used – some of – the ODK tools (prerequisite E). Most teams followed the steps provided in the manual. Teams A and B localized the ODK's content; Team B changed all the pictograms prior to their fieldwork (see figure 7-25 at the end of this section), but did not test them, and Team A discussed the questions locally and adjusted them to better fit the context. The selection of participants was mainly done through the client organizations and via other participants. Only Team A indicated having difficulty reaching their real target users. The teams conducted the interviews in pairs or with three team members, in only one case did the female designer of Team E interview one woman individually to be able to ask questions regarding menstruation. When possible, the teams conducted touchstone tours (see figure 7-4 and 7-5). According to Team D "*mainly during the tour [the participants] told and explained a lot*". Team A indicated that they shortened the interviews, could not use the tools, and had difficulty building dialogue because their participants were working (see figure 7-6). They could only speak to participants away from their work during the lunch break when offering them lunch. Team B indicated that it was difficult to get into a rhythm as the circumstances changed during each interview (context, location and translator), and that participants had difficulty recalling past experiences. All teams noted that the audience influenced their interviews, and both Teams B and D found it difficult to not talk to the translator. The teams generally considered translators who translated everything back to be most useful. Team B had difficulty with a shy translator. They properly thanked participants and discussed the outcomes.



Figure 7-4: Team D walking around on a participant's farm
Figure 7-5: Team E walking around in a participant's neighbourhood
Figure 7-6: Team A visiting a participant's shop

Most CDD and ODK guidelines were followed by the design teams. Team D remarked that, for talking to the farmers, they first had to go to a manager before going to the farmer, and afterwards thank the manager. They also indicated that although they were all *"white females"* and the translator was also female, they did not experience problems in establishing dialogue. They did experience the presence of power differences in saying "*because we were white, we were great anyway.*" From watching the videos of Team D, it can be observed that the designers, during the interview, deliberate in their mother tongue on how to continue,

while the participant answers a question. This is not favourable behaviour, as it limits rapport development. Team A had difficulty establishing a flexible dialogue and mainly followed their list of questions. Teams A and E deleted and adjusted many questions and could therefore conduct the interviews within one hour. The teams that did conduct the ODK more or less as intended and covered all the themes, conducted the interviews in 2 to 3 hours.

Teams D and E visited most participants at home and walked around inside their homes and in the area (see figure 7-7 and 7-8). Team B could do the same for two interviews, as the other interviews were conducted at organizations or on the street. Team A looked around at participants' work, but did not visit their homes (see figure 7-9). According to Teams D and E it helped a lot to see how things work, as things were different than they imagined (Team D), and new insights were obtained (Team E).

Figure 7-7, 7-8 and 7-9: Participant interviewed in her home (Team D), her yard (Team E), his shop (Team A)

All teams used the ODK questions, but none of them used the question cards. Team B did share that they *"would have helped to keep a better overview of the themes discussed, which would have been useful to deepen the discussion"*. What Team B found lacking is that *"the cards show a lot of aspects of human life, but they do not show much about change in time"*. None of the teams used the pictograms. Team D did not use the pictograms, as *"we didn't think that they really fitted the topic or would not be well understood."* Team B had prepared their own pictograms in the Netherlands prior to the fieldwork (see figure 7-10), however, the ODK was stolen and there was no time to make a new set, so these were not tested in the field. The team grouped themes by using similar colours and created one style to make it look more professional. They also adjusted the pictograms to their context (foot prostheses in Colombia) based on information found on the internet.

Figure 7-10: Pictograms made by Team B. From left to right, top to bottom: 'Introduction', 'Education', 'Land', 'Nature', 'Animals', 'Nutrition', 'Products & Services', 'Accommodation' (2 options), 'Significant Relationships', 'Kindred Family', 'Nuclear Family', 'Dreams & Plans', 'Health & Emotion', 'Health & Fitness', 'Healthcare', 'Prosthesis', 'Body', 'Mobility', 'Leisure Time (active)', 'Safety & Security', 'Meaningful Work' (2 options), 'Income', 'Leisure Time' (passive), 'Speaking Up', 'Politics', 'Spirituality' (2 options), 'Information Supply'

Teams B and D used the timeline. Team B's ODK was stolen, but the facilitator drew a timeline during five of the six interviews, and stated that the *"timeline helps in seeing which topics need to be addressed and to pose more questions. You get more information"*. Team D indicated that *"the timeline was an easy conversation starter. And provided insight in their activities and what they find important during a day"*. It also stimulated them to ask follow-up questions. Teams A and E did not draw or map. For Team B, the facilitator drew the answers given by the participants because the two other team members present did not feel comfortable drawing (see figure 7-11). Team B's facilitator remarked that the drawing and mapping worked as a confirmation, helped to maintain an overview of the conversation, and that it triggered discussion about time periods. She furthermore indicated that for their drawings they *"needed a bigger piece of paper to draw it all, it became a bit cluttered"* (see figure 7-12). During the Team D interviews, most participants did their own drawings (see figure 7-13). the participants of Team D were asked to draw their family, the area of their farm and to fill in a timeline (see figure 7-14 to 7-20). They noted that participants had difficulty deciding how to place their writing. None of the teams used the sorting exercise. Teams B and D wanted to use it, but things went differently than expected. Team B argued that *"the comparison, prioritizing is a strong point of the ODK"*.

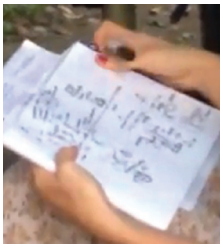




Figure 7-11: Interview of Team B with facilitator drawing
Figure 7-12: 'Cluttered' mapping by Team B
Figure 7-13: Interview of Team D with participant drawing

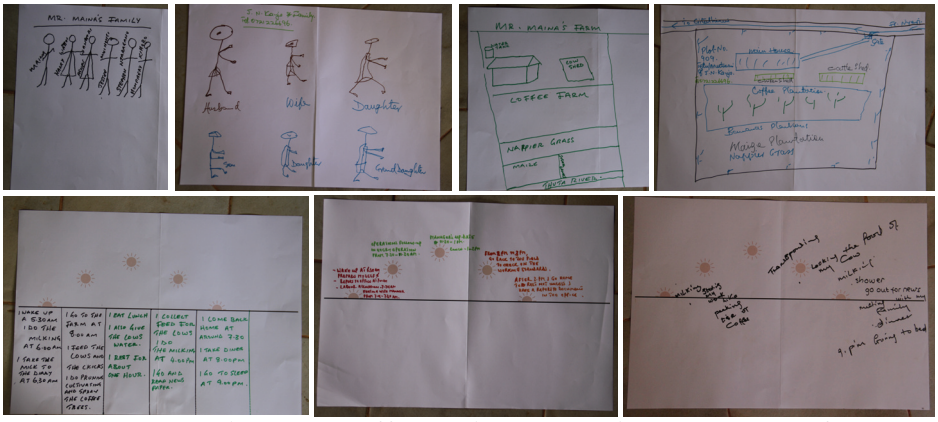
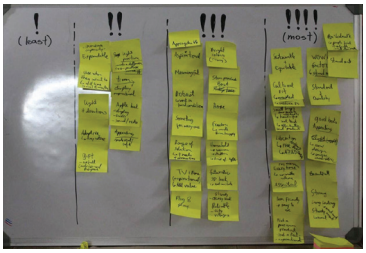


Figure 7-14, 7-15, 7-16 and 7-17: Drawing of farm area by a participant during ODK interviews of Team D
Figure 7-18, 7-19 and 7-20: Timeline made by Team D, filled in by a participant

Teams A and C used the sorting for a different purpose: to prioritize product requirements together with the client (Team A, see figure 7-21), and to make potential users prioritize between product characteristics (Team C, see figure 7-22 and 7-23).



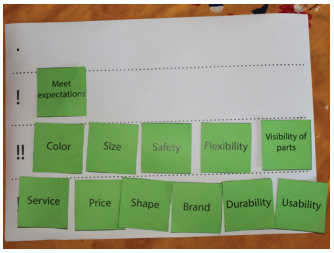


Figure 7-21: Sorting as conducted by Team A
Figure 7-22 and 7-23: Sorting as conducted by Team C

Teams A, B and D included different techniques in their interviews. Team A made participants compare and choose between photographs representing different product characteristics. They experienced that people interpret pictures in their own way, often differently to how they themselves looked at the pictures. Team D let participants make collages with the project-related visualizations they brought along (see figure 7-24), and let participants write down their coffee farming activities throughout the year on a timeline (see figure 7-25). Team B used a historical timeline to obtain more information about the things that had happened in people's lives. They indicated this to be *"useful for the researchers to keep an overview, and for the participant to go back to experiences."*

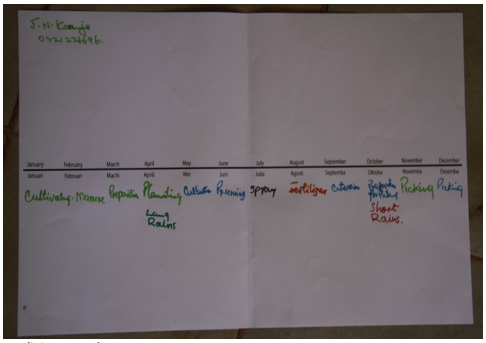


Figure 7-24: Other techniques deployed: Collage making (Team D)
Figure 7-25: Other techniques deployed: Timeline of the year (Team D)

Content

Regarding the themes, Team A used 33% of all themes, Team D 76%, and Teams B and E used all themes. Teams B and D both added two project-related themes. Team B added 'Prosthesis' and 'Body', Team D added 'Coffee' and 'Working Area'. Team B's theme 'Body' is about *"body and how you see yourself"*, *"personal care"*, and *"satisfaction with looks"*. According to Team B *"that is not yet directly in the ODK"*. Prior to fieldwork Teams B and D also both split 'Education and Information' into two separate themes. Team B split 'Health'

into 'Health & Emotion' and 'Health & Fitness.' Teams A and E used 'Family' as one theme. Team A furthermore combined Family' with 'Accommodation', and 'Meaningful Work' with 'Leisure'. Team E changed the name of 'Significant Relationships' into 'Social Life'. Teams A and D removed a significant number of questions to be able to keep the interview time short. Team E adjusted all questions to specifically focus them towards the topics of hygiene and sanitation. Only Team B used practically all the questions.

7.2.3 Conclusions try-out 1 and next steps

Of the five design teams who were handed the ODK kit for use in their DfD projects, two teams more or less used the interview method as intended, and one team wanted to use it but did not have sufficient opportunity to conduct ODK interviews. The last two teams went to the field after going through the analysis phase, and were already focused on the product. One team adjusted all ODK questions to project related questions, the other team did not use the ODK at all. The teams that did use the ODK liked the guidance the questions offered, the comprehensive view of their users' lives, and the relevant insights they obtained for their projects. The teams felt that there was too much to discuss in one interview, especially when combining the ODK questions with product questions. The teams therefore liked the ODK's flexibility, and the ODK is also intended to be flexible, but not to the extent to which all teams, except for Team B, adjusted the ODK. Teams A, D and E removed or adjusted so many themes and questions, that the comprehensiveness of their outcomes is questionable.

The teams also indicated that to use the ODK, you need time and space. Moreover, without the support of the full design team, the client and the translator, it is difficult to fully utilize the ODK's potential. The ODK is furthermore not easy to replicate in the field: the team whose ODK was stolen did not put in the time to reproduce the kit in the field, as it would have taken too long. The teams provided recommendations for the manual, the techniques and tools, and the ODK's content in order to improve its appeal and its uptake by designers. These recommendations were considered when adjusting the ODK. However, as not all techniques and tools were deployed by the teams, and only a limited amount of ODK interviews were conducted, a second try-out was conducted with design teams who were able to spend more time in the field with their potential users, to better evaluate the ODK's procedure and content.

7.3 Evaluation 2: Try-out 2 by potential users

This section describes the second evaluation of the ODK procedure: a try-out where three novice design teams used the ODK intensively in a DfD project. Figure 7-26 illustrates the focus and goal of this second try-out.

Focus

The focus of 'Evaluation 2' was on the ODK's procedure (steps, guidelines, techniques and tools). To obtain insight in the ODK's efficiency and designer-friendliness, its intended users tested and evaluated the ODK by deploying it during a DfD project. For this try-out, three

novice design teams used the ODK during their JMP BoP course at DUT. The design teams combined their JMP course with a research assignment, allowing them to conduct more intensive user-context research in the field. Their research assignment included adapting the ODK content (mainly the themes and questions) to their specific design context, leading them to evaluate the ODK's procedure, as well as its content in relation to their specific contexts.

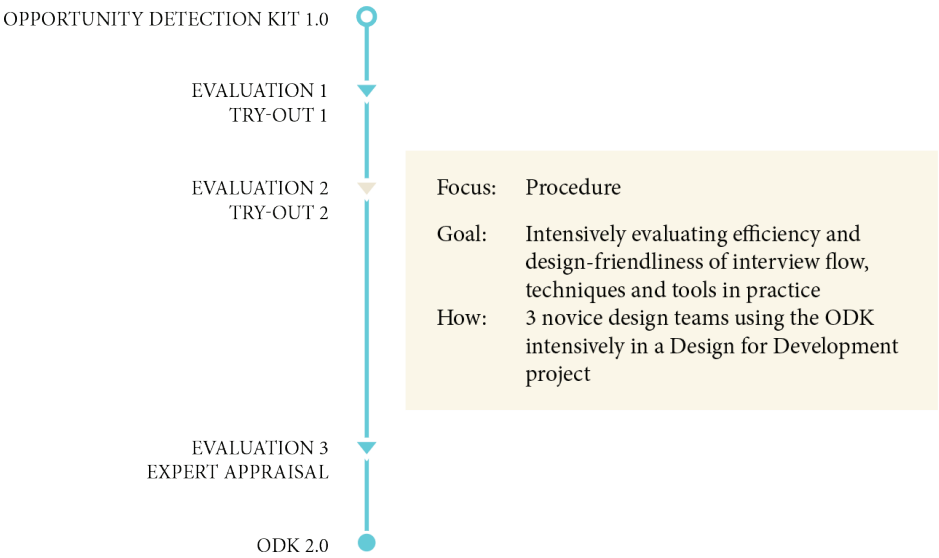


Figure 7-26: Procedure and content testing of the Opportunity Detection Kit by a second try-out

Limitations

The design project teams had six months to go through the full design process from beginning to end, which is more than during an average DfD project. While this extended time period is a good means to evaluate the ODK, the time frame does not correspond to the 'common' time frame of design projects. The design teams could not be observed while conducting the ODK interviews, but data has been triangulated by interviewing the designers, making them report specifically about the ODK, and having them participating in a focus group session to verify and discuss the research outcomes.

7.3.1 Try-out 2 by three novice design teams

As described in 'Evaluation 1' (§7.2), in JMP BoP projects, students from the three master programmes of the faculty of IDE at TUD work together to execute a DfD project. The design teams include members from different design specialties, with different backgrounds, skills and knowledge (prerequisite A), who go into the field to meet their potential users, either once or twice (prerequisite C), and co-operate with local partners in the targeted areas (prerequisite F). During this try-out, the design teams combined their JMP projects with an elective called 'Research'. The research course of the faculty of IDE at DUT strives to involve students in on-going IDE faculty research projects. For successfully completing the JMP project each student is accredited 12 ECTS, for successfully completing their research project,

each student is accredited an additional 6 ECTS. In total this equals 504 hours of study per student. By combining both courses, the design teams are thus granted significant additional time to spend on user context research during their JMP project. The research assignment for these teams was to not only test the ODK's procedure, but also to evaluate the adequateness of the ODK's contents for the context they were designing for, and to detect which ODK adaptations would be required to make a better fit of the ODK to that context. The design teams paid specific attention to the adaptation of the themes, questions and pictograms.

Evaluators and projects of try-out 2

The three design teams each comprised 4 members, and each team consisted of MSc students from different master programmes of IDE, with different gender and of Dutch nationality. For a full overview of participant characteristics, see Appendix F2. Their projects took place in Indonesia (Team F), Bangladesh (Team G), and Tanzania (Team H). Their topics were related to drinking water (Team F), healthcare (Team G), and energy (Team H). They visited the target-country twice: at the beginning and during prototyping. Teams F and H used the ODK during both visits, Team G used the ODK once, at the beginning of their project.

Method of try-out 2

To get the design teams acquainted with the ODK, its background, its value for DfD projects, and its procedure and contents, all teams were personally instructed about the ODK. The team instruction was the same as for during the first try-out. Each team was handed over the ODK kit (see figure 7-1 in §7.1.3). Then, all teams were scheduled for a second team instruction during which the team members could ask questions.

After all teams returned from the field after their first field visit, they were interviewed about their experiences with and use of the ODK. Teams F and H did fieldwork twice and conducted ODK interviews a second time, with adjustments based on their first visit. They were interviewed after their second visit as well. During these evaluative interviews, the teams were questioned about:

- To what extent and in which way they used the ODK;
- Which obstacles and benefits they experienced when using the ODK;
- What they thought about the ODK's effectiveness and designer-friendliness;
- What they found beneficial / lacking regarding themes, topics, techniques and tools.

The interviews were transcribed. The voice-recordings that one of the teams made were listened to, in order to improve the understanding of how this team conducted the interviews. The transcripts, final project presentations, final reports and voice-recordings were analysed by matching the design teams' answers with the themes, questions, prerequisites, steps and guidelines of the ODK by using colour-coding. The results of the analysis were checked by the design teams in a focus group session, to allow them to correct any errors, to clarify some statements and to discuss certain issues with each other about which they expressed different opinions. One member of each team (F1, F2, G, H1 and H2) took part in the focus group session in order to bring all experiences together. They were first asked to look at 46 propositions and indicate whether they fully agreed, agreed, disagreed or fully disagreed.

Their answers were compared and the propositions where their answers greatly differed were discussed to find out more about the reasons behind the participants answers and to compare their experiences on these issues.

7.3.2 Results try-out 2

All teams went into the field twice: in the first visit two of the team members and in the second, the two other team members. Teams F and H adjusted the ODK after their first experiences and the second team that went into the field conducted more interviews using their improved version of the ODK. The results after their first field visit are therefore referred to as results of Team F1 or of Team H1. The results after their second field visit are referred to as results of Team F2 or of Team H2. Statements from the reports of Teams F and H are referred to as coming from the full team and therefore no number is indicated. Team G also went to the field twice, but they only used the ODK interviews in their first visit. Table 7-3 provides an overview of the interview details for each team.

Table 7-3: Details of ODK usage by design & research teams

	Team F1	**Team F2**	**Team G**	**Team H1**	**Team H2**
No. of interviews	2	3	7	3	2
Interview time (hours)	3 – 3.5	1.5 – 2	1.5	2 – 3.5	2 - 2.5
Designers present	2	2	2	2	2
Themes and questions					
Themes	All covered	All covered	All covered, in 6 clusters	All covered	All covered
Questions	All used, incl. product questions	Adjusted & colour-coded, incl. product q.	All used, incl. product questions	All used, not incl. product questions	All used, not incl. product questions
Techniques and tools					
Timeline	No	No	Yes	Yes	Yes
Question cards	With picto-grams	With picto-grams (1), or photographs (2)	With local photographs	With picto-grams	With picto-grams
Sorting	Yes	Yes	Yes	Yes	Yes
Drawing, mapping	No	No	Yes	No	Yes

Results interviews and reports

The results of the interviews with the design teams, and the results derived from their reports, are summarised below. For an overview of all results, see Appendix F2.

Uptake

All teams used the ODK. From the start Teams F and H were both interested in the kit and willing to use it. Team F argued that "*if you want something that matches the target group, it is important to invest in it.*" Only the DfI student of Team G truly had to convince her team members and client organization of the usefulness of the ODK interviews.

Interview flow and effectiveness

All teams indicated that the ODK helped them to quickly and comprehensively understand the context, helped them to place things in context and to stay open-minded. Team G explained that they *"asked all kind of questions that you would normally maybe not have asked"* resulting in *"extraordinary answers."* Team F noted that *"things that might have gone undetected in more basic and static interview methods were, through this method, uncovered nonetheless"*. Team H commented that they *"have a better view of how people over there live"*, which they did not obtain from discussions with entrepreneurs and customers of their client. Teams F and H noted that it is also useful to conduct ODK interviews in a later stage to rapidly understand the context. The ODK also helped their participants to open up and not *"stick to answers that they consider to be pleasing towards the interviewer"* (Team F). One H1 participant mentioned that the ODK had given her insight in her own life, and one H1 translator from their client organization also reported having obtained interesting insights about their potential users. Team F indicated that a local design agency wanted to use the ODK as well. Furthermore, Team G indicated that the ODK *"provides a lot of [design] inspiration"* and Team H noted that the ODK helped them to build rapport with the participants and sympathize with them. They also pointed out that the ODK – misplaced or not - gave them *"some self-confidence about understanding how [the design] will function in this culture."* Teams G and H pointed out that the ODK interviews supported them during decision making. Teams G and H conveyed that through the insights the ODK gave them, they could *"assess really well which design is going to work and which one not."*

However, Team H noticed that the ODK does not take away all bias and assumptions, that it is difficult to know if people tell the truth, and Team G pointed out that it was sometimes difficult to *"stick to all the themes"* when having a specific product focus, and that the ODK is too broad to go deeper into every detail. Team F also pointed out that *"it is impossible to ask every single question of the ODK and expect a quality answer. This simply takes too much time."* Team F thereby indicated that *"many topics were also less relevant."* Team G suggest starting with comprehensive interviews and to deepen certain topics in later, more focused, interviews to reach to 'emotionally deeper' answers. All teams noted that the ODK outcomes are not generalizable. They did discuss outcomes with their translators, but they did not verify their findings in a larger group of potential users. Team H also pointed out the danger that the obtained knowledge feels like the truth for the whole area, while this is not necessarily true.

All teams indicated that they obtained insights relevant for their design projects from the interviews. They learned to understand people's thought process and priorities (Team F) and got to know surprising cultural aspects (Teams G and H), which influenced their final design:

- Team F learned that their water filter should be designed for the Indonesian middle class, making the product aspirational, that the design should not be disruptive in nature, and that it should mainly address women's preferences as they make the household decisions.
- Team G found out that the diaper will be bought by the father, and that, *"the mother has quite a tough life, so the diaper must be quick and easy."*
- Team H noted that the ODK *"triggered awareness on the importance of pride and property, and therefore status"*. 'Providing status' become one of their major design requirements.

User-friendliness

All teams indicated that the techniques and tools offered them grip and guidance. Team F liked the freedom to adjust the ODK to the context, to add questions and to follow-up on the unexpected. They also noted that once they knew the themes and questions by heart, they could have a friendly conversation and still retrieve all information. Team G noted that the ODK *"saves the designer time in creating their own questionnaires"*. They indicated that the question cards were useful to fall back on when *"the conversation hits a dead end"* and to keep an overview. Team F indicated that for them it sometimes felt forced to use the question cards, and Team G clustered the themes in order to not have to search for the right card. Team G also noted that the timeline, family questions and touchstone tour made the participants *"feel special"* and *"allow designers to sympathize with the participant."* All teams agreed that the ODK's advantages mainly arose when knowing the themes, questions and procedure. Teams G and H noted that during some interviews there was no space to lay down the tools. Team H2 further indicated that the cards were easily blown away when interviewing outside. Team F indicated that it would be useful to start an online platform where designers *"can use it and share pictures"* and, *"provide feedback about what to do and don't [...] per context."* They argued that *"designers in general do not really like reading […]. Unless they are teased."*

The teams indicated the ODK interviews to be time-consuming. Team F found the interviews exhausting, for themselves, but also for the participants. Team H indicated that *"you actually want the ODK questions to become less. And that is also not something you want, because then you don't cover everything"*. Teams F and G combined the ODK interviews with project-related questions; Team H did not. They felt they could not link the product questions to the ODK questions, and that it would take too long. However, they also indicated that they could have added a few more general product-related questions. Team H mentioned that, because they are designers first and interviewers second, they were less skilled in interviewing and *"this resulted in less attention to the why, why not and other follow up questions."* Team G also advised asking more follow-up questions. They stated that *"the sentence at the bottom of each question card that has the purpose of reminding, doesn't work very well."*

The teams noted that the ODK interviews resulted in large amounts of data to process. Teams G and H analysed the obtained data. Team F did not explicitly do so, they recorded the interviews, but did not have time to listen to the recordings. They conveyed the obtained knowledge to their team members and used the insights during the design process. Team F wondered how to *"make the translation back to the design"*. Team H indicated that the obtained knowledge is mainly implicit and therefore difficult to put in a report. Both Teams G and H clustered the contextual knowledge and visualised it in a model (see figure 7-27 and 7-28). Team H recognized the importance to process the obtained data directly and suggested making the outcomes more explicit, to avoid *"miscommunication, because you interpret the same things in a different way."*

Manual

From the manual, it was not clear where in the design process the ODK should or could be used (Team F), and the goals and value of the ODK are not clearly explained (Team H).

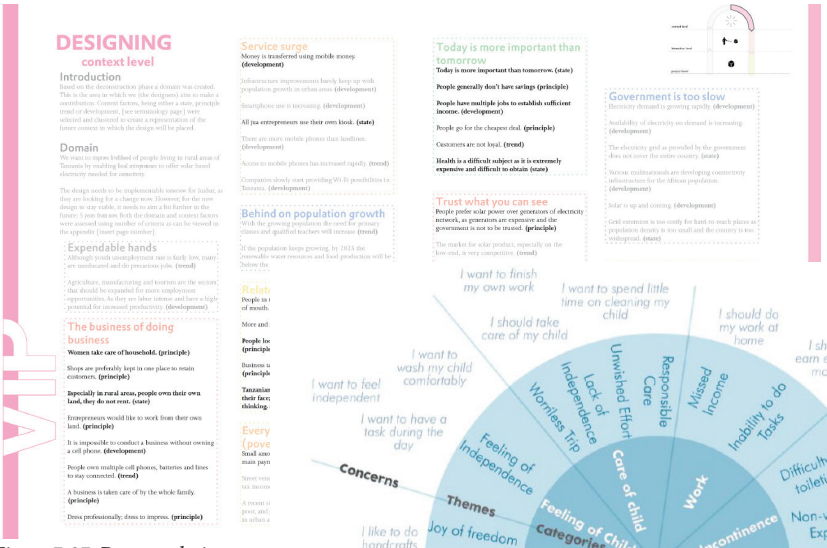


Figure 7-27: Data analysis outcor of Team H

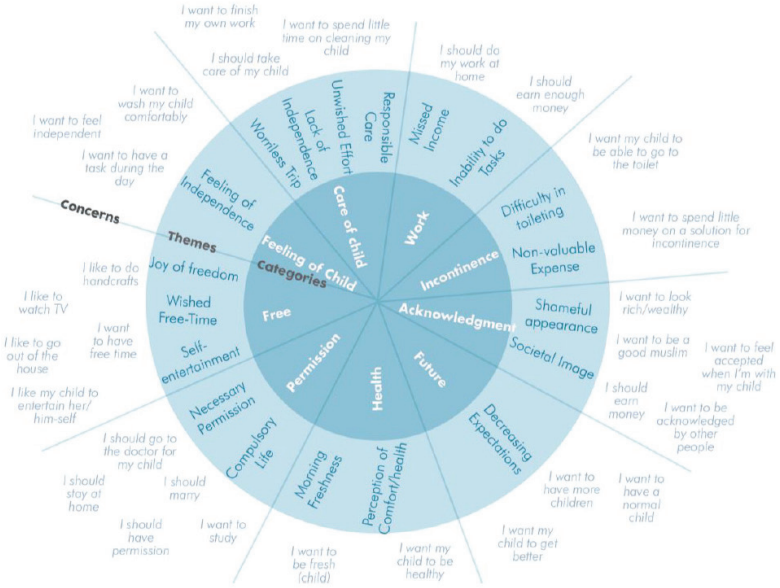


Figure 7-28: Data analysis outcomes of Team G

Team H furthermore argued that it should be explained what *"understanding culture"* exactly entails, and that the design team should have *"a plan how to implement the cultural knowledge that will be gained."* Regarding the full CDD approach, Team H2 experienced that building rapport beforehand truly helps in conducting ODK interviews. They further expressed that they experienced quite some time pressure from the JMP project, and therefore conducted the ODK interviews but did not stick to the full CDD protocol.

Procedure

- Prerequisites. Most prerequisites were followed by the design teams. Regarding prerequisite B; during one of Team G's interviews, only one designer was present to create a situation with solely women to obtain answers to sensitive questions. The teams did not follow an interviewing training (prerequisite D), and they did not share and check the outcomes of their interviews with their participants (prerequisite H), they checked the outcomes with their translators. For Team G the combination of the interviews with observation was very important, as they did not always match. Teams F, G and H collected data iteratively (prerequisite G). Lastly, all teams used the question cards and the sorting exercise, but

only three teams used the timeline, and only two teams used the mapping and drawing exercise. Team G used all the techniques and tools, but during different interviews, and indicated that *"the interviews were not playful and somehow there was a hierarchy between the interviewer and the participant."*

- Steps. The teams followed all the ODK steps, whenever possible. They all acquainted themselves with the manual, themes and questions. Teams G, H1, and H2 roleplayed the ODK beforehand, and Team F2 went through all the questions, adjusted them and colour-coded them regarding their perceived relevance. All teams obtained information beforehand about the contexts they would visit and design for, and discussed – part of – the ODK with local partners. Teams F1 and G both piloted the ODK, and that helped them to get used to the ODK interviews. Team H2 *"just didn't have the time to conduct a pilot with the people over there"*, but noticed that *"it is so much different if you [conduct the ODK interview] with someone over there."* Teams F1, F2, H1 and H2 used different translators, Team G used the same translator for most interviews. Team G switched to a female translator one time to pose sensitive questions, but indicated that *"being alone was very difficult when having to ask questions, write down answers and make pictures at the same time."* The teams recruited their translators through their existing local network. Teams F and G both gained access to participants through their translators. Team H recruited participants *"through co-workers, entrepreneurs and translators."* They all ensured that they included a variety of participants. During all the interviews, one designer acted as facilitator, the other took notes. Teams F and H took turns, Team G assigned the same roles for each interview. All teams indicated that the note-taker was required to complement the facilitator, but also to note down participants' behaviour, attitude, body language and their own or the translator's interpretations. They acknowledged that making notes was easier when the themes and questions were better known. All teams conducted the interviews at participants' homes (see figure 7-29 to 7-31), except for Team G who conducted four of the seven interviews at the day-care centre of their local client organization. Team F1 once had to explicitly explain that they were not from the company in order to obtain more honest answers and Team G experienced that *"privacy is something they don't know."* Team F1 experienced that in their context, the participants were friendly and hospitable, but generally *"required a slight push to be more elaborate in their answers."* All teams noticed that an audience highly influenced the results and Team F1 noticed that female participants *"dodged certain questions that required their opinion on a matter."* Team F2 learned from Team F1 about sensitivities, dos and don'ts in their context and took them into account during their interviews. Teams H1 and H2 found the participants generally to be very open and honest, but noticed that translation *"is really a barrier."* Team H did not follow a specific order in the themes, but started and ended with an 'easy' topic and tried to follow-up on what the participant shared. According to Team F, presents were *"considered a token of friendship [..] which indirectly shows […] respect for the other person."* However, Team H1 experienced that "*you really do not need to bring a gift, the people just want money, that is the only thing they can use.*" Therefore, they paid the participants a compensation. The teams checked certain outcomes with the translator or with a local partner, but not with the participants or in a larger group of end-users.

Figure 7-29, 7-30 and 7-31: Interview setting at participants' homes (Team F2, Team G and Team H1)

- CDD guidelines. The design teams followed most of the CDD guidelines and indicated several things that worked well, such as following the local etiquette (Team F), bringing food which worked as an ice-breaker (Teams F and G), and bringing family pictures which generated interest (Teams G and H). They also indicated areas of attention regarding questioning, such as the importance of asking sufficient follow-up questions (Team F), asking the obvious (Team G), asking sufficient open-ended questions (Team H), and paying attention to local wordings (Team H). Other areas of attention are the position of the design team and working with a translator. Team G experienced that participants looked up to them resulting in socially desired answering, Team F also indicated that participants aimed to please their guests, and Team H experienced that in some areas people were more impressed by seeing them than in others. Regarding translators, Teams F and G noticed that a proper instruction about the goal of the interview and the interviewing rules is important, as well as having a good relationship with the translator. Team H worked with *"unskilled translators"* which, according to them, *"impacted the reliability of the research."* Team G also indicated that participants were more open when the translator was familiar to them, but more closed when the translator was from the client organization, and both Teams F and G indicated that it is important to use a female translator when interviewing women. Teams G and H encountered translators that already interpreted the participant's answers, and one translator of Team H significantly shortened the participant's answers. Team H advised using one translator for all interviews to save training time and to avoid *"discrepancies in how someone translates, their gender etc., which might make the data less reliable"*.
- ODK guidelines. The design teams followed most of the ODK guidelines, however, it did not always work out as planned. Regarding time and place of the interview, Team F experienced reluctance to let them inside their homes being afraid to let their guests down, and Team H experienced that in Tanzania it was too hot inside the houses. One designer of Team H had difficulty keeping the interview flexible, she conducted the interviews *"almost like a structured interview. Because there are so many questions"*, and all teams encountered sensitivity in questioning. However, sometimes questions were perceived to be sensitive, but turned out not to be (Team H). Both Teams F and G indicated that it is wise to start with more general questions, and to ask sensitive questions later on in the interview. Team G also mentioned that some questions can better be asked to women without any men present. The interview duration differed: Teams F1 and H1 took significantly longer than the interviews of the other teams (2 to 3.5 hours compared

to 1.5 to 2.5 hours). The openness of participants, and a better knowledge of the themes and questions were indicated to cause differences. Team F noted that some participants started to become tired, making the interview harder and less insightful. About the number of interviews, Team G indicated that *"after four interviews we had the idea we were not getting any new information anymore."*

- Techniques. Team G found the touchstone tour a good way to start the interview, stating *"then you have already seen a lot and you can place it in perspective."* Teams H1 and H2 observed more than was shared by the participant during the interview, and used their observations to stimulate dialogue. Team F shared that they were too busy facilitating and taking notes to be able to make drawings and / or mappings. Team H1 did not draw, as they felt it to be distracting and redundant. They also indicated, like Team F2, that the drawing is one task too many: "*I had difficulty enough with deciding which questions to pose.*" However, Team H1 also acknowledged that drawing could work *"to check if you understood it correctly"* and advised drawing along on a *"white piece of paper."* The facilitator of Team G drew along with the timeline (see figure 7-32 and 7-33). They pointed out that the drawing helped to clarify things, to remember and verify answers, to diminish assumptions, and to have the participant being more involved. For them, it worked well, but they also indicated that "*it takes a lot of time, so you can't cover everything.*" Team H2 also tried to draw along with the participant. During one interview they encountered a practical problem: they had to sit in a row to stay in the shade and therefore the drawing did not work (see figure 7-34).

Figure 7-32 and 7-33: Team G drawing along with the participant
Figure 7-34: Team H sitting in a line to stay in the shade, making it difficult to make contact and draw along

Team F indicated that during sorting "*the people found everything important [..]. The people do not really sort*" and that it was difficult for participants to understand the pictograms. Team H1 had similar experiences, but also indicated that *"it is a good way to end"* and that one participant of Team H1 obtained insight in her own priorities due to the exercise. Based on the results of Team H1, Team H2 adjusted the sorting exercise and added two importance categories (see figure 7-35 to 7-38). This seemed to work better, but was tested during only two interviews. Team G used the sorting exercise during two interviews. They also asked the participants why they placed a theme on a certain importance category, and added their product to learn how important participants perceived a diaper to be. According to them, the exercise forced their participants to choose and therefore really made them think.

- Tools. All teams used the question cards (see figure 7-39 and 7-40). According to Teams

Figure 7-35 and 7-36: Sorting exercise in four categories (Team H1)
Figure 7-37 and 7-38: Sorting exercise in six categories (Team H2)

F1 and G, the question cards are useful to fall back on, and Team H2 argues that the pile of cards is an indication of the interview's progress. Teams F2 and G replaced the pictograms with photographs. Team F1 was advised by the local design agency to add the theme name in the local language to the question cards, but they did not do so. Team G *"clustered all the cards in themes and sub-themes"* and separated the picture from the questions to diminish the time searching for the right card and to keep a better overview. It also made it easier for them to ask follow-up questions. Team F2 started by asking *"questions per card"*, but at some point became familiar enough with the themes and questions that they *"didn't even take the card."* Team H followed the cards instead of taking the freedom to follow-up on interesting dialogues. They argued that *"there are a lot of different cards to deal with, it is hard on the interviewer."* According to Team G, *"the picture [..] decreases the distance between interviewer and participant. A picture is something that is better understood than a sentence translated and reformulated by the translator."* They also indicated that *"the use of pictures increases the chance that the participant comes up with stories herself."*

Figure 7-39 and 7-40: Conducting ODK interviews with question cards (Team F2 and Team G)

Teams F1 and F2 did not use the timeline, but Teams G, H1 and H2 did. Team G noticed that their participants *"just stopped after the morning, they didn't continue with the afternoon."* They also indicated that the timeline stopped the flow of the interview as the participants *"came up with a lot of different things that they wanted to talk about"* instead of continuing with the timeline. However, they thought the timeline *"was a good start"* which helped to identify topics for starting the dialogue. Team H found the timeline too small and crowded to draw on (see figure 7-41 and 7-42), and they had difficulty drawing on it while sitting on the floor. They proposed a new timeline with faded suns and moons (see figure 7-43) and the use of thinner markers.

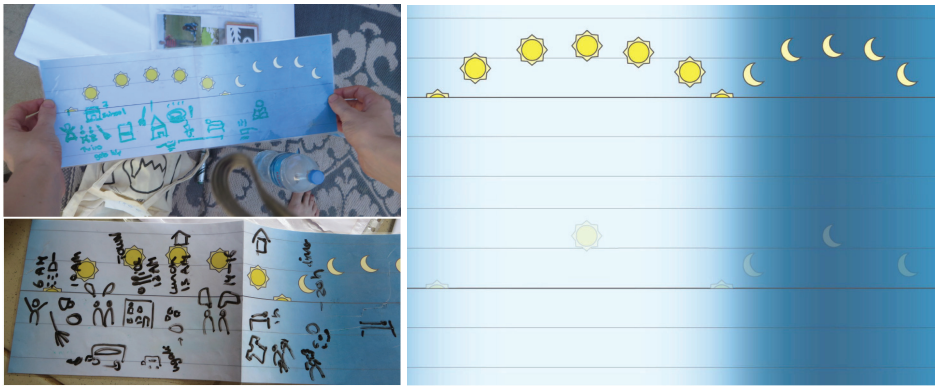


Figure 7-41 and 7-42: Drawing along with the participant on the timeline (Team H2)
Figure 7-43: Existing and proposed timeline for future use (Team H)

Team H2 replaced the exclamation marks with five-point stars, as they thought stars are considered more important in Africa (see figure 7-44). However, they did not notice a difference, in their experience the used symbol *"it is what you say it is."* Team H2 also changed the order of importance: *"having the important themes at the top felt as an improvement"* to the researchers. They changed the paper's orientation to 'portrait' to fit the six categories, but *"this reduced the space to place cards beside each other, which was not ideal."* Teams F2 and G used the importance sheet with the photographs, but they did not use smaller cards for sorting, as was intended, and therefore did not have sufficient space to place all the cards (see figure 7-45 and 7-46).

Figure 7-44: Importance sheet with importance categories represented by five-point stars (Team H)
Figure 7-45 and 7-46: Sorting the themes (Team F2 and Team G)

Teams F1, F2, H1 and H2 used pictograms (see figure 7-47 and 7-48). Team F1 experienced difficulty using them: *"Because some of them are so abstract, that specifically during prioritization, the link to the theme could not be made."* Team F2 indicated that they *"were constantly explaining what it means. Also with prioritizing, we had to explain it again."* Thereby, Team F indicated that they themselves found it hard to memorize which pictogram represented which theme. Team H had a different experience, they indicated that it is nice *"when it corresponds, but if you say, this is this and they recognize it there, then it is good enough."* According to Team H2, whether their potential users often watch television and commercials, and download DVDs may have played a role, as *"many people watch western things."* Team G replaced the pictograms with local photographs, as they

and their client organization thought that pictograms would not work. Some pictograms, however, were not directly clear to the participants. The teams that used pictograms indicated that participants had difficulty understanding the pictograms of 'Health', 'Land', 'Nature', 'Politics', 'Speaking Up', 'Products and Services', 'Dreams and Plans', 'Leisure Time', 'Mobility', and to a lesser extent those of 'Nutrition', 'Meaningful Work' and 'Animals'.

Figure 7-47 and 7-48: Using pictograms to visualise the different themes (Team F2 and Team H1)

Teams F2 and G replaced the pictograms with local photographs. Team F2 used photographs from the internet and photographs they made locally (see figure 7-49), but indicated that they had difficulties finding suitable photographs for all themes. Team G used photographs from their client organization. Gradually, they replaced some of the photographs with those made by themselves. Team F2 indicated that the photographs worked better than the pictograms. They indicated that they still had to explain what the photograph meant, but not three times, as in the case of the pictograms. They suggested that the photographs could be made more abstract by making *"line drawings from these photographs. Make them more like a colouring picture."* Team G explained that they *"started with too many photographs"*, but that after reducing the number, the photographs worked well (see figure 7-50). During the sorting exercise they had to explain only two or three pictures, not all of them. Team G therefore advised to use only one picture per theme during the interview to avoid chaos and searching for the right picture, but that *"it is difficult to have one image that represents a certain theme."* Team H2 argued that *"it might be nice to have three or four icons per theme and that [the design team] just chooses one"*, together with the translator or based on a pilot.

Figure 7-49: Photographs used by Team F to replace the pictograms

Figure 7-50: Photographs and visualizations eventually used by Team G, shown per cluster of themes. From left to right and top to bottom: 'People', 'Work', 'Environment', 'Home', 'Belief' and 'Health'

Teams F2 and G indicated some points of attention for designers when choosing photographs:

- Do not use too many photographs (Team G).
- Make the photograph represent all the topics within the theme (Teams F2 and G).
- The photograph for one theme should not link to another theme (Team F2).
- Use pictures regarding the aspired yet achievable situation (Team F2).
- Stay *"gender neutral, country neutral and age neutral"* (Team F2).
- Make the photographs recognizable for the participants (Team F2).
- Be aware that visualizations are perceived differently in different regions (Team F2)
- Be aware about local preconceptions to avoid overtone (Team F2).
- Discuss the visualizations with a local partner (Team F2)

Lastly, Team H advised adding a tool: a card with '10 commandments' which summarises what the designers need to pay attention to. The team indicated that a card with '10 commandments' would have helped them to remember the most important interviewing rules.

- Themes. All teams indicated that there are a large number of topics to go through. Team H2 lost the overview and could not always recall if certain topics had been already covered or not. Team G therefore clustered the themes in six categories (see figure 7-51 and 7-52) to keep a better overview and to save time. The teams indicated several topics missing: 'Communication' (Teams F2 and H2), 'Hygiene' (Team H, see figure 7-53 to 7-55), and 'Upbringing and Punishment' (Team H). However, Team H also indicated that all these topics do not necessarily need to be added, as there are already so many themes. They also indicated overlap, themes being too broad, and topics less relevant: questions about

transportation devices are in both 'Products and Services' and in 'Mobility' (Team H), 'Products and Services' is soooo broad" (Team H), the theme 'Politics' has no connection to design and could be removed (Team G). The teams also suggested combining themes: 'Nuclear Family' and 'Kindred Family' (Team F2), 'Health' and 'Healthcare' (Teams F and H) and 'Speaking Up' and 'Dreams and Plans' (Team G), and splitting themes: 'Education and Information' into 'Education' and 'Communication and Information' (Team F2) and 'Health' into 'Health' and '(Emotional) Well-being' (Teams F and H).

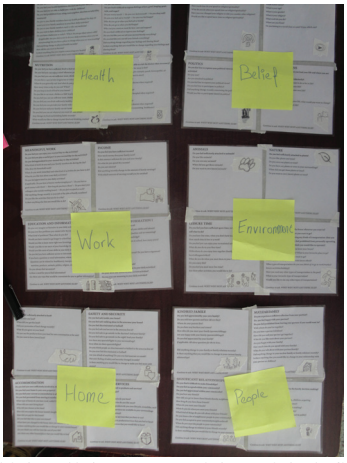


Figure 7-51 and 7-52: Team G clustering themes in 6 categories: 'People', 'Work', 'Environment', 'Home', 'Belief' and 'Health'

HYGIENE
Do you feel you can be sufficiently hygienic?

How do you wash yourself? And where?
How often do you wash yourself?
How about your partner and/or children?
How is your dental hygiene?
Where do you go to the toilet?
How do you clean your home? How often?
What other roles does hygiene play in your life?

Continue to ask: WHY? WHY NOT? ANYTHING ELSE?

HYGIENE
Do you feel you can be sufficiently hygienic?

How do you wash your clothes?
How do you clean your home? *And how often?*
How do you wash yourself? And where?
How often do you wash yourself?
How often would you like to wash yourself?
When do you wash your hands? *And how often?*
How about your partner and/or children?
How is your dental hygiene?
Do you have a bathroom or toilet? / Where do you go when nature calls?
If applicable: Are you obstructed to do your daily activities when you are menstruating? Do you have a place to change when you are menstruating?

Continue to ask: WHY? WHY NOT? ANYTHING ELSE?

Figure 7-53 and 7-54: 'Hygiene' questions and pictogram as proposed by Team H and used by Team H2
Figure 7-55: Final proposed questions for theme 'Hygiene', as proposed by Team H after conducting the interviews

- Questions. All teams indicated that there were many questions, limiting follow-up questioning and making it difficult to keep an overview, especially when participants introduce their own stories as well. Team F2 colour-coded the questions beforehand: *"questions we really wanted to ask, questions for women, questions for follow-up, and questions less relevant."* Team H2 crossed out the questions they had asked using a marker. The teams indicated missing questions regarding communication, information (Team F2), hygiene, workload, and time consumption of tasks (Team H2). Team H2 developed, tested and improved questions regarding 'Hygiene' (see figure 7-53 to 7-55), and added questions about workload and time consumption for certain tasks to 'Meaningful Work'.

Teams F2 and G added project related questions to the ODK interviews. Team G indicated that with the themes as a starting point *"it is very easy and useful to go from a broad theme towards practical questions."* Team H argued that asking all project related questions in an ODK interview would be too much, but indicated, with hindsight, they could have added a few more general product questions. They advised explaining in the ODK that designers can add a theme. The teams indicated that some questions are too broad and abstract for participants to answer. These mainly concerned questions about decision making, information, places to go (Team H), and dreams and plans (Team G). However, Team G also indicated that *"at the same time it worked very well, because then things came out like, wow, that is something we did not expect."* Team H2 sometimes indicated more specific directions for answering, but noticed that participants only answered regarding the given options. Team G advised asking the questions in a broad way in the first interviews, and to focus more in the following interviews. The teams also indicated that some wordings were not understood by translators (Team H2), that they found some questions belittling, (Team F), feminine (Team F), sensitive (Teams G and H) or context-specific (all teams). For an overview of the indicated issues, see Appendix F2.

Results focus group session

The results of the data analysis of the focus group session held with the design teams is summarised below. Table 7-4 provides an overview of the evaluators of this session.

Table 7-4: Details of ODK usage by design & research teams

	Team F1	**Team F2**	**Team G**	**Team H1**	**Team H2**
Master programme	SPD	IPD	DfI	SPD	IPD
Gender	Male	Female	Female	Female	Male
No. of interviews facilitated	2	3	7	1	1
No. of interviews documented	0	0	0	1	1

Interview flow and effectiveness

All evaluators agreed that the ODK assists designers in making design decisions, in understanding the culture, understanding participants' priorities, keeping the bigger picture in mind, and providing design inspiration. All evaluators, except G, agreed that the ODK helps the designer to understand participants' thought processes. F1, G and H1 agreed that the ODK also offered participants insights into their own lives, but F2 and H2 did not notice this. All evaluators fully agreed that the ODK challenged them to pose questions they would normally not ask, and that the ODK helped to detect things relevant for design purposes that would otherwise have gone undetected. F1 and F2 did, however, indicate that it is not sure if things would otherwise go undetected. All evaluators agreed that the ODK interviews take a lot of time, but that it is worth the effort. However, F1 indicated that participants *"can be really introvert which can lead to a low outcome in relation to the time put into that specific interview."* G and H1 agreed that the results depend on the participant's openness and involvement. All participants indicated that they would use the ODK again in another DfD project, but H1

added that she would use it only if time allows. H2 noted that in a developed region, the ODK might work as well.

F2 and H1 noted that it is difficult to convert the obtained data into usable input for the design process. F2, H1, and H2 argued that most information is subconscious, and difficult to indicate, however, F1 and G disagreed. H2 indicated that the interviews influenced the design outcome, but that it was not as simple as knowing what to design by conducting an ODK. F1 stated that they did use parts of the ODK interviews in their design criteria. F2 noted that they based their design goal on information from the ODK interviews, but that they could not identify concrete, functional guidelines from these interviews. G stated that they did, as the thickness of their diaper was related to 'Hygiene', 'Mobility' and 'Accommodation'. However, she indicated that that was also because they combined product-related questions with the ODK. H2 noted that the interviews might have had more influence than they realised, but that it is not relevant to quantify the influence of the ODK.

Designer-friendliness

All evaluators agreed that conducting ODK interviews is exhausting, H1 even noted that for her it was not possible to conduct two interviews a day. F1 therefore suggested to switch roles when conducting two interviews a day. All evaluators, except for G, agreed that using the ODK sometimes felt forced in asking certain questions just because they are part of the ODK. However, they all agreed that the ODK is a good basis to fall back on and that it can be adjusted to personal preferences. All evaluators, except for F1, agreed that in their design projects they did not have sufficient time to truly consider all the insights gained, and F2 indicated that it takes a great deal of time to process the data.

Manual

Evaluators F2 and H1 agreed that it was difficult to understand what the ODK would bring for their design project, while for the other three evaluators this was clear. H1 clarified that it is clear that the ODK would improve their understanding of the local culture, but it was not clear what it would bring for the product and / or service to be designed. All evaluators agreed that the ODK is most relevant at the beginning of a design project to guide the design process, but F2 added that she also obtained great insight in people's lives, and how they handle their products, providing relevant insights for the marketing strategy. In the manual, it will also be included that it works well to start broad during the first interviews, and to focus more in each consecutive interview, as indicated by F1 and G.

Procedure

- Steps. All evaluators agreed that the ODK works best in combination with making observations. H2 noted that it does not require a lot of effort and added significant information to their interviews, however, H1 admitted that she found it difficult to ask participants for a tour. F2 indicated that the first time conducting an ODK interview is a bit uneasy, but the second time it is easier to enter the conversation, knowing better which things can and cannot be asked, or how they can be posed differently. F1 and G discussed the ODK locally beforehand, which they indicated to be valuable. All evaluators agreed

that contextualizing visualizations would work well during the interviews. However, according to H1 and H2 this is not required. All evaluators, except for G, indicated difficulties regarding wording. H2 noted that they had one participant with a basic level of English, and in that case they did not use the translator. He later on realised that this could have been the reason why this participant misunderstood some of the questions. F2 stressed that difficult themes or questions could be posed after starting with easy topics and building initial rapport. She also indicated that most themes are related and it was therefore easy to switch between them, but, both F2 and H2, noted that some themes, for example 'Land', 'Income' or 'Animals' just had to be put in somewhere, which did not always happen smoothly.

- Guidelines. F1 and F2 had coffee with their translators beforehand, which worked well to explain the ODK's content and procedure and about appropriate behaviour and attitude. Translators being familiar with the participants helped to create a good atmosphere (F1 and F2). G indicated that the translator sometimes did not translate everything, as he was too busy and hasty, but that he was well educated and translated well. H1 indicated that their translator started to join the dialogue and gave his own opinions instead of the participant's, and F1 noted that one of their translators answered the questions before asking the participant. F1 indicated that finding a good interpreter was simply a question of luck, to which F2 added that networking helps. H2 added that having different translators did not work well, but F2 did not have any problems with that. All evaluators could vary in their selection criteria and could randomly select participants, however, H1 remarked that they did not obtain a view of their target group as they interviewed only Muslims. G agreed that religion plays an important role, and both F2 and G agreed that the obtained view is not generalizable. Regarding sensitive questions, H1 admitted that she was mainly held back by her own culture to ask certain questions, and H2 was surprised that one female participant openly shared her thoughts about menstruation with him present. F2 indicated that she ended up talking openly about contraception with a female participant even though the translator was male, and she had expected it to be a sensitive topic. G indicated that there was a great deal of shame in Bangladesh and that only one participant openly discussed her menstrual hygiene, when no male person was present. G also indicated that the Bengali people really looked up towards the designers, begin westerners, and suspected her participants did not want her to notice how miserable they were. On the contrary, H2 had the idea that participants pretended to be worse off in order to get more money from them.
- Themes. All evaluators agreed that it is necessary to discuss all themes at the beginning, but that it is useful to focus more after conducting a number of interviews. F1, F2 and G agreed that there were too many themes to keep a good overview. However, H1 and H2 did not have a problem with the number of themes. All evaluators, except for H1 agreed that it would be a good idea to cluster the themes. F1, H1 and H2 agreed that 'Hygiene' was missing as a theme, but F2 argued that 'Hygiene' is covered in other themes. All evaluators, except for G, agreed that 'Communication' could be added as a theme, although F1 noted that communication is already present in other themes. G did not see the need to add any theme, as in her opinion, there are already sufficient themes.

- Questions. All evaluators, except H1, agreed that asking all the ODK questions was too time-consuming for themselves and the participants, and that designers should make a selection when using the ODK. F2 argued to adjust them to the conversation and the context. During the discussion H1 and H2 learned that the other teams got more detailed information out of the ODK interviews by adding product questions, and H2 remarked that it could have been useful if they had done so. H1 still found their project too broad to be able to do so. F1 commented that adding product questions would also depend on the phase of the design process. F1, F2, and H1 agreed that some questions were belittling, difficult or scary to ask and / or answer. However, H1 was not sure if that was actually true in her project or it was just her *"opinion because of my culture."* G and H2 disagreed, but participant G indicated that her participants were ashamed to discuss some of the questions. Further, all evaluators, except G, agreed that some questions were ambiguously phrased, or too open and broad. G indicated that if participants did not specifically answer the question, those answers still often conveyed relevant information. F2 explained that these questions were uncomfortable to answer, and that they therefore negatively influenced the interview atmosphere. Evaluator G said that it was not the participants who had difficulty with broad and open questions, but that the translator had difficulty understanding the relevance of asking these questions, as they did not concern the to be developed product. H2 advised to make the questions regarding 'Products' and about recent changes more specific. Evaluator F2 provided examples, but indicated that these should not be too specific. G did not ask questions about 'Speaking Up', as they found these questions inappropriate for the Bengali culture. H1 found the questions of 'Speaking Up' vague, and therefore hard to ask and / or explain. Finally, F1 noted that their translators sometimes had difficulty asking certain questions, as they found some of them either simple or difficult. F2 indicated that it was useful to ask the broad and simple questions, as the answers might have been expected, but if one of ten answers are different, that might be the 'deal breaker'.
- Techniques. F1, F2 and G agreed that drawing and mapping improved the designer's understanding during the interview. H1 and H2 both agreed that drawing could support the interview, but added that the note-taker needs adequate drawing skills to keep up with the interview tempo. H1 also indicated that drawing while sitting on the floor was difficult. F2, G, H1 and H2 all agreed that drawing was not really required, although G stressed its value. F1 mentioned that drawing is required and that it could be combined with note-taking, especially when the interviews are being recorded. Regarding sorting, all evaluators, except H1, encountered participants who had difficulty understanding the sorting exercise. G stated that the technique needs a clear explanation from a good translator. All evaluators agreed that sorting is a good exercise to close the interview, and all evaluators, except G, agreed that sorting added additional insight. F1 added the side note that the technique could be *"pretty challenging"* for the participant.
- Tools. All evaluators agreed that discussing the day – whether or not using the timeline – was a good conversation starter, and that the pictograms / photographs during the conversation were useful to keep an overview and to make the interview less 'dry' and tiring. G remarked that she placed photographs to subtly guide participants towards a

new topic. Regarding the question cards, all evaluators agreed that they helped them and the participants to keep track of the interview progress. G clustered the cards prior to the interview in order to improve the fluency of the conversations. H2 clustered the cards on the spot, but that sometimes resulted in chaos and straying from one topic to another. F2 explained that she, at some point, knew which questions to ask, but that she liked her team member placing down the cards regarding the topic being discussed, as this worked as a reference for the conversation, and helped to see which cards were left. Lastly, all evaluators agreed that a separate question card with tips to keep in mind during the interview would be useful. G commented that it might be useful to have designers creating their own tips. H2 noted to add a question about a home tour on the card.

- Pictograms versus photographs. F1, F2, H1 and H2 agreed that pictograms work as a reference during the interviews, but that they have to be clear. F2 indicated that the pictograms should become less childish. H1 and H2 did not have the same feeling, and H2 added that it did not really matter what visualization is used, but that it had to be recognizable, and the facilitator needs to know what the visualization depicts. According to F1, some of the current pictograms were multi-interpretable, and that during questioning, the pictograms worked well, but with the sorting exercise, participants did not remember the meaning of the pictograms, and therefore chose to rank only those pictograms that they did understand. H1 shared that their participants just asked what the pictograms meant. F2 referred to a suggestion made by one of their translators; if people are literate, it might be useful to use pictograms with the title added in the local language. G immediately decided to use photographs to have a better link to the specific culture, after a discussion with the client organization team. All evaluators agreed that photographs probably would work better than pictograms as a reference point during the interviews. H2, however, wondered if participants might be steered towards certain answers with photographs. F2 indicated that she did not notice that happening, but that it was difficult to find suitable photographs for each theme. She also noted that they made assumptions for photographs suiting certain themes which did not always turn out to be correct, and therefore advised to locally test or discuss whether the photographs cover the themes' contents.

7.3.3 Conclusions try-out 2 and next steps

All three design teams used the ODK and most of its tools, and indicated that the ODK supported them to keep the bigger picture in mind, and to understand the participants' culture and priorities. The insights gained helped them in making design decisions and provided design inspiration. However, they also remarked that the ODK takes time and needs to be planned for, and that the tools require space and opportunity to be used. The teams provided recommendations for the manual, the techniques, tools, and the ODK's content in order to improve the ODK's appeal and uptake. These recommendations were considered when improving the ODK. As the try-outs focused on improving the ODKs procedure, the next step was an appraisal with experts from different backgrounds and affiliations in order to specifically evaluate the ODK's contents. The expert appraisal is described in §7.4.

7.4 Evaluation 3: Expert Appraisal

This section describes the results of the appraisal of the ODK by 53 experts in eight focus group sessions in two countries. The feedback obtained through this appraisal has been used to evaluate the ODK 1.0's content (see figure 7-56).

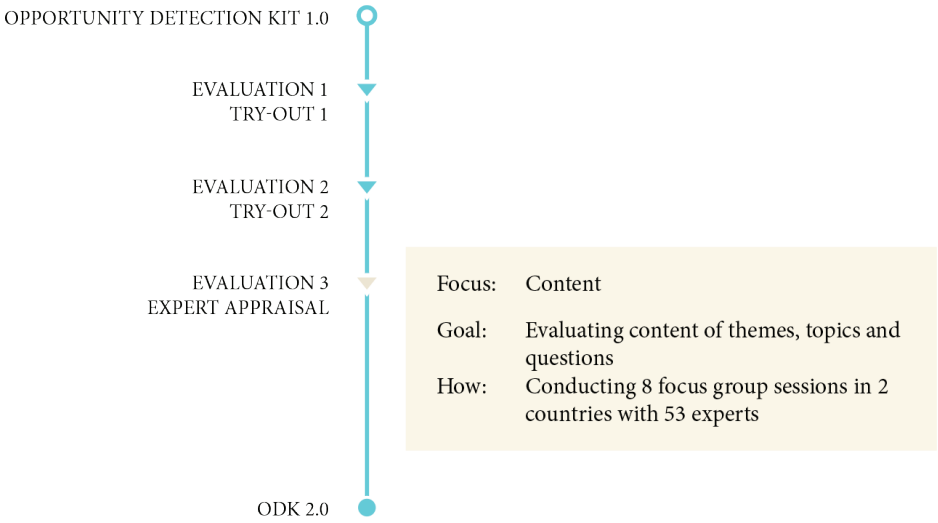


Figure 7-56: Content testing of the Opportunity Detection Kit by an expert appraisal

Focus

The focus of this evaluation was on the ODK's content (mainly on the themes and questions). To obtain insight in the comprehensiveness of the ODK's content, focus group sessions were organized at a conference in India and a seminar in Delft.

Limitations

There was little control on who would take part in the workshops. During the conference in India, mainly Indian students participated. While most participants were from the same nationality and background, this workshop resulted in valuable outcomes, as many of these students conducted design projects in the field. During the seminar in the Netherlands, the participants were a better mix of students, researchers and practitioners with different nationalities. Both workshops were conducted in a different manner: the initial workshop set-up led to some confusion at the conference in India, and was therefore adjusted to yield better results at the seminar in the Netherlands.

7.4.1 Expert appraisal by eight focus group sessions

To consult experts in the domain of DfD, eight focus group sessions were conducted at two different venues. The first four focus group sessions were held during a two-hour workshop the research team organized at the 'Design for a Billion' (DfB) conference, held in Gandhinagar, Gujarat, India on November 7-9, 2014 at the Indian Institute of Technology. According to its

webpage, the conference aimed to attract *"researchers, educators, practitioners, entrepreneurs and venture capitalists to discuss the implications and future of mass impact design"*[28]. The second group of four focus group sessions were held during a two-hour workshop at the 'Design and Engineering for Well-being, Agency and Justice' seminar, that was organized by the research team and other project partners. The seminar was held in Delft, the Netherlands on November 20-21, 2014 at Delft University of Technology. The seminar aimed to attract researchers, students, policy-makers and practitioners[29].

Evaluators

Details of the participating experts and the composition of the groups can be found in Appendix F3. The ODK 1.0 was evaluated by 24 experts divided in four groups at the conference in India and by 29 experts divided in four groups at the seminar in Delft. The experts were from different gender, nationality, background, and age.

Method

During both events, first a general presentation about the CDD approach and the ODK interview method was given, specifically indicating the themes and tools used in the ODK. Thereafter, the registered evaluators were asked to form four groups, each including six to seven group members with varying backgrounds.

Conference Gandhinagar, India

During the 'Design for a Billion' conference, each group was given the question cards of five or six themes in order to discuss them. For each theme they were asked to discuss:

- The convergence of the theme name with its contents;
- The clarity of its contents;
- Any missing and / or redundant topics;
- Clarity and adequateness of the pictogram.

All discussions were held in English and voice-recorded. Two research team members acted as facilitators for the four groups. All evaluators were then invited for a plenary discussion. During this discussion they were asked to:

- Have a look at all themes to see if they could indicate any missing and / or redundant themes;
- Discuss the potential of the ODK as a general basis for user context research and to what extent its contents should be contextualised;
- Discuss the ODK's usability for other stakeholders than designers and for other contexts and target groups than people living in developing regions lacking many capabilities.

Workshop Delft, the Netherlands

During the 'Design for Well-being, Agency and Justice' workshop, each group was handed

28 www.iitgn.ac.in/dfb

29 www.design4wellbeing-agency-justice.nl

out an ODK toolkit, comprising the timeline, question cards and importance sheet. They were asked to discuss:

- Own experiences with DfD projects to bring about missing themes and topics;
- Two specific settings for which the ODK could be used and to describe the users, stakeholders and changes required to the ODK to fit these purposes;
- Contextualization of the ODK, specifically its visualizations and suggestions for using pictograms or other visualizations.

All discussions were held in English and voice-recorded. A facilitator was appointed for each group. After the group exercise, all groups presented a summary of their discussions to the other groups.

For both workshops (see figure 7-57 to 7-59), all voice-recordings were transcribed in order to colour-code the feedback. The feedback was categorized regarding 1) the themes; 2) the topics and questions; 3) the procedure and opinions of the ODK in general; 4) the techniques and tools and more specifically the pictograms; 5) questions or comments on the ODK and its usage. The feedback was analysed regarding the number of evaluators who agreed / disagreed with the comments made in their group. When the majority of a group agreed, or when a comment was given in multiple groups, the comments were taken along to improve the ODK and the CDD approach.

Figure 7-57, 7-58 and 7-59: Group discussions in Group 1, Group 6 and Group 7

7.4.2 Results expert appraisal

The results of the workshop data analysis are summarised below. For a full overview of the workshop outcomes, see Appendix F3.

General remarks

The different groups made the following general remarks:

- Significance of user involvement. Potential users should be involved throughout the design process (Group 7), to collect opinions about potential product consequences, and check people's perceptions about the product during development (Group 5);
- ODK establishment. Group 7 wondered how the questions were established;
- Link between themes and capabilities. This was not clear to Groups 3 and 6. Group 5 confused 'capabilities' for 'capacities';
- Outcome usage. Different groups wondered how the outcomes could best be analysed,

used (Group 7), and quantified (Group 2);
- Other things to explore in the field. There are more things to explore in the field besides the user context, such as facilities for good design (Group 2) and interest from business (Group 7);
- People's lives change. Future changes of lives over time and in space are not captured (Group 8), and as people's lives change over time, themes might change as well (Group 2);
- Outcomes are context-dependent. As people have different beliefs and feelings (Group 2), relationships (Group 3) and preferences (Group 4) towards different themes, outcomes differ per context;
- Method triangulation is important. Groups 2 and 7 argued that interviews should be combined with other methods for a full picture, as words do not cover everything and what people say is not always what they do. Relevant methods indicated are: observation (Groups 3 and 5), surveys (Group 6), games (Group 6) and group discussions (Groups 7 and 8);
- Similar methods exist. According to Group 6, IDEO's Human-Centred Design Toolkit, contextmapping, and contextual design are similar methods, which can be used to explore the user context.

Relevance and effectiveness

Group 6 remarked that the ODK imposes a specific way of categorization and discussed that *"you will never get categories that work"* in every context and Group 7 wondered to what extent structural things, processes and trends can be identified by using the ODK. Group 7 furthermore discussed the relevance of addressing all 21 themes, and wondered whether it made the discussion too broad and open, but were willing to use it. Group 3 agreed that the themes provide *"useful information"* and can *"aid the discussion"*, but that *"it might not be essential for every project"*. Group 4 perceived the ODK as being useful as a conversation starter, Group 6 thought the ODK to be useful for detecting project goals, setting priorities and hierarchy, and Groups 6, 7 and 8 indicated the find the ODK useful for evaluative purposes and impact prediction. In the plenary discussion at the DfB conference, seven evaluators agreed that the underlying principles and basic structure of the ODK offer useful clues, and can be used as a basis, but that it is important to contextualise certain aspects, such as the visualizations, or the exact definitions of each theme. Group 2 indicated that individual feelings are very subjective and difficult to measure or generalize, Group 7 noted that the ODK cannot indicate opportunities to design for radical behaviour change. All groups suggested other users, target groups and purposes for deploying the ODK. These can be found in Appendix F3.

Designer-friendliness

Groups 4 and 7 indicated that going through all the themes would take a long time. However, in the plenary discussion it was noted that the ODK also saves time by offering a basis which can be readily applied, reducing the time designers normally spend on figuring things out. Group 6 indicated that the ODK use depends on the use setting and on the designers using it. They also indicated the relevance of clearly expressing the added value of the ODK to trigger

designers to use it. Group 4 suggested making a flowchart to indicate connections and guide designers through the questions, or to prioritize between the themes and leave out those with less priority if time runs out. Group 5 suggested to *"pick out the most meaningful card [..] as a guide, and use the rest of the cards to achieve that"*. In the plenary discussion, five evaluators agreed that the ODK should allow for flexibility in order to work for a larger group of designers. They indicated that sufficient grip should be provided for efficiency purposes, but that designers should be able to include their own experiences and context. Group 6 agreed to that and indicated that designers *"should also think for themselves, not just grab something and use it"*. In the plenary discussion, one evaluator indicated that the ODK should be more visually equipped for the designer, to stimulate its uptake and Group 6 noted that it is important to enable quick replication in the country itself, in case the kit gets lost or damaged.

Manual

To Group 6 it was unclear what the ODK actually is: a toolkit, a tool, a design game, an interview guide, or an interview tool. Group 4 perceived the ODK *"like a guidebook"* indicating *"21 ways to become capable of being happy"*. Group 7 had many questions about the exact use of the ODK and its different techniques and procedures, and wondered if and how product questions can be brought in.

Procedure

- Steps. In the plenary discussion, and by Groups 5, 6, 7, and 8, it was argued that the ODK provides a good base, but the local context should be included. Group 3 indicated the relevance of interviewing people in their own personal space. Group 5 suggested to start from dreams, activities, limits and barriers in people's lives. Group 8 indicated that using visualizations in combination with words might help to open up shy people, as well as asking what they do not like. Group 3 stated that designers should judge participants' answers on relevance and truth, and to look for patterns. Group 5 noted that during interpretation, it is relevant to consider the questioning behaviour of the facilitator, and the time of the day and week the interview is held.
- Guidelines. Groups 5 and 7 indicated that input should come from different actors of different levels. Group 7 wondered how much to tell about the project goals in advance, while Group 5 stressed the value of being honest about intentions and the product's possibilities. Group 5 wondered how many interviews are required, and Groups 5 and 8 indicated that in the field, things do not always go as desired or planned. Group 6 commented that it would be relevant for designers to discuss their relation to the local people during the interview, to make the local people perceive them more as insiders. Regarding sensitivity of questions, Group 1 was wondering how honest people will answer them, Group 3 stated that they might lead to *"uncomfortable situations"*, and Group 7 pointed out that in a *"two hour interview you cannot get information about [..] delicate issues"*. Group 1 advised being sensitive to people's emotions, and Group 3 suggested asking questions in indirect and different ways.
- Techniques & Tools. The groups indicated other techniques that would be useful for user

context research: roleplaying (Group 6), using visuals (Groups 5, 6, plenary discussion), historical timeline (Group 8), something interactive to bring about feelings and emotions (plenary discussion). Regarding the ODK techniques and tools they commented the following:

- Timeline. The timeline is useful for understanding daily routine, motivations, difficulties in daily life, lifestyle, behaviour and mind-set (Group 1), and for opportunity detection (Group 7). However, it should be bigger, clearer and simpler (Group 1).
- Mapping and drawing. The benefits of these techniques were clear to Groups 6 and 8, but Group 8 also stated that most people are afraid to draw and prefer to talk or write. Groups 5, 6, and 7 indicated that children can assist, and Group 5 also indicated that a local designer can be hired to draw.
- Visualizations. Groups 2, 4, 5 and 7 pointed out that people have different perceptions of visualizations and their meaning, and that certain objects or representations can be unfamiliar to participants. Groups 5 and 7 noted that that is not necessarily a bad thing, as long as these perceptions are discussed. Groups 2, 4 and 6 indicated that the pictograms *"will have to be very contextual"* (Group 4) as *"you can't find just one unified way to present it"* (Group 6). Group 6 warned that visualizations are often interpreted literally. Group 8 warns to not make the visualizations too specific, to avoid steering participants to think in a specific direction. On the one hand, Group 8 stated that participants can often better relate to a realistic image than to a pictogram, as pictograms are too generic, on the other hand, Group 7 argued for using pictograms, as images and pictures can be full of interpretation. Thereby, contextualizing visualizations takes time (Group 8). Group 5 also noted that contextualizing pictures takes time, but that it leads to better results. Groups 5 and 8 noted that what kind of visualization should be used depends on the purpose. The pictograms work well to *"represent a category"* (Group 8) and help designers *"think about what topics to address"* (Group 5), but when participants need to use the visualizations in an exercise they *"wouldn't use pictograms"* (Group 8). Group 6 suggested making a public database for people to post photos useful for different contexts and settings. They also noted that it would be *"nice to have a kind of checklist"* in the ODK for making pictograms. Four evaluators in the plenary session agreed that it might be useful to make *"a pack of possible pictograms"* which the designer can choose from, possibly together with a local partner. Group 6 suggested developing four varieties for each theme with differences in gender, age and context, and to hire a graphic designer to make the pictograms look more professional. The different groups also suggested other options for visualizations, which can be found in Appendix F3.
- Pictograms. Group 5 wondered if the figures in the pictogram represented male or female persons, Group 6 indicated that the pictograms *"are very much targeted at western culture"*, and Groups 5 and 6 both indicated the influence of colour on people. Group 6 explained that colours might be perceived differently by different cultures and that values can be attached to them. They advised using two colours for all pictograms. The groups also made specific comments per pictogram, which can be found in Appendix F3.

- Sorting. Group 5 *"very much appreciated"* the sorting technique and remarked that it could also be used with different stakeholders. They indicated that for prioritization, post-its can be used. Group 7 commented that the technique can help identifying people's priorities. They suggested prioritising based on what people value and what they need as those are two different things, and to use the mapping exercise to indicate the priorities of the different themes as well.

Content

Groups 2, 3, 4, 5, 7 and 8 indicated that multiple themes or even all themes are interrelated, and Group 4 suggested visually presenting the links to designers. Group 3 noted that all themes are relevant, but that especially 'Dreams and Plans' will reveal a valuable information for designers. One evaluator in Group 3 indicated that the themes *"generalise a lot of things"*, Groups 5 and 6 both mentioned that not all themes are at the same level, and Groups 6 and 8 remarked that the themes water and energy were missing. Then, the evaluators also made remarks per theme, which are the following:

- 'Health' and 'Healthcare'. Groups 1 and 6 suggested making a distinction between physical and mental health. Group 5 wondered what the difference between 'Health' and 'Healthcare' is;
- 'Significant Relationships'. Groups 2, 5, 6 and 7 indicated that 'significant' should be left out, as it attaches a certain quality to the theme (Group 7), can be misinterpreted, and can lead to incomplete answering (Group 6), is *"kind of normative"* (Group 5), and misleading (Group 2);
- 'Meaningful Work'. Groups 5, 6 and 7 indicated that 'meaningful' should be left out, as it attaches a certain quality to the theme (Group 7), can be misinterpreted and lead to incomplete answering (Group 6), and is *"kind of normative"* (Group 5).
- 'Nuclear Family'. Groups 3 and 7 pointed out that the term 'nuclear' can be misunderstood. Team 3 indicated that 'Nuclear Family' has a specific meaning in India, and suggested to restructure the themes concerning family;
- 'Leisure Time'. Group 2 indicated that 'Leisure Time' is misleading as a counterbalance for 'Work', indicating that 'Work' is an obligation and bound by certain restrictions, Group 8 argued that the title was misleading and suggested 'Hobby' or 'Spare Time';
- 'Mobility'. Group 2 indicated that 'Mobility' 'Mobility' is a very broad term which might include physical mobility, information mobility, transportation mobility, work mobility, migration, income and income mobility;
- 'Products & Services'. Group 2 noted that this theme is very broad and requires more elaboration and direction;
- 'Dreams and Plans'. Group 3 wondered if this theme is about short-term or long-term dreams and plans;
- 'Income'. According to Groups 4, 5 and 6, the definition of 'Income' should be broader. The groups suggested that the theme title should include 'Wealth' and 'Resources' (Group 4), 'Financial Situation' (Group 5) and savings and spending (Group 6);
- 'Accommodation'. Group 6 suggested using 'Housing', as they found 'Accommodation' a difficult word;

- 'Education and Information'. Group 5 argued for the name 'Education and Skills', Group 8 remarked that 'Education' and 'Information' are connected, but different themes;
- 'Politics'. Group 7 suggested broadening the title from 'Politics' to 'Participation', Group 8 suggested the title 'Society and Participation';
- 'Nutrition'. Group 6 noted that the title does not cover the theme content, as water is not nutritious.
- 'Land'. Group 4 suggested broadening the theme 'Land' to 'Space'
- 'Safety and Security'. Group 4 pointed out that this theme comprises many things, as it can be physical (from others or from nature), cyber, financial, emotional / psychological (fear, comfort).

Some of the mappings made by different teams during their discussions can be viewed in figure 7-60 to 7-62.

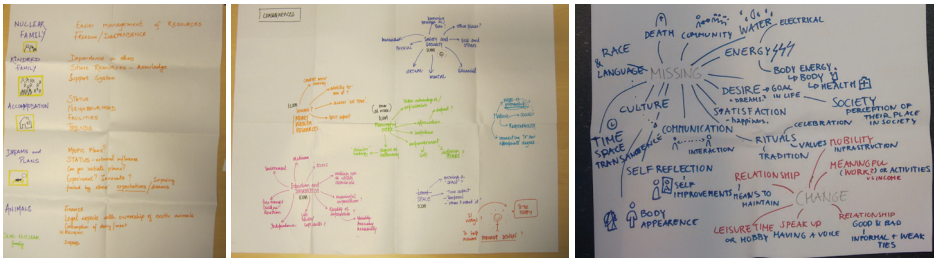


Figure 7-60, 7-61 and 7-62: Mappings of themes and topics made during the workshops by Group 3, Group 4 and Group 8

Regarding the topics and questions, the different groups made some general remarks and remarks per theme. On a general level, Groups 1, 3 and 4 had difficulty with the focus on people's feelings, experiences and freedom. They noted that the term 'feelings' is universal (Group 1), confusing (Group 3), broad and misleading (Group 4). Group 4 furthermore noted that the right towards certain opportunities should also be acknowledged. Group 7 remarked that it is important to go beyond what people value and detect their reasons for the way they live their lives. Then, several topics were noted missing, which are deliberately not specifically mentioned in the ODK, as they are overarching and should be detected through questioning participants about the different themes and topics. These are: insurance (Group 3), rules & regulations (Groups 2, 3 and 4), rights (Group 4), laws (Group 4), tradition, rituals, belief, culture (Groups 5, 7, 8), hierarchy (Groups 1, 3), habits (Group 7), values (Groups 5, 7), emotional and cultural attachments (Group 5), financial feasibility (Group 5), behaviour (Group 5), preferences (Group 5), perception (Groups 5, 6), gender issues (Groups 6, 7), women rights and position (Group 6), justice (Group 6), connectivity (Group 6), communication and interaction (Group 8), misunderstanding and stigmatisation (Group 8), time, perception of time (Groups 6, 8), ownership (Group 6), freedom (Group 6), influence (Group 6), feelings about life (Group 8), happiness (Group 8), satisfaction (Group 8), privacy (Group 8), access to water and energy (Groups 6, 8). Many more themes and topics came up during the sessions, of which many are already part of the ODK. For all existing 21 themes new topics were mentioned (see Appendix F3). Besides those, new themes also came up:

- Body and Appearance: how people perceive themselves, body energy (Group 8);
- Life: mortality, vulnerability (Group 8), food intake in relation to work (Group 1);
- Self-reflection: self-reflection and self-determination (Group 8), blessings (Group 1), happiness (Groups 1 and 2), inner peace (Group 2), being an inspiration for others (Group 4)
- Nature and value of relationships (Group 1, 2 and 3);
- Communal organization (Group 5) and cooperation (Group 2)
- Time: perception of time and what people do with time (Group 6).
- Natural environment: Group 5 distinguished between 'private space' such as gardens and shared nature / environment. Includes access and feeling with / attachment to nature, rules and regulations, consciousness about nature, exploitation, access and attachment to nature, happiness, relaxing (Group 5), natural resources (Group 6), and physical infrastructure (Group 8)

Moreover, Group 1 noted that other people are required to speak to when 'Speaking Up', and Group 4 noted that *"feeling of safety [..] is always in relation to something, it is not just being"* and not restricted to the living area, but to any place people go.

7.4.3 Conclusions expert appraisal and next steps

The focus group sessions generated input regarding new topics for the ODK, as well as in-depth discussions on the role and value of pictograms. Furthermore, the experts evaluated the ODK's different techniques and tools, and indicated improvements to the procedure and the manual. They also provided recommendations for improving the ODK's appeal and uptake. All recommendations made by the design teams and the experts have provided input for making adjustments to the ODK. These are presented in the next section.

7.5 Adjustments and conclusions

The results of the two try-outs and the expert appraisal have led to several proposals for adjusting the ODK manual, the procedure (steps, guidelines, techniques and tools), and the content (thinking framework, prerequisites, themes and questions). These also have an influence on the CDD approach. An overview of the changes can be viewed in figure 7-63.An overview of the adjusted prerequisites, steps and guidelines can be found in Appendix C6, an overview of the adjusted themes and questions can be found in Appendix D6.

7.5.1 Capability Driven Design

Even though the focus of the try-outs and expert appraisal were on the ODK, they also led to insights affecting the CDD approach. This is mainly because the ODK's content forms the backbone of the CDD approach, and because the experts and designers involved suggested additional methods and steps beyond the interview activity. Adjustments made to the CDD approach resulting from this feedback are presented below.

Attractive manual and an online platform

Different experts and designers indicated that the approach's uptake and proper usage will

improve when the amount of reading is minimised, and visuals guide the designer. The manual should therefore be redeveloped to provide a quick visual overview of the most important elements of the approach, and the text should mainly support the visuals and provide additional explanations. Team F and Group 6 suggested making the ODK available on an 'online platform' or 'public database'. This would make it freely accessible, and facilitate sharing experiences, visualizations, contextual adaptions and more, resulting in continuous improvement of the approach based on user-experiences.

What is CDD? What benefits does it offer?

To attract designers to use the CDD approach, it should immediately be clear what its benefits are, specifically for the to be designed products and / or services. This should be clear before designers even open the manual. By clearly indicating what distinguishes the CDD approach from other approaches, toolkits and manuals is, the focus of the approach has to be clear, so that designers can quickly decide if the approach is relevant to them, to their setting and to their project. The text on the title page of the ODK will therefore be revised to include the following:

> *Comprehensive user insight in Design for Development projects*
>
> *The Capability Driven Design (CDD) approach is created to help design teams to efficiently and comprehensively explore the user context in Design for Development (DfD) projects. This information supports the design team in making decisions throughout the design process and provides inspiration to develop products and / or services that are better accepted by potential users as they support them in the things they want to be and do.*
>
> *The Capability Driven Design Approach provides conversation topics and questions to help in getting to learn a lot about potential users and their context in a limited amount of time. It includes a step-by-step approach, several methods, techniques and tools in order to rigorously obtain comprehensive insight. Tips & tricks for conducting fieldwork are also provided.*

Outcomes

As indicated by the design teams, the outcomes of the CDD approach and the ODK interviews are not generalizable. The outcomes are, at most, generalizable for the investigated context. Moreover, the insights obtained comprise past and current experiences, but not future experiences. It is, however, not the goal of the CDD approach to obtain statistically generalizable or future insights; the insights must allow designers to get a feeling for the lives of the potential users in order to better address their needs and wants, both now and in the future. Designers will therefore consider their lives, lifestyle, behaviour, norms, values, habits, desires and aspirations when developing the product and / or service, resulting in better accessibility, applicability, acceptance and adoption of the design outcome.

Themes and topics save time

The CDD approach takes time, but the pre-defined themes and topics also save designers

preparation time, as it provides them with conversation topics and a structure to fall back on. However, it should be clearly mentioned in the manual, that the pre-defined themes and topics are a guide and that the design team should be open to local input and contextualization, and not miss out on important issues specifically related to local culture.

Processing insights

The CDD approach results in many insights, and processing them takes time. The approach propagates iterative data analysis, after each conducted activity. By immediately noting down surprising and unexpected insights and identifying patterns after each activity, valuable insights are detected and can be used in the design process. These insights should be checked with a bigger group of participants after being analysed and interpreted (step 4 of the CDD approach). The design teams need to plan time for this analysis and validation, and also for implementing the outcomes in their projects.

Two clear time frames: for quick and extensive research

During the expert appraisal, a much-raised question was how much time it takes to use the approach in the field. Currently, there is no specific time frame mentioned for using the CDD approach and the ODK. As design projects differ, and a longer time spent in the field results in a deeper insight and better understanding, two potential 'program outlines' have been added, each with a different time frame and an indication of an activity program. The first of these is the 'quick scan', resulting in insights in a period of one week. The second program is the 'extensive scan', which results in deeper insights gained in a period of one month. It should be stressed that spending more time and investing in building rapport and learning from the potential users results in deeper insight, as it remains difficult to access the inner feelings and perceptions of potential users if time for rapport building is limited. The 'scans' are presented as example programs, including activities that should be done and activities that are optional. The design team does not have to strictly follow the time schedule and program, they should think for themselves what best fits their preferences, the project and the context. The programs include time to prepare and conduct the activities and to process the outcomes.

Relevance of addressing ALL themes in a relaxed manner

During the first try-out, only one team obtained comprehensive insight by questioning potential users using all the themes. The main contribution of the CDD approach, however, is the endeavour to obtain comprehensive insight. It should therefore be stressed that all themes need to be addressed, also those that do not appear directly relevant at first sight. Therefore, in the beginning of the manual, it needs to be clearly stated that the goal is to look beyond product-user interaction and to obtain a comprehensive view of users' lives and that it is therefore important to discuss all the themes and topics. However, it will also be stressed that if participants do not want to discuss specific issues, or will not discuss certain issues in depth, that the themes and topics should not be forcefully addressed and followed, as this is intrusive for the participant and will not result in good data. Thereby, the knowledge that certain themes and topics are sensitive or difficult to discuss also provides the design team

with relevant insights. Moreover, after some initial ODK interviews during which all themes are addressed, the design team can continue the following interviews by going less broad in order to deepen certain issues by posing more 'why' questions.

Intrusiveness

One design team indicated that the ODK caused frustration as they could not help the participants with all their issues. This same frustration can come from participants, who are questioned about all aspects of their lives, and not necessarily get things in return, except for compensation of costs, food and / or a gift. Designers should be aware not to only extract information for their own benefit, and in this way raise expectations without offering solutions to the community. Designers should be open and honest, and clearly explain the purpose of their research and the possible outcomes. They should provide proper compensation for the time and effort that participants put in and provide participants follow-up on the project and its progress. The relevance of the ethics of fieldwork will be stressed in the CDD approach.

Why going into the field?

As indicated, everyone needs to be on board to make user context research a valuable undertaking. As one supervisor of the design teams indicated: *"already so much research has been executed to get to know the context. So, read about what people have written about it and talk to people, but don't do it all over again"*. Part of the CDD approach is indeed to conduct secondary research in order to learn from others beforehand what is already known about the context. However, it is valuable to go into the field itself and learn directly from the potential users about their desires, practices and context. By direct engagement, less distortion and filtering of information takes place and information can be gained about attitudes and values of which the potential users are not consciously aware. Not for every design project the relevance and level of direct engagement and participation is the same. As Kleine (2011); Kleine, Light, and Montero (2012) argue, the more pre-defined the product and / or service is, the more user choices are pre-determined and therefore, the more participation is needed in order to make the product / service fit the life that its users value.

Flexibility

As many of the design teams and experts indicated that a flexible approach is appealing for designers, it will be stressed that CDD and the ODK are flexible in use. The approach offers a generic base of a thinking framework, themes, questions and prerequisites. However, designers can adjust the questions, methods, techniques and tools to the context they are working in, to their own preferences, and to fit their project and its goals. The CDD offers a flexible range of add-on methods, and the ODK comprises five techniques and tools, but designers can also add their own. Designers are also free to add and / or remove questions, and to develop their own pictograms, images, drawings, photographs or other visualizations. However, the design team should keep an eye on the prerequisites: activities should be fun, simple and participatory, and should ensure method triangulation.

Targeted users are designers in both developing and developed regions

The CDD approach is not only relevant for use by 'Western' designers, companies, and organizations who conduct DfD projects, but also for local ones. Local designers also have biases, assumptions and preconceptions due to their backgrounds, skills and knowledge, and by using the comprehensive CDD approach, they might obtain new perceptions and insights.

Place in design process

For the design teams, it was not immediately obvious where to position the ODK within their design projects: when to use it and how to combine it with other design activities. The manual should explain that the CDD approach is meant to be used at the very start of the design project, in the beginning of the analysis phase. While the design teams F and H indicated that the ODK also helped them halfway through the project to quickly adjust and get a feel of the context, and several experts indicated that the approach can also be used to evaluate design projects, the intention of the CDD approach is to be used at the very start of a DfD project.

Multiple contexts

The manual should stipulate that when a product is meant for multiple contexts ('Context Variation by Design') it can be combined with the CDD approach. The design team will need sufficient time and resources to collect insights from all targeted contexts. This information can be used to search for commonalities and differences, as explained in the 'Context Variation by Design' approach (Kersten et al. 2015).

Participation throughout the design process

It should be clear that the CDD approach is not a way to quickly obtain insights in a specific context, ensuring good project outcomes. The potential users should continuously be involved throughout the design process to check opinions or to even co-create together with the designers.

Creative freedom

Understanding the user and knowing their lives, lifestyle, behaviour, norms, values, habits, desires and aspirations help designers to develop products and / or services that truly improve their potential users' well-being. However, a design team should not blindly follow everything their users want. They have their own creative freedom, methods and tools to develop products and / or services that might better suit the potential users in a way that the users themselves cannot imagine. Designers have to design for the future, and may even influence or steer this future and users' behaviour.

7.5.2 Backbone of CDD

The backbone of the CDD approach consists of the CA-based thinking framework, prerequisites, guidelines, themes and questions. Based on the evaluations, all these elements have been adjusted. The adjustments are described below.

Thinking framework

From the try-outs, it became clear that the difference between resources and conversion factors were poorly understood. In the expert appraisal, the link between capabilities and the themes were questioned. The description of the thinking framework and the relation between the CDD approach and the CA needs to be more clearly elucidated.

Prerequisites

The design teams that executed ODK interviews followed prerequisites A, B, C, F, I and J. However, some prerequisites were not followed, and new prerequisites arose based on the experiences of the design teams in the field:

- Prerequisite B: Activities should be conducted by two designers. As became clear from the experience in the field, it is not always possible to conduct activities in pairs. For example, the two team members of team G split up during one interview to create a specific situation – in their case: a situation with solely women present. When conducting an activity individually, data triangulation is ignored and it is difficult to focus on facilitating, note taking, observing behaviour and surroundings and deploying techniques and tools at the same time. Therefore, it is stressed that activities should preferably be conducted in pairs. However, if the situation does not allow two designers to be present, the designer conducting the activity is advised to bring a voice recorder to enable a better focus on the activity. It will also be stressed that recording the interviews, even with multiple designers present is useful, as it enables the note-taker to focus on behaviour, body language and the environment.
- Prerequisite D: Training. None of the design teams followed a training programme regarding qualitative research techniques. One team noticed that they lacked interviewing skills and argued that they are designers first and interviewers second. Training is, however, a prerequisite for conducting sound, rigorous research, and it makes the interview less invasive and more worthwhile. A training module will be added to the CDD manual, stressing the importance of ethical behaviour. In addition, a card with the most important interviewing rules will be added to the ODK toolkit, as well as an 'ethics' card. The module and card, however, do not replace training. Training involves practicing skills and techniques, while the module only describes an ideal and ethical attitude and behaviour, and different interview techniques.
- Prerequisite E: Participatory, simple and fun activities. The tools in the ODK toolkit are designed to make interviews engaging and interactive. However, not all teams deployed all tools either due to lack of time, because they did not recognize the added value, or because the technique did not suit them (mainly the drawing technique did not suit the users, although they often did see the relevance of drawing and mapping). However, it is particularly important to make the interview not feel like a questionnaire, but to stimulate dialogue and opening up of participants. The relevance of using tools and making activities interactive should therefore be stressed. It should be added to this prerequisite, that design teams can also add their own tools or adjust the ODK's tools to their preference.
- Prerequisite G: Iterative data analysis. It was not clear to every design team that the ODK

is a flexible interview guide that can be tweaked and adjusted, within certain boundaries. This will be better explained in the manual, and it will also be stressed in the prerequisites that obtained data leads to new understanding, and that this new understanding should be used to inform the next interview or activity. The title of this prerequisite will be changed to: Use insights to inform the next activity, as this title is easier to understand.

- Prerequisite H: Sharing and checking outcomes. The design teams did not take the time, or did not have the possibility, to share and check the outcomes of the interviews with their participants or in a broader group of potential users. Some teams did ask the participants to explain their drawings and / or mappings during the interview, but they did not verify their interpretations with participants, after their data analysis. They also did not share the outcomes with a larger group of potential users in order to validate their insights. Most of them did discuss the outcomes with their translators. The main reason given for not following this prerequisite was lack of time. However, they also argued that the obtained data is not generalizable. Designers, therefore, do not only need to plan time for preparing and conducting activities, time is also needed for interpretation and validation of the insights. The title of this prerequisite will be changed to: Discuss outcomes in a larger group to improve their usefulness, as this title is easier to understand and stresses the relevance of the prerequisite.
- Prerequisite J: Learn the themes and questions by heart. All teams studied the themes and questions prior to the interviews and the three teams that used the ODK intensively role-played the interviews beforehand, but they still indicated that, especially during the first interview, it was difficult to establish dialogue as the themes and questions were not yet familiar to them. After the first interview it became easier. To improve designers' understanding of the themes, they will be categorized and linked to each other to make them easier to remember. Moreover, it will be stressed that studying the themes and questions, roleplaying them, and piloting them in the field are all useful activities when learning them by heart.
- NEW - Prerequisite K: Get the team, client and translator on board. This prerequisite will be added to the list, as it is important for all those involved to see the relevance of the CDD approach to ensure reliable and rigorous data collection.
- NEW - Prerequisite L: You need to plan for it. Time is a recurring word in all evaluations. Conducting user context research takes time, especially in developing regions where 'things do not always go as planned', and often time is needed for travel, for establishing contacts to obtain access, and for acclimatisation to the local situation. Preparation takes time, conducting activities takes time, and data analysis and validation take time. The design team needs to plan sufficient time to properly follow all the steps and conduct rigorous user context research. It should not be a 'side-activity'.
- NEW - Prerequisite M: Triangulation. The CDD approach already ensures triangulation by its basis of four different methods, techniques and tools and by prerequisite A and B (Multidisciplinary team and conducting activities in pairs). However, the relevance of triangulation will be stressed in this prerequisite to explain why it is important and which measures result in triangulation.

The order of the prerequisites will be re-arranged, in order to follow the procedure of

preparation, conducting activities, and reflection / sharing. Moreover, to remind the design team about the prerequisites to follow, all of them will be summarised on a 'prerequisite reminder card', which will be included in the CDD toolkit. The card will be like one of the question cards, but larger and will concisely list the prerequisites. In the manual the full explanation of each prerequisite will be provided.

CDD guidelines

The following additions and changes were made:

- Guideline A: Select a variety of participants. It will be stressed that among the participants, it might be relevant to include people who do not belong to the target users, to obtain a broader picture of task distribution and perceptions. Religion was indicated as being an important differentiator; this will also be added. As this guideline is extremely important for user context research, this guideline will be changed to a prerequisite. Inequalities based on gender, social class, religion and ethnicity are not specifically paid attention to in the themes and questions, while these are important issues in 'development'. The detection of these issues should come from applying the CDD approach, when a variety of participants is included. It is therefore important to include men and women, of different age, different religion, different social class, etc.
- Guideline B: Appropriate behaviour and attitude. Paying attention to hierarchy / etiquette to properly approach participants, paying attention to local customs, avoiding deliberations in the design teams' mother tongue or in English with the translator, will be added to the tips & tricks on behaviour and attitude. Being honest about goals and that participants should be kept informed about the progress made regarding the design project will be added to this guideline.
- Guideline C: Appropriate questioning. The need for follow-up questions to obtain deeper insight, and that designers should not be afraid to pose 'dumb' questions will be emphasised.
- Guideline E: Bring along the required supplies. The designers going into the field should take along all supplies and plan bringing food along, when required. The necessity for supplies during the ODK interview means that this guideline will be changed to a step.
- Guideline F: Selecting, instructing and working with a translator. The translator's availability for all interviews familiarity with the participants, and that the translator should not have a stake in the results will be added as selection criteria. It is important to pay attention to the gender, social class, age, clothing, religion and ethnicity of the translator with reference to the participant. It may be useful to select both a female and a male translator to be able to open up dialogue with both male and female participants. Furthermore, the translator should have sufficient time, be sufficiently educated or skilled, and should have an interest in the research. As an instructional tip it will be added that it might be good to have a meal or a drink with the translator and to develop a relationship. The translator should be told that some questions may sound simple, but that they still should be asked.
- Guideline H: Be aware of your position. When people look up to the designers and / or the translator, and / or want to stress or reveal their miserable situation, the distance can

be reduced by sitting at the same level, showing interest, being open and honest, and by sharing food. It is important to show appropriate behaviour and attitude (guideline A). The possible influence of the design team's position should be noted down and incorporated during interpretation of the data.

- New - Guideline: Compensation. Compensation can and should be provided to participants for their lost time and possible transportation costs, but be aware that money does not become an incentive to participate, as this influences the interview outcomes. Money, food and gifts to bring depend on the activity and on the context. Providing a tangible gift allows the participant to show the gift to other people, but might not be appreciated everywhere. It is important to find out what the people in the area find valuable. The compensation can be decided upon in collaboration with local partners.
- New - Guideline: The use of video and photography. The ODK only suggests asking for consent for video and / or photography. In the new guideline, the benefits and disadvantages of video, photography and voice recording will be explained.
- New- Guideline: As the intended 'receivers' of the message displayed in the visualization vary, it is difficult to develop one universal set of visualizations suitable for every context. Therefore, contextualizing the visualisations might stimulate discussion. The following tips and tricks should be kept in mind when contextualizing visualizations:
  - Keep the audience in mind (Hodge 2008);
  - Consider using words, images and graphic forms (Pettersson 2010);
  - Make the lay-out clear and simple (Pettersson 2010; Hodge 2008): use one specific style (Pettersson 2010; Hodge 2008), avoid unnecessary detail, keep the amount of elements limited (Pettersson 2010), and use a limited amount of perspectives (Hodge 2008);
  - Consider the display size of the visualization (Hodge 2008): use picture elements which are large enough and shown in boldface (Pettersson 2010);
  - Emphasize the important aspects (Pettersson 2010);
  - Pay attention to colour and contrast (Pettersson 2010);
  - Iteratively improve upon visualizations: consider feedback expressed by participants (Pettersson 2010);
  - The tips and tricks provided by Teams F and G.

Themes and topics

Based on the evaluations in the field and with experts in the focus group sessions, several themes and topics were noted as being missing, and different theme names were suggested. Furthermore, the evaluations noted that not all themes were at the same level and that many themes are interrelated. The design teams commented that there were too many themes to oversee them all. Based on the feedback, the following changes will be made:

- 'Nuclear Family' and 'Kindred Family' will be combined to one theme: 'Family';
- 'Land' and 'Nature' will be divided into 'Natural Property' and 'Environment';
- 'Significant Relationships' will be split into 'Community' and 'Social Life';
- 'Products & Services' will be split into 'Products' and 'Facilities';
- 'Health' will be split into 'Emotions' and 'Health';

- 'Education & Information' will be split into 'Knowledge & Skills' and 'Information & Communication';
- 'Mobility' will still be included, but only concerns the places to go. Transportation devices will be placed under 'Products' and infrastructure will be placed under 'Facilities' (infrastructure). The theme name will be changed to 'Movements' to avoid associations with different kinds of mobility (e.g., income mobility, information mobility)
- The themes 'Meaningful Work' and 'Leisure Time' will be combined and the theme name will be changed to 'Work and Spare Time';
- 'Politics' will be changed to 'Participation & Organisation';
- The theme title 'Accommodation' will be changed to 'Housing';
- The theme title 'Nutrition' will be changed to 'Food and Drinks';
- The theme title 'Income' will be changed to 'Financial Situation';
- 'Speaking Up' will be split among different themes by adding the topic separately to: 'Family', 'Community', 'Social Life', 'Participation & Organisation', 'Daily activities' and 'Work & Spare Time'.

During the expert consultation, many other topics came up, which are also not specifically mentioned in the CDD's themes and topics: gender issues, insurance, rules & regulations, tradition, rituals, belief, culture, hierarchy, habits, values, emotional and cultural attachments, financial feasibility, behaviour, preferences, perception, justice, misunderstanding and stigmatisation, perception of time, ownership, freedom, influence, feelings about life, happiness, satisfaction, privacy, access to water and energy. These topics should come out from the dialogue about the different themes, and are therefore not specifically added to the existing themes. Finally, the themes will be clustered to provide a better overview for the design team, and their interrelations will be visualised in a schematic picture. The final themes and topics are presented in chapter 8.

Questions

The questions will be adjusted according to the feedback from the evaluations, and based on the adjusted themes and topics. While topics, and therefore questions, have been added, the total number of questions per theme will be reduced. The designers, as well as the experts, perceived them as being too many. To make the number of questions less overwhelming for designers, three adjustments have been made:

- The bold questions have been transformed into a short summary of the topics under discussion, the 'conversation starters' will remain as questions to open up conversation. In this way, designers can more quickly see what a theme is about during the interview, and there is no confusion about what the bold questions mean and are meant for.
- The 'conversation starters' have been scrutinized to remove similar questions.
- The 'perception' of the number of questions will be changed. For example, questions about the doctor, hospital, clinic and dentist are similar and repeated, and they will now appear as one question: how far away is your doctor / clinic / hospital / dentist? How often do you visit your doctor / clinic / hospital / dentist? This change does not reduce the total number of questions, but design teams will be less overwhelmed.

In addition, some questions were perceived as being too abstract, unclear, belittling, gender-specific and context-specific. These questions will be adjusted accordingly:

- To indicate that designers are free to change or add questions and should ask follow-up questions to detect people's reasons. In the manual the importance of posing follow-up questions will be stressed, and it will be indicated that the questions are 'examples of conversation starters'. Thereby, the following sentence will be added to every question card: *"How / why / what / who / where / when ……?"*. Moreover, the importance of asking follow-up questions will be added on the card with the 'ten commandments'.
- Questions about communication, hygiene, working hours, upbringing, punishment, body & appearance, spirituality, trust, support, pressure, celebrations, working hours, working area, corruption, participation, guests, energy, water, public nature, product trends, and loans will be added.
- In addition to the above-mentioned specific topics, the following 'overarching' topics are implicitly present: rules & regulations, rights, laws, exploitations, tradition, rituals, belief, culture, habits, values, emotional and cultural attachments, financial feasibility, behaviour, preferences, perception, gender issues, women rights and position, justice, connectivity, communication and interaction, misunderstanding and stigmatisation, time, perception of time, ownership, freedom, influence, feelings about life, happiness, satisfaction, privacy, access to water and energy. These topics should arise when asking the conversation starters and follow-up questions, and will therefore not explicitly be added.
- Questions regarding 'Speaking Up' and 'Self-Reflection & Dreams' will be changed to make participants open up more. This is also the reason why 'Speaking Up' will be divided among several themes. Being a separate topic makes it more difficult to discuss.
- The questions about 'Mobility', 'Speaking Up', 'Information', 'Self-Reflection & Dreams', and 'Products' and 'Facilities' will be made more specific, to try to keep them open enough to stimulate discussion about them.
- Questions about transportation devices will be moved to 'Products'. Questions about infrastructure will move to 'Facilities'. The theme 'Movements' will be about places where people go and want to go.
- Questions about 'Social Life', 'Family', 'Financial Situation', 'Work & Spare Time', 'Mobility', 'Speaking Up', 'Health', 'Nutrition', 'Accommodation', 'Self-Reflection & Dreams' will be reviewed to make them less belittling and / or gender specific. However, not all questions will be changed. A note will be added to the manual that if certain questions seem to limit the dialogue, they should either be changed or skipped.
- The questions considered to be 'dumb' or 'irrelevant' will be kept. The facilitator should not be scared about asking these questions, as they might reveal unexpected information and are meant to reduce biases and assumptions.
- As the bold questions will be removed, there is less reference to 'feelings' and 'freedom', resulting in less confusion. However, the focus on people's feelings and freedoms will still be present in the questions and this is also stressed in the thinking framework.

7.5.3 ODK manual, steps and guidelines

The try-outs and expert appraisal led to feedback regarding the ODK procedure, involving its manual, steps and guidelines. The proposed adjustments are indicated below.

ODK manual

The adjustments made to the manual, based on the feedback from the evaluations, are described below.

Role of ODK within the full CDD approach

In the manual, the ODK should be explicitly linked to the CDD approach, as only conducting interviews is not sufficient to guarantee quality insights. Building rapport and observing people is required before conducting ODK interviews, and validating the outcomes by sharing them in a larger group is required after conducting the interviews.

What is ODK? What benefits does it offer?

The ODK is a toolkit that supports one of the essential methods of the CDD approach: semi-structured interviews. It uses the backbone of CDD (thinking framework, prerequisites, themes and questions) and includes several techniques and tools. The techniques and tools can be used during the interview to start the conversation, stimulate participants to open up, make the activity fun, simple and participatory, address all the themes, provide an overview of the conversation topics discussed, and provide the design team with a basis to fall back on. The advantages of the ODK should be clearly explained in the manual, before explaining all the things it comprises.

How to use the ODK?

The ODK procedure, following its techniques and tools, should be clearly visualised and described in the ODK manual. It should be stressed that during the first few interviews, all themes should be addressed, but that the facilitator should follow-up on the unexpected and on issues that the participant finds interesting. During the latter ODK interviews, after iterative data analysis of the first interviews, the facilitator can go deeper and obtain more specific insight in emotions and feelings regarding the themes that are of greatest interest.

Combination with product-related questions

During the ODK interviews, 'generic' product questions can be asked. Product questions can be added when certain themes are discussed that are obviously related to the product or service to be developed. For example, when a solar charging station for mobile phones needs to be developed, questions about mobile phones ('Products'), connectivity ('Mobility', 'Significant Relationships', 'Family' or 'Services') and energy ('Services') can be asked. Example questions could be: 'Do you own a mobile phone' and 'What do you use your phone for?' and 'How do you charge your mobile phone?'. More specific questions, for example about aesthetic preferences for the charging station, are not suitable during the ODK interviews, they will make the interview too long and too much focused on the product; the interview sets out to gain a comprehensive insight.

ODK steps

The following steps will be adjusted, based on the feedback from the evaluations:

- Step 1: Get familiar with the ODK. This step will stress that the best way to get to know the ODK, the themes and questions is to read the full manual and to roleplay the ODK. The benefits of becoming familiar with the ODK (faster interviews, better dialogue, more opening up) will be stressed.
- Step 2: Obtain information beforehand. It will be added that obtaining information about the context beforehand is useful to detect structural things, processes and trends. The benefit of obtaining information prior to the interviews will be stressed: the information can be used as input for the fieldwork and reduces the interview duration. However, the designers should be aware that the obtained information should not result in biases and preconceptions.
- Step 3 / 5: Localize the content and conduct a pilot. The relevance of localizing the pictograms and wording of the themes and questions will be stressed, as this stimulates dialogue and helps to obtain more relevant outcomes. The ODK provides a sound basis, but the local context should be brought in. Designers will be advised to contextualise the visualizations, as this results in better outcomes, but that they do not have to be contextualised if time does not allow for it. The pictograms can be discussed during the interview to align people's perceptions with the theme content, and this can also be an interesting start of the conversation. The themes, questions and tools can be discussed with a local partner and by piloting the ODK interview, they can further be adjusted to suit the local context. Step 3 and 5 will be merged into one step, as they are interrelated. Tips & tricks for contextualizing visualizations will be added to the manual.
- Step 4: Carefully select and instruct a translator (if required). The selection and use of a single translator for all interviews will be advised, as this reduces the training and interview time. Furthermore, a translator familiar to the participants who does not have a stake in the research project, helps participants to open up.
- Step 6: Select participants. To this step will be added that participants can be selected through local partners, translators or via other participants, but that the selection criteria should be kept in mind and that attention should be paid to the selection of an unbiased sample of participants. It will be stressed that a variety of participants should be selected, which can also include people who do not belong to the group of potential users. For example, when the potential users are disabled children, it is not only relevant to obtain insight into the lives of the children's mothers, but also into the lives of their fathers to obtain both their perceptions, and to learn about the division of tasks.
- Step 7: Assign roles. It will be emphasized that it is important to pay attention to the person to be interviewed and to appoint a facilitator that matches the participant most (e.g., in gender, age, social class, clothing, religion and ethnicity). However, if the characteristics of the facilitator are very different from those of the participant, this does not necessarily negatively affect the outcomes of the interview.
- Step 8: Decide on time and place. Two teams indicated that the presence of company employees negatively influenced the interviews. However, one team stated that one participant seemed to feel more relevant when someone from the company joined the

interview. Nonetheless, a note will be added to this step that not only the audience should be limited, but that the presence of employees from the client organization should be avoided, if possible. Audiences who have a stake in the project often result in the participant being less open. The design teams also indicated that ODK interviews held on the street and / or during work time are not suitable as there is too much interruption and audience. This will also be added to this step, as well as some tips and tricks: by conducting interviews during lunch or dinner and bringing food, participants can be triggered to participate outside working hours. Moreover, if participants do not have time, it might be useful to build rapport by working along with the participants and ask questions 'in the meantime'. The interviews should preferably be conducted in the participant's own personal space, in order to combine the questions with observations.

- Step 9 & 10: Introduce & ask for consent. It will be stressed during this step, that the design team should be honest towards the participant and can explain that the purpose is to design or improve a specific product and / or service, but that during the interview the questions will address many aspects of their lives, in order to learn from the participant, and therefore become better able to address their needs and wants.
- Step 11: Ask for the participant's introduction. The relevance of learning participants' names, age, place of residence and religion and noting this down, in order to acknowledge the participant and make him or her feel relevant will be emphasized in this step.
- Step 12: Touchstone tour. It will be stressed that the combination of observation and dialogue results in better outcomes.
- Step 13a: Sit down and…build dialogue. Practical advice like: if three designers are present, it is best to not all sit together, and that the facilitator should be able to easily face both the translator and the participant will be added here. Working with a translator results in an extra barrier, but the designers should try to address the participant and not lapse into discussions in their native language. It will be stressed that it is important to start and end with 'easy' topics (which one are 'easy' depends on the context), and that asking follow-up questions is important. The facilitator should not only follow-up on the unexpected, but also on topics that the participant finds interesting. When participants have difficulty opening up, the facilitator can fall back on 'easy' topics or use drawings to elicit more response. If certain topics are clearly sensitive or cause the participant to close down, the facilitator should switch the topic. Any question affecting the dignity of participants must not be pursued. The CDD approach pays attention to ethical guidelines, but there is a thin line between immersion and intrusion, and designers have to be cautious to not only extract information only for their own benefit and then leave. It is important to consider and respect people's privacy, and their personal space. If participants do not allow the designers to enter that personal space, that should be respected. Participants should be kept informed about the progress made regarding the design project, and properly be thanked and compensated for their invested time and effort.
- Step 13b: Sit down and…document. It will be explained that a note-taker should pay attention to participants' behaviour, attitude, body language and interpretations. It will also be added that the 'note-taker' can draw, and capture photographs and video, especially when a voice recording device is used. However, the possible effects of recording devices

should be known. They can influence the participant, who can become shy or hold back from opening up and sharing specific details. This advice will be added to this step.

- Step 14: Thank the participant. The design teams had different experiences in the field regarding bringing a small gift. In some regions, people very much appreciated a tangible gift, in another region money was much more appreciated. It will be stressed during this step that money should not become an incentive for participation, but that participants can and should be compensated for their lost time and possible transportation costs. Information about compensation will be added as a guideline.
- Step 15 / 16: Document immediately. Interpret and reflect. This step will be changed to: Analyse, interpret, discuss and reflect immediately. Analysis refers to taking out the relevant insights directly after each interview to enable quick identification of patterns for use in the design process. The designers present during the interview should immediately discuss and interpret the most striking insights and their perceptions of the interview, the participant, the translator and, if present, the audience. Participants are not always totally honest for a number of reasons, ranging from the presence of audience, designers and / or the translator, the time of the day, week, the location of the interview or the lack of rapport being built. These aspects should be reflected upon and the answers should be interpreted by the designers present, but also in consultation with the other team members and local partners. Also the behaviour and attitude of the facilitator needs to be reflected upon.

ODK guidelines

The following additions and changes were made:

- Guideline A: Time and place of the interview. Step 8 already provides tips & tricks for deciding on the time and place of the interview. The exact time and place mainly depends on what is convenient for the participant. A home setting is preferred for combining interviews with observation, but if the home setting results in shyness, embarrassment, is too hot, or results in an audience or other disturbances, it might be better to conduct the interview in a more contained space.
- Guideline B: Flexible but focused individual conversations. The ODK is an individual interview, and it will be emphasised that the interview is not a protocol to follow; it is semi-structured and therefore flexible. The question cards help in making the ODK interview flexible, avoiding the need to bring 'a list of questions'. The categorization of the themes will help designers getting a better overview and help them conducting the interviews more flexible.
- Guideline C: Duration of interviews. The ODK 1.0 contained many more questions than the prototypes. It was therefore not clear how long an ODK interview would approximately last. From the experiences in the try-outs, it can be concluded that an ODK interview lasts between 2-3 hours, and can be conducted more quickly when the themes and questions are known by the designers and the translator. A note will be added that if a participant becomes tired or disinterested, it is best to end the interview.
- Guideline D: Number of interviews. The number of interviews is not fixed; it is up to the design team to decide when sufficient insight has been obtained. The context, the project, the participants, the translator and the skills of the facilitator all influence the outcomes

and therefore these all determine the number of interviews. It is not the intention to obtain statistically generalizable data, and after the first few interviews, the amount of new insights will decrease. The 'quick scan' program includes at least five interviews, conducted in three days. However, the amount of insights obtained determine whether this is sufficient, or if more interviews are required. The 'extensive scan' allows for conducting more interviews in combination with other methods.

- Guideline F: Dealing with sensitive questions. A note will be added that it may be better to let male designers pose sensitive questions to male participants, and female designers to female participants, when possible, as this increases the possibility of honest responses. It will be stressed that designers do not have to forcefully ask questions, just because they are in the ODK. However, they should also not be led by their own shame or sensitivities, as sensitivities differ per context. The facilitator should be sensitive to people's emotions, and might rephrase questions in different ways in order to elicit a response. However, the facilitator should not force participants to answer if they do not want to. Sensitivities can be checked beforehand with local partners, but the information provided by local partners should not be leading.
- New - Guideline: Start broad, go deeper. It will be added that during the first interviews it is important to touch upon all themes and topics, and that after some initial interviews, some of the topics and questions can be left out in order to deeper investigate the topics and questions that seem surprising or interesting for the design project.

7.5.4 ODK techniques and tools

The techniques and tools were not all used, and the design teams adjusted them or used them for other purposes than intended. The techniques and tools will therefore be more elaborately explained in the toolkit and adjusted to stimulate their appeal and user-friendliness for designers. The techniques and tools need to be:

- made more interactive to elicit feelings and emotions;
- made easily replicable;
- flexible to improve uptake, different options to choose from;
- usable in a small space;
- usable outside, without blowing away;
- usable when sitting down on the floor.

By making the techniques and tools available on an online platform, it will be easier for designers to access and adjust them.

Question cards

When used, the question cards were considered to be helpful to keep an overview of the themes discussed, and they provided a base to fall back on if a conversation stagnated. The cards help to keep the interview flexible and show the progress of the interview to the participants and the translator. However, as the questions are on the back, the cards need to be turned all the time and cannot be laid down for the participant to see. Thereby, the pictograms were sometimes misunderstood or confusing. Most experts also indicated that contextualised photographs elicit better responses, but it was also argued that pictograms can

work, if the perceptions and meanings of the different themes and pictograms are discussed during the interview. The preference is still to localize the ODK's content, and therefore its visualizations in order to elicit better responses, but if there is no time, design teams have a good option to fall back on. As a basis, the generic pictograms will remain, and the following suggestions will be addressed to improve them:

- Different options of pictograms will be added for each theme, of which the design team can choose one, depending on the context. The other pictograms can be brought along, in case the chosen pictogram does not work;
- The pictograms will be made in one style, regarding line thickness and type of pictures;
- The pictograms will be in black and white to rule out any emotions and meanings attached to colours in different contexts;
- The pictograms will be kept neutral (regarding gender, country and age);
- The question cards will remain, but are mainly to guide the designer. An extra set of cards without questions will be added to the ODK, which can be used to provide visual feedback to the participant. The cards can be placed underneath a transparent card holder, which was also done for the sorting exercise used in the ODK 1.0;
- Tips & tricks to contextualise visualizations will be added to the guidelines.

Drawing on the timeline of the day

Not all teams used the drawing and mapping sheet and one designer indicated that a more professional look would help convince the design team, the participants and the translator to use this technique. The same designer argued for a larger piece of paper. To make the drawing and mapping exercise more professional and attractive to the participants, and easier to use by the design team, the use of an electronic drawing device that automatically stores the drawings is advised. However, this option is not always possible for the design team, therefore the timeline will be adjusted to suit this purpose. The timeline was never intended to draw or write on, but the design teams that used the drawing technique during the interview did use it in this way. They found the timeline an easy conversation starter, triggering follow-up questions, and helping to keep an overview. However, for drawing and writing, the timeline was perceived as being too small and too colourful. Therefore, the timeline will be adjusted: it will be made larger and the background will be faded.

Mapping on a drawing sheet

To allow for mappings of:

- People's housing, surroundings and mobility patterns, a drawing sheet will be included;
- People's appearance and social life, another drawing sheet will be included.

On each drawing sheet, the pictograms of the themes that should be visualised are printed to remind the facilitator and the translator, and guide the participant. The pictograms are designed to generate interest and to open up dialogue, stimulating the use of the drawing sheet.

Sorting sheet and sorting cards

The design teams indicated that the sorting technique provided them with insights into

people's priorities, and pointed out contradictions. They indicated that it is a good way to close the interview, but that the exercise was not readily understood by participants. The experts furthermore indicated that it is not exactly clear is being sorted: people's values or people's needs. They indicated that it might be interesting to compare them. One design team expanded the categories from 4 to 6, in order to allow for greater differentiation. Based on this feedback, the sorting sheet will be adjusted and consist of 6 categories, indicated by exclamation marks. It will be explained that the sorting exercise serves to sort people's values. For the CDD approach it is relevant to identify needs, but the focus is on people's desired and aspired capabilities. The exercise will also be better explained in the ODK manual: participants should indicate which themes they value most in their lives. To avoid confusion, this can be done best by providing the sorting cards one by one and let people sort them one by one. When all the cards are laid down in front of the participant, they become more easily confused, or are tempted to only sort those themes of which they remember the visualizations.

Reminder cards

Several cards with quick reminders will be added to the ODK toolkit, to support the designer to stick to the right behaviour and attitude and not miss out on prerequisites and steps.

- Card with 10 commandments. A card comprising the most important rules for interviewing will be added. Designers are free to add to this card;
- Prerequisite card. A card shortly stating the prerequisites of the CDD approach will be added;
- Steps card. A card shortly stating the steps of the ODK interview will be added;
- Ethical guidelines card. A card shortly stating the most important rules regarding ethics in qualitative research.

Add-on tool: Historical timeline

Another timeline will be added to the ODK: two design teams included a timeline stretching over a longer period than one day. A timeline of participants personal history assisted the participants to go back to past experiences and made it easier for the designers to keep an overview of historical events and to notice contradictions, unclarities and misunderstandings. A timeline of one year helped one design team to obtain more insight in participants' activities throughout the year. This can be relevant, as participants' activities may vary per season. Therefore, in addition to the one day timeline, a yearly timeline and a personal history timeline will be added, which can be deployed if the interview allows for it.

7.5.5 Conclusions and next steps

The evaluations pointed out the relevance and effectiveness of the ODK interviews, but also resulted in several ways to improve its designer-friendliness and usability in the field. The ODK's content (thinking framework, prerequisites, themes and questions) can also be improved. In order to more effectively detect capabilities, functionings and their underlying resources and conversion factors, but also to find out more about people's preferences, needs, habits and their choice-making behaviour, several adjustments to the CDD approach and the

ODK should be made. In chapter 8, the final practical outcome of this research is presented: the adjusted CDD approach and ODK method. In chapter 9 the theoretical outcomes of this research are presented and reflected upon.

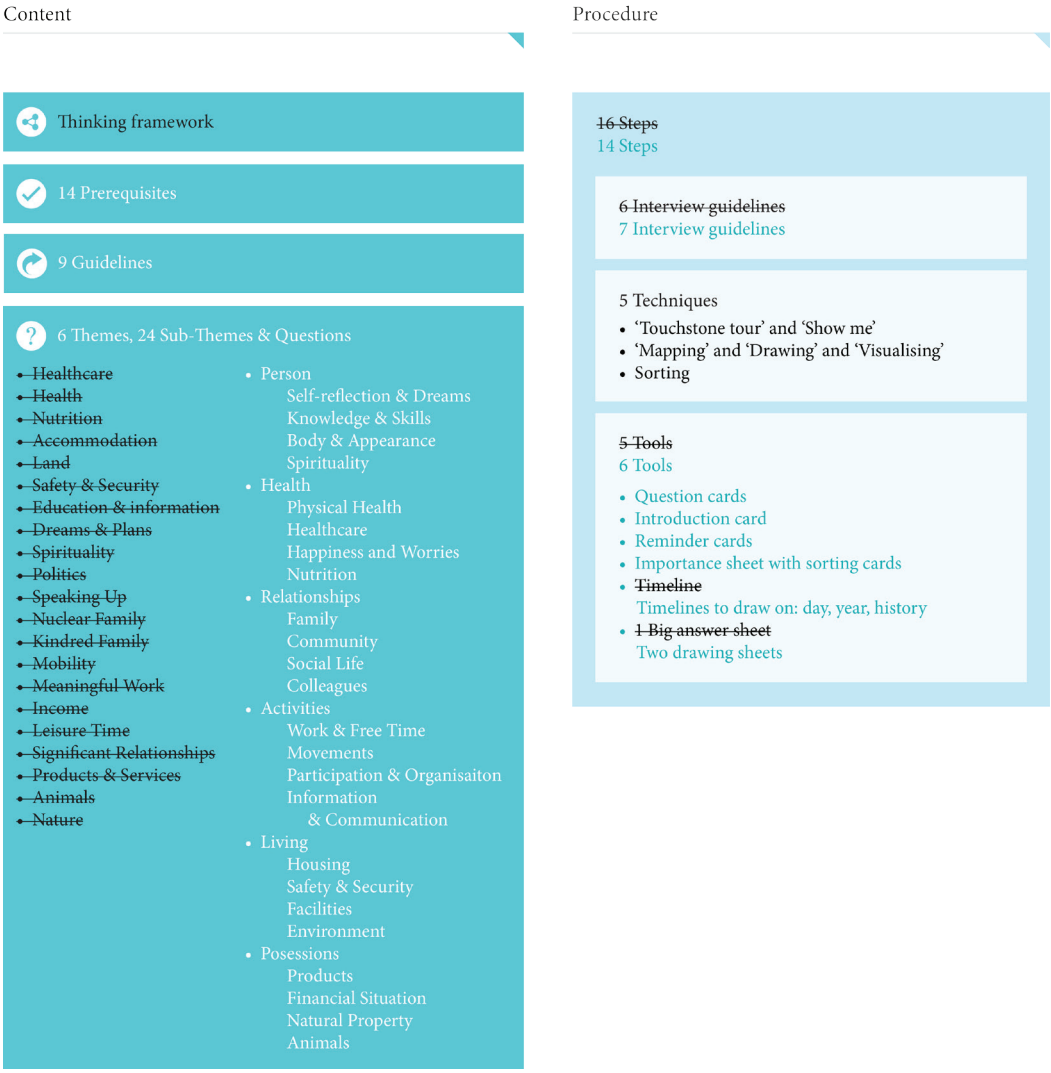
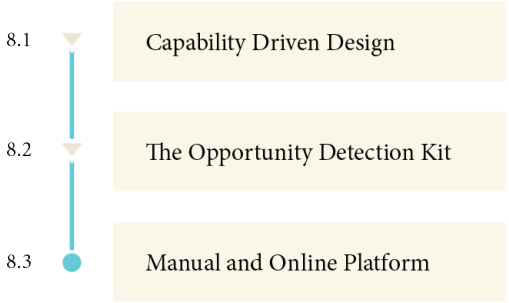


Figure 7-63: Overview of changes to the Opportunity Detection Kit as a result of the evaluations

CHAPTER 8

Practical Research Outcomes

In chapter 6 and 7 is described how the Capability Driven Design (CDD) approach and the Opportunity Detection Kit (ODK) were set up, developed and evaluated. This process resulted in adjustments and refinements to the approach. In §8.1 the final version of the CDD approach is presented and in §8.2 the final toolkit. These two deliverables form the practical outcome of this study. However, although the approach and kit are described as being 'final', they will continuously be developed and improved upon, based on user experiences. Therefore, they are available as manual as well as on an open online platform. The aim of this platform is to make the approach and toolkit available to product designers in an easily accessible way, to stimulate a broad uptake. The platform includes the manual, a picture library, and a discussion forum, as well as serving as an opportunity for exchange, leading to adjustments based on user-feedback (§8.3).



8.1 Capability Driven Design

The Capability Driven Design (CDD) approach is a designer-friendly approach, created to help designers and design teams efficiently and comprehensively explore the user context in Design for Development (DfD) projects. The CDD approach has two parts: practical guidance forms the approach's procedure, analytic guidance forms its content. Both the analytic and the practical part of the CDD approach are presented in this section and are visualised in figure 8-1.

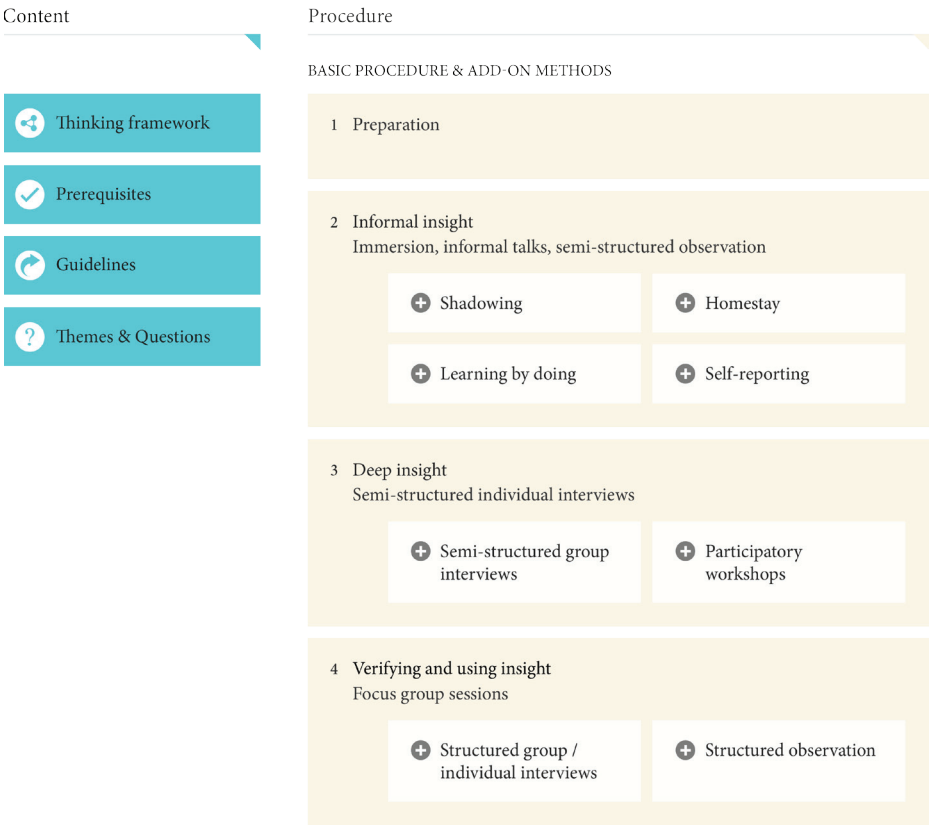


Figure 8-1: The elements of the Capability Driven Design approach

The practical part of the approach is based on the literature from DfD, User-Centred Design (UCD) and Rapid Ethnography (RE), and consists of:

- Steps and guidelines, which the designer should follow when exploring the user context;
- A set of 'basic methods', which should all be deployed to obtain user insights. Using this basic set only results in a 'quick scan';
- A set of 'add-on' methods, which can be deployed when more insight is required, or when more time and resources are available to obtain deeper insights and understanding. Using all these methods results in an 'extensive scan'.

The analytic part of the approach is based on the Capability Approach (CA) and consists of:

- A thinking framework, which guides designers to focus on people's valued beings and doings (capabilities);
- Prerequisites which should be fulfilled when a design team wants to comprehensively explore the user context;
- A set of themes which guide the designer to investigate the user context in a comprehensive, holistic manner;
- A set of guiding questions for each theme, which aid the designer to derive information from participants when talking to them.

Firstly, the practical part is introduced (§8.1.1), followed by a description of the analytic part as it is used in the CDD approach when executing the practical part (§8.1.2). A full overview of the analytic and practical parts of the CDD approach can be found in the manual as presented in Appendix G.

8.1.1 Capability Driven Design Procedure

Below the procedure and the required time for conducting the 'quick scan' and a more extensive '1-month scan' are presented. The required time is an indication, not based on empirical evidence. Thereby, the time needed to execute activities depend on many factors, e.g., the availability of participants and a translator, holidays, weather conditions. Thereby, a complex, varied user context might require more time than proposed below. Steps can also be sped up when the designers conduct activities in teams of – at least - two at the same time.

The 'quick scan'

When spending 10 days in the field, a rigorous analysis of the user context can be conducted. Below, the steps to take to obtain comprehensive user insight are provided and visualised (see figure 8-2 to 8-6). For an elaborate description of each step, see Appendix G (Manual CDD). These steps can be expanded, shortened or adjusted by the design team, according to their own preference, the context or the project requirements. Step 3, deep insight, is extensively tested by the study presented in this thesis (ODK). These steps are elaborately explained in §8.2.1.

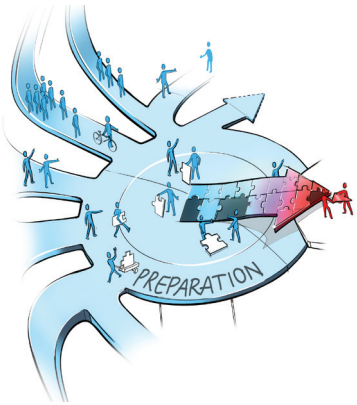


Figure 8-2: Step 1: Preparation

Step 1: Preparation (7 days)

Before going to the field, several preparatory steps should be executed to make the fieldwork more efficient and effective:

- Step 1-a: Establish local partnerships (beforehand);
- Step 1-b: Get everyone on board;
- Step 1-c: Prepare the multidisciplinary team for qualitative research (2 to 3-day training);
- Step 1-d: Get acquainted with the CDD backbone: thinking framework, prerequisites, themes and questions;
- Step 1-e: Obtain meso- and macro-data about the context beforehand;
- Step 1-f: Prepare methods and materials;
- Step 1-g: Plan activities.

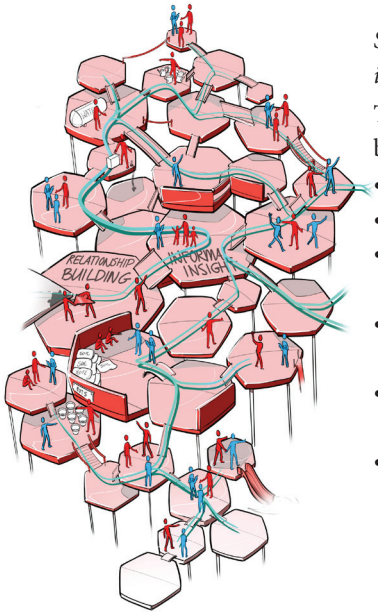


Figure 8-3: Step 2: Informal insight

Step 2: Informal insight via immersion, observation and informal talks (3 days)

The first step in the field is to meet the stakeholders and build rapport with potential users:

- Step 2-a: Meet local partners;
- Step 2-b: Select the research area;
- Step 2-c: Select and instruct a translator, when required;
- Step 2-d: Emerge and build rapport by immersion, observation and informal talks;
- Step 2-e: Analyse, interpret and reflect within the team after each day in the field;
- Step 2-f: Share interpretations with the participants and local partners.

Figure 8-4: Step 3: Deep insight

Step 3: Deep insight via individual semi-structured interviews (5 days)

After building initial rapport in the field, deep insight can be obtained:

- Step 3-a: Discuss, test and adjust the interview locally;
- Step 3-b: Prepare the interview: instruct the translator, assign roles;
- Step 3-c: Select a variety of participants and decide on time and place;
- Step 3-d: Engage in deep dialogue via individual semi-structured interviews (3 days);
- Step 3-e: Analyse, interpret and reflect within the team after each interview;
- Step 3-f: Share interpretations with the participants and local partners.

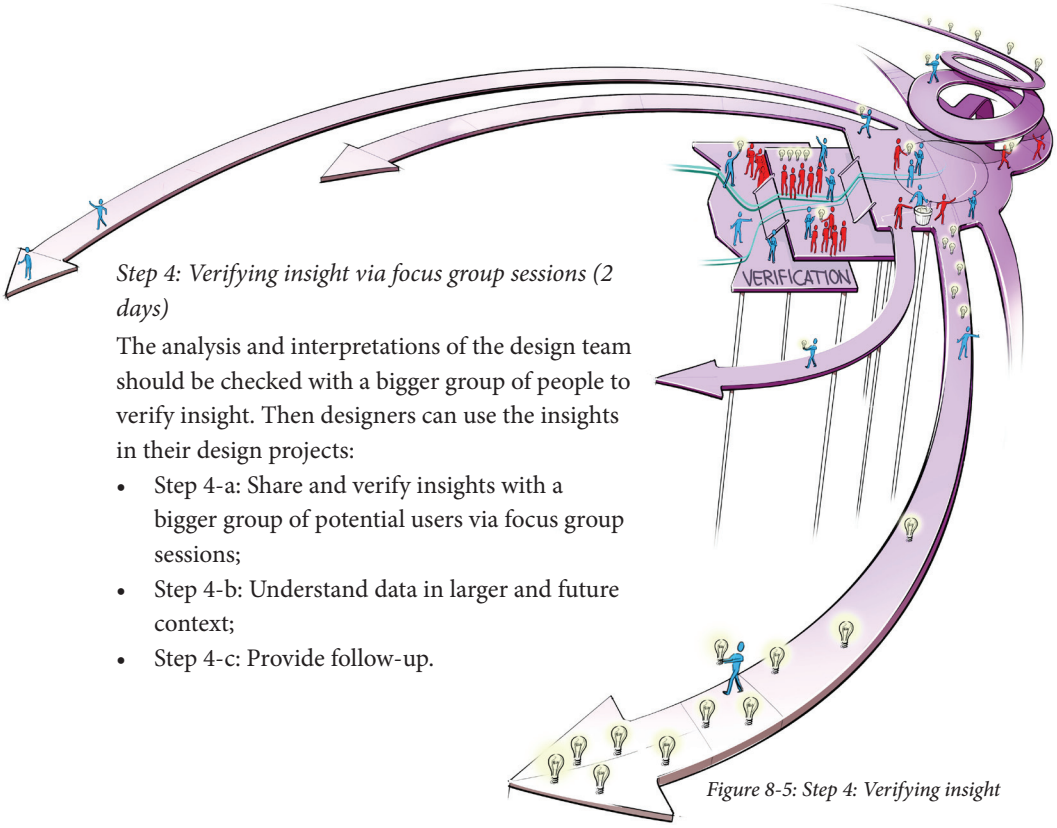


Figure 8-5: Step 4: Verifying insight

Step 4: Verifying insight via focus group sessions (2 days)

The analysis and interpretations of the design team should be checked with a bigger group of people to verify insight. Then designers can use the insights in their design projects:

- Step 4-a: Share and verify insights with a bigger group of potential users via focus group sessions;
- Step 4-b: Understand data in larger and future context;
- Step 4-c: Provide follow-up.

The '1-month scan'

When spending 1 month in the field, a deeper understanding and a more rigorous and comprehensive analysis of the user context can be conducted. For an elaborate description of each step, see Appendix G (Manual CDD). These steps are examples of how comprehensive user insight can be obtained, but steps can be expanded, shortened or adjusted by the design team. The steps are the same as explained above for the 'quick scan', but methods and sub-steps have been added.

Step 1: Preparation (10 days)

The preparatory steps are the same as during the 'quick scan', but this step takes longer due to longer training and preparation of additional methods and tools. Especially the self-reporting packages take time to prepare.

Step 2: Informal insight via immersion, observation, informal talks and self-reporting (6 days)

The first step in the field is to meet the stakeholders and build rapport with potential users. After building rapport, self-reporting packages can be distributed to participants to obtain a view about life as it is felt by them. To further learn about participants' routines, the methods of shadowing, homestay and / or learning by doing can be deployed. During this 'extensive

scan', more time is spend to build rapport and more methods are deployed, taking extra time. Consequently, data analysis will also take longer.

- Step 2-a: Meet local partners;
- Step 2-b: Select the research area;
- Step 2-c: Select and instruct a translator, when required;
- Step 2-d: Emerge and build rapport by immersion, observation and informal talks;
- Step 2-e: Adjust self-reporting packages based on obtained insights and discussions with local partners;
- Step 2-f: Capturing life as felt by participants for design inspiration by making participants self-report;
- Step 2-g: Understanding routines by shadowing, homestay and / or learning by doing;
- Step 2-h: Analyse, interpret and reflect outcomes within the team after each activity;
- Step 2-i: Share interpretations with the participants and local partners.

Step 3: Deep insight via individual interviews and participatory workshops (10 days)

After building rapport in the field, participants can be selected for obtaining deep insight. In the 'quick scan' this was done by individual interviews alone, but participatory workshops – executed in groups - support the collection of insights in latent and tacit needs and wants. The addition of group workshops takes time and more time can be taken to conduct semi-structured interviews. Consequently, data analysis will also take longer.

- Step 3-a: Discuss, test and adjust the interview locally;
- Step 3-b: Prepare the interviews and the participatory workshops: instruct the translator, assign roles;
- Step 3-c: Select a variety of participants and decide on time and place for both the interviews and workshops;
- Step 3-d: Engage in deep dialogue via semi-structured individual interviews and semi-structured group interviews;
- Step 3-e: Organize participatory workshops to learn more about participants' latent and tacit needs;
- Step 3-f: Analyse, interpret and reflect within the team after each interview;
- Step 3-g: Share interpretations with the participants and local partners.

Step 4: Verifying insight via structured observations / interviews, and focus groups (4 days)

The analysis and interpretations of the design team should be checked with a bigger group of people to verify insight. This can be done by focus group sessions, but, now that the categories that local people use to describe situations and local perceptions are known, structured interviews and observations can be conducted to obtain a more generalizable set of insights. The use of additional methods and data analysis take extra time from the design team.

- Step 4-a: Share and verify insights with a bigger group of potential users via structured observations, structured interviews and focus group sessions;
- Step 4-b: Understand data in larger and future context;
- Step 4-c: Provide follow-up.

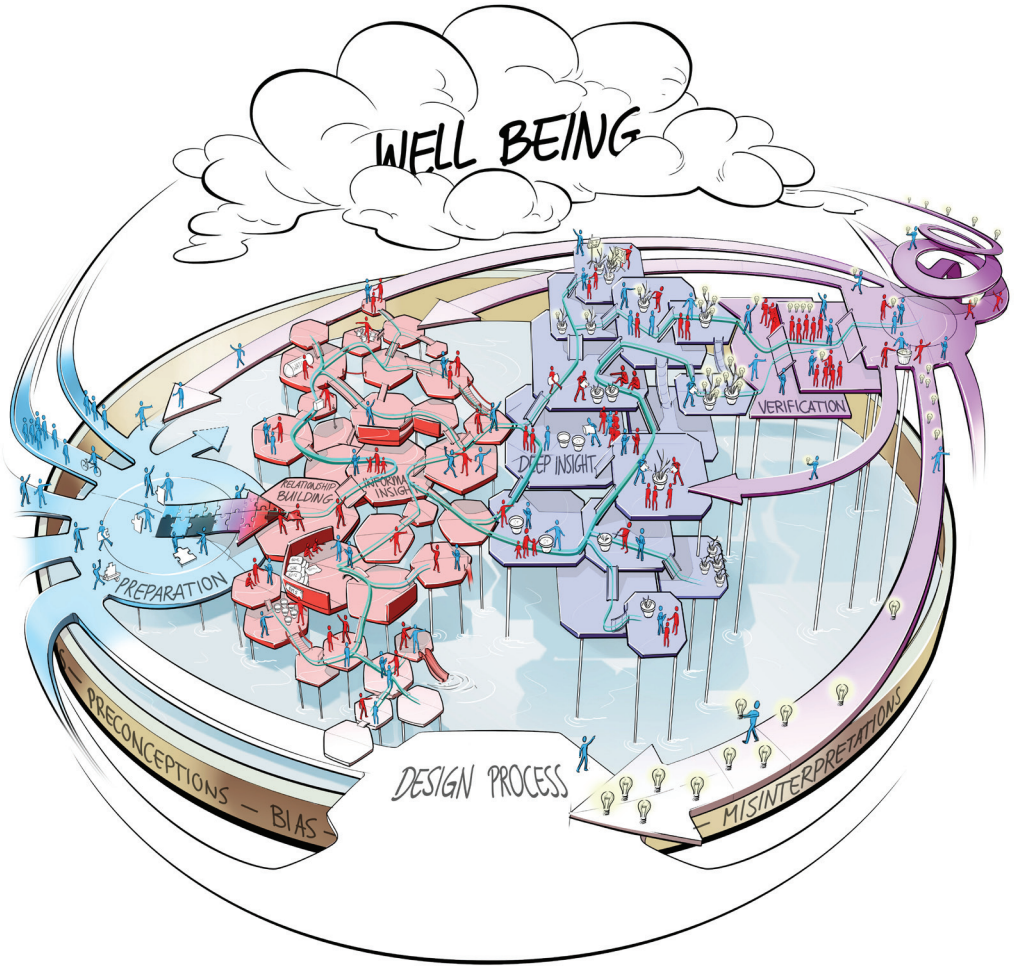


Figure 8-6: Capability Driven Design approach

8.1.2 Backbone of Capability Driven Design: thinking framework, prerequisites, guidelines, themes and questions

The analytic backbone of the CDD approach consists of a thinking framework, 14 prerequisites, 8 guidelines, 6 themes, 24 sub-themes and 248 questions. These are presented below.

Thinking framework

The Capability Approach (CA) based thinking framework is developed and presented in chapter 2. This thinking framework has not changed, only its explanation in the Capability Driven Design (CDD) manual and in the Opportunity Detection Kit (ODK) manual have been adjusted to improve the explanation of resources, conversion factors, capabilities and functionings. Especially the distinction between resources and conversion factors is further explained, and the relation between capabilities and the themes and questions is elucidated. On the next page the thinking framework is presented (see figure 8-7).

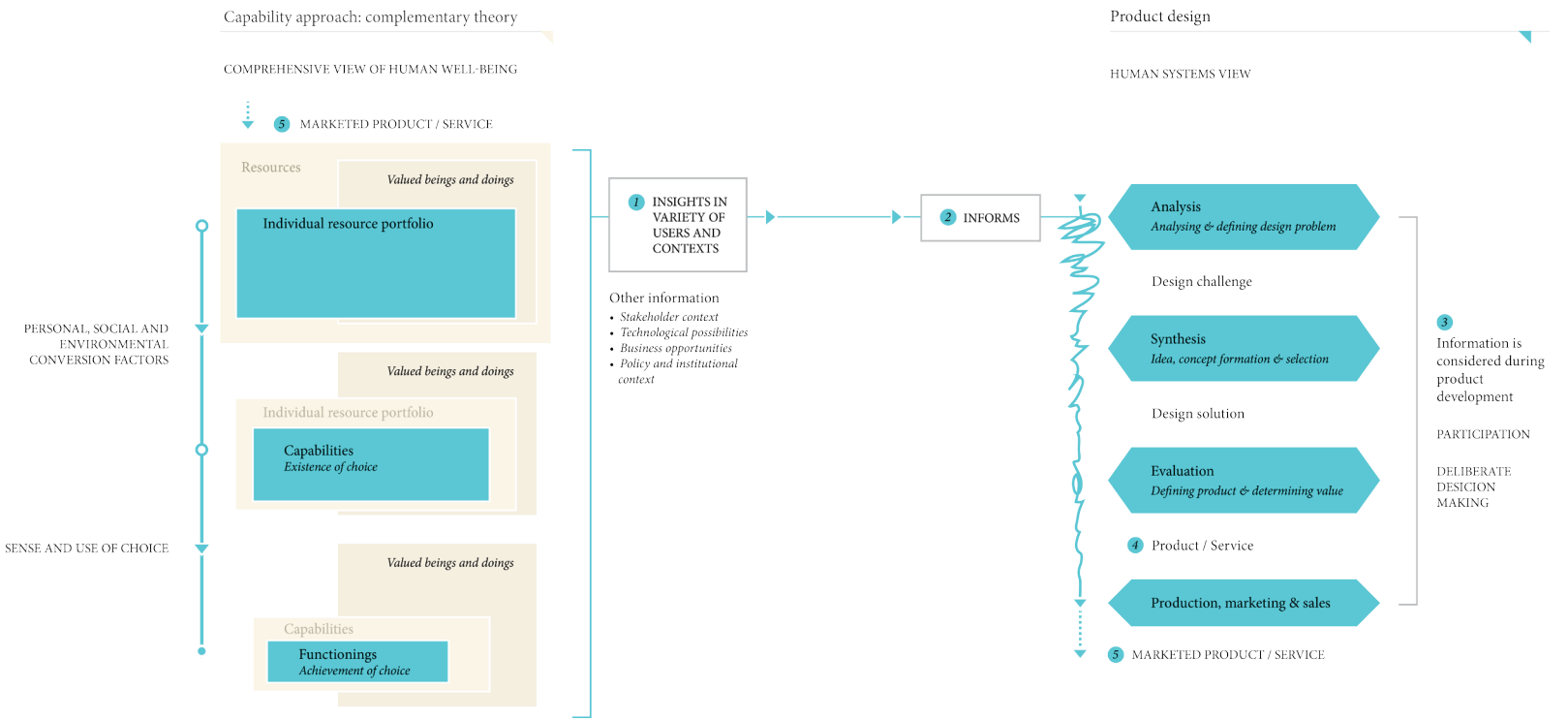


Figure 8-7: CA-based thinking framework for the CDD approach: (1) obtaining comprehensive user insight by identifying potential users' valued beings and doings; (2) the insights inform the design process, aiding in defining the problem and developing design requirements; (3) the insights are considered throughout the product development process, enabling designers to make deliberate design decisions while keeping the potential users involved; (4) products and services are developed that provide users with choices they value; (5) when the choice is made to use the product and / or service it impacts the life of its user, and the process can start again

Prerequisites

There are certain prerequisites regarding CDD that are also relevant for using the ODK. These comprise the following:

A. Triangulate for data reliability and validity. In order to enhance data reliability and validity designers should triangulate data. There are multiple types of triangulation:
   - o Discipline triangulation: involving designers from multiple disciplines to look from different perspectives and in this way reduce errors (prerequisite B);
   - o Investigator triangulation: conduct the research with multiple designers (varying in gender, age, ethnicity, status, insider/outsider role) to cross-verify observations and descriptions (prerequisite C);
   - o Data triangulation: using different data sources (e.g., from different people, places) (prerequisite H);
   - o Theory and methodology triangulation: using multiple methods, for example a combination of observations with interviews and discussions (prescribed by CDD approach)
   - o Tool and technique triangulation: using multiple tools and sources of confirmation, for example by asking different type of questions about the same topic, by using drawings and showing pictures (prescribed by CDD approach)

   CDD already prescribes the use of multiple data sources, methods, tools and techniques, and prerequisites B, C and F ensure discipline, investigator and data triangulation. This prerequisite is added to stress the importance of these different types of triangulation.

B. Multidisciplinary team. CDD already prescribes the use of multiple data sources, methods, tools and techniques, to improve data reliability and validity. To further improve outcomes, designers from multiple disciplines should be included in the design team: they should have different backgrounds, skills and knowledge. This leads to a balanced perspective and access to a range of participants. Thereby, when team members conduct activities - in pairs – at the same time, the process of user context exploration is sped up.

C. Establish local partnerships. Local partners are required in order to adjust quickly to the local circumstances, obtain information about the potential users and community structures, get advice on activities, help figuring out what to do, be properly introduced in the community, help provide access to an unbiased selection of participants, build trust in communities, and to be properly introduced to the local people. They can also aid in selecting participants and finding translators. A community partner should be someone who understands local things and is respected by the people.

D. Get the team, client and translator on board. It is important for all those involved to see the relevance of the CDD approach to ensure reliable, rigorous data collection.

E. Follow qualitative research and ethics training. In order to conduct sound, rigorous research that does not invade people's private lives in an incompetent way, and which results in valuable data, designers should have a solid and broad understanding of doing good research in the field. The research should be executed in a systematic, sceptical, ethical and rigorous manner. Designers should not conduct extractive research, but ensure an interactive, participative process together with the potential end-users to their mutual benefit. Therefore designers need to follow a training in which they are taught

the right attitude, behaviour and questioning skills, and during which they practice their learned skills and techniques. Designers should also continuously examine their attitude, behaviour and questioning when conducting user context research in order to improve upon them. Capability Driven Design contains a 'training module' that designers can use to learn about doing good research in the field. In addition, a card with the most important interviewing rules will be added to the ODK toolkit. This module and card, however, do not replace practical training under guidance of an expert.

F. Learn the themes by heart. In order to obtain broad insight into all aspects that comprise a person's life and context, the themes and topics are leading. The themes should therefore be learned by heart, in order to allow for quick changes in conversation topics and establishing a fluent dialogue in which participants truly open up. They also help to pay attention to a comprehensive set of aspects when observing potential users in their natural settings. It helps to study the themes and questions, to roleplay them and to pilot them in the field. The facilitator and / or note-taker can keep track of the themes and questions by using the question cards.

G. Plan for it. Conducting user context research takes time, especially in developing regions where 'things do not always go as planned', and often time is needed for travel, for establishing contacts to obtain access, and for acclimatisation to the local situation. It should not be a 'side-activity'. Preparation takes time, conducting activities takes time, and data analysis and validation take time. Plan sufficient time to properly follow all the steps and to conduct rigorous user context research.

H. Select a variety of participants with different characteristics for a broad range of insights. Especially a variety in gender, ethnicity, social class, age, and religion are important to include. Do not only include potential users, but obtain a broader picture to learn more about task distributions and perceptions of the broader community. Be aware not to only select participants that are easy to access, as this results in bias. It is, however, not always possible to talk to an unbiased sample of participants, as some people are truly difficult or even impossible to reach. It often depends on the community partner what is possible.

I. Activities should be conducted in pairs and preferably be recorded. CDD already prescribes the use of multiple data sources, methods, tools and techniques, to improve data reliability and validity. To further improve outcomes, each activity should be conducted with multiple team members. By assigning one activity facilitator and one note taker, each of them can focus on their own specific task, while interpretations, experiences and perceptions can be compared afterwards, ensuring investigator triangulation and improved data reliability. A third person can be added to take photographs or shoot video (when consent is given), but more people can overwhelm participants. Activities should preferably be recorded, to enable the note-taker to focus on behaviour, body language and the environment. When it is not possible to conduct an activity with multiple team members present, for example when a situation with solely women needs to be created and there is only one female team member, the activity should be recorded to allow for the designer to focus on the activity and the participant and to enable other team members to listen back to the things being said. However, only when consent for recording is given by the participant.

J. Activities should be conducted in participants' natural setting. Potential users should be directly observed and interacted with in their natural settings in order to improve learning and understanding by building a shared language, capturing detail, gather concrete data, develop empathy and reduce bias and rationalization, filtering and distortion of information. Preferably, the design team will be in the field throughout the design project, but if that is not possible, at least at the beginning, prior to problem definition, and during prototyping, in order to obtain feedback and make adjustments to the design.
K. Participatory, simple and fun activities. CDD stimulates the use of a variety of techniques and tools, which can be tweaked by the designers to better fit their purpose. For the ODK interview method, techniques and tools have been selected and defined, but can still be changed. When designers develop or adjust techniques and tools, it should be kept in mind that multiple techniques and tools should be used (prerequisite A), and that activities should be simple, engaging and interactive, in order to create an enabling atmosphere in which participants feel free to express themselves. It is advised to let participants perform tasks or to let them create things, to stimulate expression of latent and tacit needs and desires.
L. Use insights to inform the next activity. As newly obtained information leads to new understanding, research goals and methods should be changed accordingly to obtain additional information. The research outcomes should therefore be analysed by the team after each activity to adjust the activities based on new insights.
M. Discuss outcomes in a bigger group to improve their value. The information, knowledge and interpretations should be shared with participants to point out misunderstanding and to improve data validity. If participants agree, they should also be shared with the community and local partners to keep stakeholders involved, enhance transparency and openness and improve data reliability.
N. Critical reflection on limitations. The data obtained, the methods used, the researchers involved and the project executed all have limitations and the researchers should reflect on them and be open and honest about them. These limitations can depend on the following:
    - The facilitator's quality, skills, behaviour, bias, subjectivity and terminology used;
    - The design team's presence, biases, characteristics, agenda and perspective;
    - The participant's character, motivation, interest, well-being, feelings, emotions, etiquette, availability of time, scepticism, distrust, suspicion, prior experiences, cultural background and values;
    - The setting of the interview, the audience present, gatekeepers present, disturbances and distractions from outside;
    - The translator's presence, biases, skills, interest in and understanding of the project;
    - The amount of distortion due to translation;
    - The presence of recording devices.

CDD guidelines

A. Appropriate behaviour and attitude. All team members should follow the tips and tricks for 'appropriate behaviour and attitude'. It is important to have an open mind, to build trust, to respect participants and their time, to treat them as experts and to truly listen

without beliefs, biases, and making assumptions. Be honest about goals, keep participants informed about the progress made regarding the design project, properly thank and compensate participants for their invested time and effort. See: 'tips & tricks'.

B. Compensation. Compensation can and should be provided to participants for their lost time and possible transportation costs, but be aware that money does not become an incentive to participate, as this influences the interview outcomes. Money, food and gifts to bring depend on the activity and on the context. Providing a tangible gift allows the participant to show the gift to other people, but might not be appreciated everywhere. It is important to find out what the people in the area find valuable. The compensation can be decided upon in collaboration with local partners.

C. Appropriate questioning. The facilitator(s) should be trained on qualitative research skills (prerequisite). In order to guide the facilitator, the tips & tricks regarding 'appropriate questioning' should be followed. See: 'tips & tricks'.

D. Document everything. Note down characteristics of the participant (e.g., name, gender, social class, religion, age, occupation), of the activity (e.g., type of activity, the people present, date and location, materials used), and of everything that is seen, heard, felt, smelled, tasted, and / or surprising. Observations during the interviews are a useful means to check and interpret answers, and valuable when starting and continuing the dialogue. Observe during the touchstone tour, but also observe the participant's behaviour and body language. Keep an eye on intonation. Follow the tips and tricks for 'what to pay attention to'. See: tips & tricks.

E. Selecting, instructing and working with a translator. A translator forms a disconnect between you and the participant, as participants often focus on the translator. This limits the building of rapport. Translators differ in motivation, understanding and skills. Their age, gender, social class, clothing, religion and ethnicity of the translator with reference to the participant plays a role. Therefore, the tips and tricks for selecting, instructing, and working with a translator should be followed. See: 'tips & tricks'. It is not always possible to control all translator characteristics, but by building rapport with the translator, and with a proper instruction the translator can be guided to diminish his / her influence on the outcomes.

F. Schedule more time than planned. Things often take more time in the field, due to, for example, dependency on other people, differences in punctuality, religious breaks, unavailabiity of electricity, internet access or the required materials, limited infrastructure, and limited access to stakeholders.

G. Be aware of your own position. Local people perceive you in a certain way. Because you are an 'outsider', you might be perceived as interesting to talk to, as a professional or expert, or you can be distrusted or not being taken seriously. It might even be dangerous to walk around and talk to people. People might also see you as a source of help (financial or otherwise) and therefore try to convince you of their misery, or they might be embarrassed and try to hide their situation from you. Your age, gender, social class, religion, ethnicity and with reference to the participant plays a role. It is important to build rapport and behave and interact appropriately (tips & tricks). It is important to be aware of the influence of age, gender and clothing, and how these are perceived by

participants, to limit its influences on the interview outcomes and to at least take this influence into consideration during data analysis and interpretation.

H. Influence of recordings. Using video, voice recording and / or photography have several benefits and disadvantages. They might result in participants becoming shy or hiding information in order to not let it be recorded. On the other hand, they provide visuals and dialogue which aid the designers to analyse and interpret the data and to communicate the data to their team members. The design team can decide to secretly record observations and interviews, but should always ask permission afterwards for using these, and must realise that secret recordings can seriously damage the relationship with the participant.

I. Contextualising visualisations. As the intended 'receivers' of the message displayed in the visualization vary, it is difficult to develop one universal set of visualizations suitable for every context. Therefore, contextualizing the visualisations might stimulate discussion. See: tips & tricks for developing these visualizations.

Themes

The themes of the CDD approach are clustered in six categories: 'Person', 'Health', 'Relationships', 'Activities', 'Living' and 'Possessions', and each category comprises four sub-themes and several discussion topics (see table 8-1). All themes bring in discussion topics which designers can use to bring out valued beings and doings of their potential users.

Table 8-1: Overview of new themes and sub-themes

Person			
Self-Reflection & Dreams	*Spirituality*	*Knowledge & Skills*	*Body & Appearance*
Self –reflection, identity, plans for the future, goals, self-improvement, habits, expectations, barriers, confidence, life satisfaction	Religion, beliefs, rituals, functionings. Involvement of others, time spend, way of practicing, body energy, inner peace, intentions	Knowledge, skills, talents, training, (in) formal education, work, capacities, imagination, reasoning, literacy, language, activities, critique, availability of (in)formal education	Appearance, care, hygiene
Health			
Health	*Healthcare*	*Happiness & Worries*	*Food & Drinks*
Physical condition, life expectation, health limitations, medicine, mortality, body energy, ability to perform activities	Doctor, nurse, (in)formal care, dentist, clinic, hospital, trust, familiarity, attitude, beliefs, superstition, stigmas, medicine, subsidies, affordability, accessibility, connectivity	Worries, stress, strain, love, care, support, loneliness, happiness, bless, expression of feelings, vulnerability, uncertainty about future	Habits, intake, nutritional value, availability, affordability, variety, quality, cooking

Relationships			
Family	*Community*	*Social Life*	*Colleagues*
Partner, parents, siblings, children (contraception, abortion, infertility, care), in-laws. Ties, love, attachment, romance, pressure, support, having voice, tradition, knowledge transfer, hierarchy, cooperation, acceptance, appreciation, competition, activities, decision making, sharing	Friendships, ties, activities, attachment, stigmatisation, class differences, acceptance, appreciation, competition, cooperation, pressure, tradition, sharing, support, social status	Friends and acquaintances. Strong and weak ties, informal relations, networks / digital, attachment, acceptance, appreciation, competition, cooperation, pressure, tradition, sharing, support	Friends, ties, activities, attachment, acceptance, appreciation, competition, cooperation, pressure, support, exploitation, teaching / inspiring others
Activities			
Work & Spare Time	*Movements*	*Participation & Organisation*	*Information & Communication*
Paid / unpaid (e.g., household, care) activities, leisure, hobby, time perception / usage, activity type, where, with whom, working area, enjoyment, usefulness, power, learning / training, decision making, relaxing celebrations	Places to go, freedom to go out, ability to go out, safety to go out	Communal, regional, national. Social activities, involvement, participation, express opinion/ speak up, vote, critique, power, control, view, politics, misuse/ misbehaviour/forgery, corruption, justice, rules / regulations, political support	Phone, internet, relationships, solving problems, information distribution, mobility, correctness of information
Living			
Housing	*Safety & Security*	*Facilities*	*Environment*
Type, ownership, size, choice, facilities, attachment, migration, own space, comfort, envy / judging	In- /outside home and area, day and night. Bullying, discrimination, physical and emotional security, cyber security, fright	Energy, energy access, water, infrastructure. Accessibility, affordability, reliability	Nature, climate, condition, wildlife, eco-system, attachment, access, relaxing, rules / regulations, consciousness
Possessions			
Products	*Financial Situation*	*Natural Property*	*Animals*
Household, personal, mobility, communication. Ownership, cultural value, characteristics, product security, attachment, usage, fashion/ trends	Savings, income, expenditure, possibilities, behaviour, affordability, accessibility/ control, taxes / policies, financial security	Land, plants, trees. Number, size, price, availability, rules and regulations, usability, attachment, happiness, relaxing, care, abuse, privacy	Pets, cattle for work, protection or food/ drinks, acceptance, attachment, beliefs

Questions

The CDD approach comprises 248 questions, which are example questions to start the conversation. All questions are presented in table 8-2. The themes and questions do not indicate an order. Per design context and participant the designers must decide for themselves what the order of the themes and questions will be. It is advised to start with the introduction and timeline, and to start and end with topics that are 'easy' to answer for the participants in the context under investigation. Not all questions have to be posed, designers should locally discuss and pilot the questions to identify local sensitivities and pay attention to participants' answers and body language that indicate sensitivities, and these questions should not be pursued. It is important to consider and respect people's privacy, and their personal space.

Table 8-2: Overview of new set of conversation starting questions

Introduction
Note down:
• Participant: gender, ethnicity, name, age, place of residence, religion, job.
• Interview details: setting, audience present, translator details
Timeline
1. Can you describe your normal day to day activities? (Getting up, eating, working, leisure, sleeping, other)
2. Do you have sufficient time to do all the things you want in a day?
3. When do you take rest?
4. Which days are different?
5. *Do you enjoy the things you do in a day?*
6. *Is there anything you would like to change?*
Self-Reflection & Dreams
1. Do you have a passion?
2. Are you satisfied with your life as it currently is?
3. What are the things you are proud of?
4. Do you have a plan of what you want to do or be in life?
5. Who do you go to for advice about your life? Who's opinion matters to you most?
6. What do you want to achieve in your life? What do you dream about? (can be both short-term and long-term)
7. Can you decide yourself what you want to do or be in life?
8. Are you confident?
9. Do you feel you can make your own decisions in life? (Decisions can be related to: accommodation, healthcare, household, family, products, nutrition, other?)
10. Would you like to be more involved in decision making?
11. If you could change anything in your life, what would you want to change?
Spirituality
12. What does spirituality mean to you? Is it important to you?
13. How much time do you spend on spiritual practices? Would you like to spend more time?

14. What do you do when you spend time on spirituality?
15. Which spiritual rules do you follow? Why?
16. Which religion do you follow? And your family?
17. What do you think about other religions? Have you ever considered other religions?
18. How do you find inner harmony and piece?
19. Which things in life give you energy?
20. Do you believe in guilt and punishment?

Knowledge & Skills

21. Have you ever been to school, how many years? And your partner? And your children?
22. Would you have wanted to go longer to school back then? If yes: why didn't you?
23. How do you improve upon your knowledge and skills?
24. Did you follow any courses / trainings? Do you have any other diplomas?
25. Would you like to learn more right now (trainings, courses)? What would you like to learn?
26. Do your children go to school? Where is the school? What type of school is this? How do you get admitted there? What do you think of the teachers?
27. Which languages do you speak? Can you read and write? Can you count? Do you have a signature? Do you want or need any of these?
28. What are the things you are good at in you daily activities?
29. Do you use your skills and talents in your daily activities? Would you like to use them more?
30. Do you use your knowledge in your daily activities? Would you like to use it more?
31. Do you ever face problems you cannot solve by yourself? What kind of problems? Then what do you do?

Body & Appearance

32. How much time per day do you spend on personal care (washing, brushing teeth, clothing, styling)?
33. What kind of products do you use for personal hygiene?
34. When and how often do you wash your hands?
35. Do you like your clothing? Do you think you have sufficient clothing?
36. How often do you go to a barber?
37. Do you work out or exercise?
38. How confident are you about your appearance?

If applicable: Are you somehow obstructed to do your daily activities when you are menstruating? Do you have a place to change when you are menstruating?

Health

1. How is your physical condition?
2. Do you have any health problems? And your family members? Do these limitations obstruct you / your family members in your / their daily activities?
3. Do you or your family members take any medicine?
4. Where do you get your medicine? And medical devices?
5. Did anything change regarding your health recently?
6. How long do you want to live?
7. How do you try to prevent illnesses?
8. Is there anything that you require concerning your health?

Healthcare

9. Do you have a doctor / hospital / clinic / dentist / other medical treatment facilities?
10. How did you choose your doctor / hospital / clinic / dentist / other medical treatment facilities?
11. How far away is your doctor / hospital / clinic / dentist? Are they easy to reach?
12. How often do you visit the doctor / hospital / clinic / dentist? When do you visit?
13. How familiar are you to your doctor / hospital / clinic / dentist?
14. Can you and your family visit the doctor / hospital / clinic / dentist when required? Are they expensive? How do you pay for them?
15. Do you trust your doctor / hospital / clinic / dentist?
16. What type of doctor do you have (quack, homeopathic, allopathic, family doctor, other) ? Why?
17. Is there anything that you require regarding healthcare?

Happiness & Worries

18. Are you happy? Are you hopeful? Why?
19. Who do you go to when you feel happy?
20. Who can you count on most for love, care and support?
21. What do you feel blessed about?
22. Do you find it difficult to express your feelings?
23. Do you worry much? Do you ever feel stressed? Do you sleep well? Why?
24. Do you ever feel sad or lonely? Why?
25. Who do you go to when you feel sad or lonely?
26. Who are you able to tell everything?
27. Have you ever felt differently about life?
28. What would you like to change regarding your feelings and sharing them?

Food & Drinks

29. What do you generally eat and drink? Do you have a special diet (vegetarian or other)?
30. Do you like what you generally eat? What else would you like to eat?
31. How many times a day do you eat? When?
32. Do you keep a stock of food in your house? Do you have a refrigerator?
33. Do you like to eat meat, chicken or fish? And vegetables?
34. Where do you get your food and drinks?
35. Do you feel you can eat varied enough?
36. Do you ever feel hungry? Do you feel you can eat and drink whenever you want to?
37. Do you feel you have sufficient food and drinks for you and your family?
38. Do you feel you can eat sufficient meat, chicken or fish? And vegetables?
39. Have your food and drinking habits changed in the last years?
40. What would you like to change in your food and drinking routine?

Family

1. With whom do you live together in your house?
2. How much time do you spend with the family members with whom you live together?
3. What do you do together? What do you talk about together?

If applicable: How did you and your partner get together? What do you like most about your partner? When do you spend time together with your partner?

If applicable: Do you have children? Do you want to have children / more children? What do you find most important to offer your children? What do you like them to become?

4. Do you still have parents? Where do they live?
5. Do you have any brothers and sisters? Where do they live?
6. Do you have in-laws? Where do they live?
7. How often do you meet your parents / siblings / in-laws? What do you do together?
8. Are you happy with your family?
9. Do you have specific family traditions and / or celebrations?
10. Do you feel appreciated / accepted by your family?
11. In which ways do you support your family? Do you feel like you can count on your family for support?
12. Who makes the decisions in your family? Why?
13. Are you able to speak up freely in your family?
14. Are you able to express emotions and aspirations within your family?
15. Do you feel you can make your own choices in life? Do you experience any family pressure?
16. Did anything change in your family or family relations recently?
17. Is there anything you would like to change in your family?

Community

18. Do you know a lot of neighbours / people in your community?
19. Do you feel accepted in your neighbourhood / community?
20. When do you meet the people in your neighbourhood / community?
21. Do you feel you fit in your community? Are there people who do not fit in the community?
22. Do you belong to a specific social group?
23. How does your community treat outsiders?
24. Are you able to speak up freely within your community?
25. Are you able to express emotions towards your community?
26. Did anything change in your community in the past years?
27. Is there anything that you would like to change in your community?

Social Life

28. Do you have friends? How and where did you get to know them? When did you get to know them?
29. Do you like to meet your friends? Would you like to meet them more often?
30. When do you meet your friends? How do you meet your friends?
31. What kind of things do you talk about with your friends? Do you feel like you can tell your friends everything?
32. What activities do you do when you meet your friends?
33. Do you feel like you can share your emotions and aspirations with your friends?
34. Did anything change in relation to your friends in the past years?
35. Is there anything that you would like to change in your current friendships?

Colleagues

36. Do you have a boss / co-workers / employees?
37. Do you have a good contact with them?
38. How long do you know them?
39. Do you meet your colleagues also outside working hours?
40. Do you feel accepted and appreciated at work?
41. Are you able to speak up freely at work?
42. Are you able to express emotions and aspirations at work?
43. Did anything change in relation to your colleagues in the past years?
44. Is there anything that you would like to change in your relationships with your colleagues?

Work & Spare Time

1. What kind of activities do you do during the day? And your family members?
2. Where do you work? And your family members?
3. Who does the household work? Who cooks?
4. Why do you do this work / activities? Are you happy with doing them?
5. Where did you learn to do this work? Which training did you have? How do newcomers learn to do the work?
6. What are the things you are good at in your work? Do you feel appreciated / useful?
7. Are there other work activities you would like to do?
8. How many hours do you work? Do you feel you need more work time?
9. How much time is free in a week? Are you able to relax in this time?
10. Is there time when you feel free to do nothing?
11. What do you do when you do not work?
12. With whom do you enjoy spare time together?
13. What do you do when you meet them in your free time? Do you enjoy this?
14. Which festivities / parties / events do you celebrate in a year? Why? When?
15. How many spare hours do you have in a week? Do you feel you need more free time?
16. What do you like best about your daily activities? And what do you dislike?
17. Is there anything else that you would like to do? Or like to change?
18. Did anything change in your job / activities in the past years?

Movements

19. Do you go out often? Where do you go? Why do you go out?
20. Do you often go out of your community? Why?
21. Where do you travel to? (e.g. for family, work, spare time, friends, healthcare, shopping, political participation)
22. What is the furthest place you ever went? Why did you go there?
23. Which places do you go when you leave your house? What is your favourite place to go?
24. Are you able to go wherever you want to go? Whenever you want to go?
25. Is it safe to go everywhere you want to go?
26. Which places would you like to visit (more often)?

Participation & Organisation

27. Do you vote? How do you vote? Why do you vote?
28. Are you involved in politics? Would you like to participate (more) in political activities?
29. Are you involved in social activities on a communal / regional / national level?
30. Do you feel the government provides sufficient support?
31. Have you ever met public officials?
32. Do you feel there is any corruption or misbehaviour in your community / region / country?
33. Are there many rules & regulations that you have to stick to?
34. How is the political situation in your community / region / country? Did anything change in the past years?
35. What would you like to change regarding the current political situation in your community / region / country?
36. Do you feel free to participate in political activities? Do you feel free to express your views and opinions in public? Also when they express critique?

Information & Communication

37. How do you communicate with other people? Do you have a mobile phone / internet access / television?
38. Are you on social media? Does your phone have internet access?
39. How much money do you spend on mobile phone usage / internet / communication?
40. Are there other forms of communication which you would like to use?
41. What kind of communication device do you like most?
42. How do you search for information? Do you always find an answer? (Information quest can be related to: health(care), transportation, education, nutrition, products, animals, politics, religion, other themes)
43. Do you feel you have sufficient access to information? Is the obtained information usable?
44. Is there a need for you to find more or different information?
45. Are there more ways for you to gather information that would be convenient?
46. What has changed in the past years regarding communication and information?

Housing

1. What type of house do you have (roof, walls)?
2. How many rooms does your house have?
3. When do you clean your house?
4. When did you start living here? Why did you choose to live here?
5. How did you acquire the house (rented, bought, build)? How did / do you pay for this home?
6. Do you feel that your house is your own space? Do you feel comfortable in your house?
7. Do you like to invite guests to your house? Why?
8. What have you changed in the house since you started living here?
9. Do you feel your current accommodation is adequate for your current needs?
10. Do you have a bathroom and / or a toilet? Where do you go when nature calls?
11. Is there anything that you would like to change in your current house?
12. Do you feel you were involved in choosing your house?
13. Do you think you will live here the rest of your life? Why? Are you free to move?

14. Are there any other houses/places that you would like to live? Why?

Safety & Security

15. Do you feel safe and secure in the area you live in? And outside that area?
16. Do you feel safe to go outside in day-time and night-time? And your family?
17. Are there any quarrels / fights / crime / conflicts in your surroundings? How often?
18. Who solves the conflicts in your surroundings?
19. Do you think people are discriminated or bullied in the area you live in?
20. Do you ever feel discriminated or bullied?
21. Do you ever feel scared? What are you afraid of?
22. Do you ever feel insecure or unsafe?
23. Has your feeling of safety and security changed in the past years?
24. Is there anything you would like to change to feel more safe/secure?

Facilities

25. Do you have light, electricity, gas?
26. What type of energy sources do you use? And what for do you use them?
27. How much money do you spend on energy?
28. Would you like to use other energy sources? Which ones?
29. How do you cook?
30. Where do you get potable / drinking water?
31. Where do you get water for cooking / cleaning?
32. Which modes of transportation do you have access to (private / public)? Which ones do you use / have you used?
33. Would you like to use any other types of transportation?
34. What is your favourite type of transportation?
35. Are there any other services / facilities that you have or use?
36. Did anything change in the past years regarding your access to energy, water or infrastructure?
37. Are there any services that you would like to have? Why?

Environment

38. How important is your natural environment to you?
39. Do you ever visit public spaces? What do you do there? How often do you go?
40. Are there any rules and regulations regarding the use of environment that you are aware of?
41. Which resources does your environment provide you with?
42. Where do you dispose waste?
43. How is the climate / weather in your surroundings?
44. Are there any dangers from nature in your surroundings? Is there wildlife around?
45. Is the area you live in clean or polluted?

Products

1. What kind of personal / household / transportation / work related products do you have? Are there any other products that you have or use?
2. Where do you use them for?
3. Which product(s) do you like most? Why?

4. Which product(s) do you like least? Why?
5. Who makes the buying decisions?
6. Do you follow product trends? How do you stay up to date?
7. Do you feel you can buy everything you want?
8. Did anything change recently in products that you had or have?
9. Are there any products that you would like to have? Why?

Financial Situation

10. How much money do you earn in a day / week / year?
11. Is this amount sufficient for your family?
12. Are you able to save money? What are you saving for?
13. Do you have loans? Why did you take a loan?
14. What do you spend money on? Who is responsible for the expenses?
15. Do you find it difficult to choose between options to spend your money on?
16. Do you feel your current income is adequate for your current needs? How much money would be enough for you and your family?
17. Which things would you like / want / need to buy?
18. Did anything recently change in your financial situation?

Natural Property

19. Do you own any land? How much? Where is the land?
20. What type of land do you have? What do you use it for? Which benefits do you get from your land?
21. When did you get this land? How? How did you pay for this land?
22. Do you feel your current land is adequate for your current needs?
23. Do you like plants and trees?
24. Do you own any plants or trees? How much? Where are they? Where do you use them for?
25. Do you have any plants or trees in your surroundings?
26. When did you get these plants or trees?
27. Do you want to own (more) land, plants or trees?
28. Did your possession of land / plants / trees change in the past years?

Animals

29. Do you like animals?
30. Do you own any animals? Where do you use them for (pets, cattle, protection, food & drinks)?
31. When did you get these animals? How did you pay for them?
32. Where are your animals living? Do you have sufficient food for your animals?
33. What is your favourite animal?
34. Do you want to own (more) animals?
35. Did your possession of animals change in the past years?

8.2 The Opportunity Detection Kit

Individual semi-structured interviews are the key method of the CDD approach, as they result in broad and deep insights (step 3). To offer designers guidance to conduct comprehensive user interviews, the Opportunity Detection Kit (ODK) has been developed, refined and evaluated. The ODK consists of the analytic guidance that the CDD approach offers (thinking framework, prerequisites, themes & questions) and a procedure, consisting of:

- Steps: a procedure which the designer should follow when conducting semi-structured interviews;
- Guidelines: support the designer in conducting the steps;
- Techniques: specific ways of obtaining user insight that can be used during the interview to improve the outcomes;
- Tools: tangible elements that can be used to support the techniques.

As the analytic part is already presented above, below only the procedure of the ODK is presented. An overview of the ODK interviewing method – as part of the CDD approach - is provided in figure 8-8.

8.2.1 Interview steps

The steps that need to be executed in order to conduct semi-structured interviews are the presented below. When using the ODK, all fourteen steps should be followed and step five to thirteen should be repeated for each interview.

Prepare the interview

1. Get familiar with the ODK procedure, techniques and tools. The team members must become acquainted with the flow and structure of the interview. By being familiar to the themes and questions it is easier to switch between them, offering flexibility which improves the building of dialogue. Roleplay the interview in the team, pilot the interview and read the full manual to get the most out of the interviews.
2. Include general product questions in the ODK. During the ODK interviews, 'generic' product questions can be posed. Product questions can be added when certain themes are discussed that are obviously related to the product or service to be developed. For example, when a solar charging station for mobile phones needs to be developed, questions about mobile phones ('Products'), connectivity ('Mobility', 'Significant Relationships', 'Family' or 'Services') and energy ('Services') can be posed. More specific questions, for example about aesthetic preferences for the charging station, are not adequate to pose during the ODK interviews, they will make the interview too long and focused on the product, while it is meant for a comprehensive insight.
3. Localize the content and conduct a local pilot. Locally discuss the ODK contents beforehand. As accents, words, expressions, dialects and pronunciations might be different and words might mean different things in different regions, it is important to make sure the translator and the participant have the same understanding of the themes and questions. To adjust wordings to local dialects and to point out sensitivities it is important to discuss the themes and topics with people familiar to the potential users and their context. To improve participants' understanding of the themes and build relationship, the

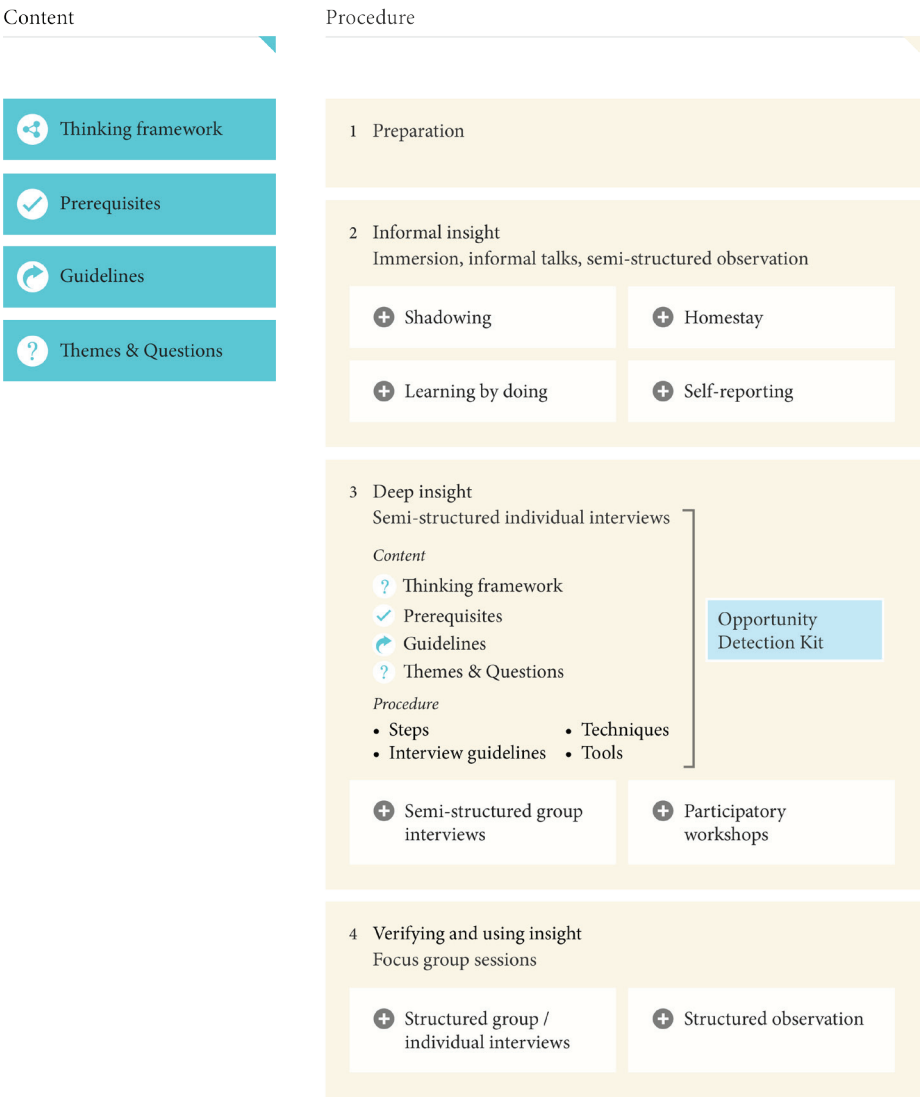


Figure 8-8: The Opportunity Detection kit as part of the Capability Driven Design approach

pictographs can best be replaced by local visualizations. Be careful to select visualisations to which the participant can relate, but which do not steer the participant into a certain direction. Adjusting the ODK to the local context results in better dialogue and better outcomes. After adjusting the ODKs contents, a local pilot should be executed in the field. By conducting a pilot in the field, the designer becomes familiar to the ODK content and procedure. Moreover, sensitivities and terminology become even more clear. Especially when using a translator it is relevant to conduct the pilot locally, as in this way the translator also becomes familiar to the ODK content and procedure. Tips & tricks for contextualizing visualizations are provided in the manual.

4. Carefully select and instruct a translator (if required). Follow the tips & tricks in the manual. The translator should be thoroughly informed about the task at hand and his or her role. Share the goals of the research and explain the rules. If step 5 (conduct a local pilot) is not feasible: go through all the themes and questions before the first interview to get the translator acquainted with the interview flow and structure, the themes and key questions. It is best to use one and the same translator for every interview, as this reduces training and interview time. Moreover, when the translator is familiar to the participants, but does not have a stake in the interview, it is easier for participants to open up.
5. Select participants. A local partner, translators or other participants can aid in selecting participants. However, the selection criteria should be followed. As stated in prerequisite H, a variety of participants should be selected, also outside the potential user group.

Conduct the interview

6. Assign roles. Conduct the interview with at least two (a facilitator and a note taker / photographer) and a maximum of three designers and assign roles beforehand to clarify the purpose for each researcher. Appoint a facilitator who resembles the participant most (e.g., in gender, age social class, religion and ethnicity), when possible.
7. Decide on time and place. Time and place of the interview should be at convenience of the participants and preferably in their local context. Try to prevent to conduct interviews with participants who are busy and distracted (e.g. because of work, time limitations), and interviews that suffer from interruption by audience. Try to not bring employees from the client organization, as they have a stake in the research outcomes and might influence the participant's answering. Make sure there is sufficient space to use the ODK techniques and tools.
8. Bring along the required supplies. The materials for the activities, recording devices, a notebook and pen should be brought along to the interview. Consider to bring along pictures of yourself and your surroundings and food for the participant as well.
9. Introduce & ask for consent. Introduce the research, the interview, the translator and yourselves. Be honest and explain the research goals and why comprehensive user insight is required to be able to develop a product and / or service that suits the people's needs and wants. Explain that they are the experts and that the interview is to learn from them. Giving your introduction in the local language helps to build rapport and to establish a more relaxed atmosphere. Participants should be informed about the research and its goals and about the activity. Ask for consent to record the interview, to take pictures and to use the data. Stress that participants are not obliged to participate and can withdraw from the activity at any time. Clarify how much time the interview will approximately take, based on the local pilot. It is very important to be clear about compensation to set the right expectations for participants. Communicate openness and being non-threatening, stress that there are no wrong answers and that not all questions have to be answered. Explain the participant that he or she is free to leave. Make the participants feel relevant as participants by sharing yourself, verbally or with help from pictures.
10. Ask for the participant's introduction. Asking participants to tell something about themselves provides an easy start and shows interest. Learn participants' names, age,

place of residence, job and religion and note this down, in order to acknowledge the participant and make him or her feel relevant.

11. Conduct a touchstone tour. Let the participant show you around in their house or the environment where the interview is conducted. Use the show me technique: let the participants show you objects, spaces and tools. Conducting a touchstone tour results in better outcomes, as the observations made can be used to establish dialogue and to cross-check the information that participants share.
12. Sit down and…

    When multiple team members are present, try to not sit together and do not discuss things in your mother tongue. Also try to limit discussions in English with the translator. The participant should be the one talking.

    a. For the facilitator: …build dialogue.
        - Start with personal details. Ask the participant's name, age, place of residence and religion. Share pictures that you brought from your home country. Look at the tips & tricks for appropriate behaviour and attitude to help you to build a comfortable and relaxed atmosphere.
        - Continue with the timeline. Ask what the participant does during a day. The timeline can be combined with the visualisation cards and erasable markers to create an overview of the participant's day. Try to let participants create, if they are unwilling let the note taker create.
        - Continue with the question cards. Use the drawing sheet, the visualization cards and the erasable markers to visualise the answers. Start with the current situation for one theme and from that point ask about changes in the past and aspirations for the future, before continuing to the next theme. When discussing a theme, explain what the pictograph/local visualization is about. Again, try to let participants create, if they are unwilling let the note taker create. There is no indicated order for discussing the themes, but start with an 'easy' theme or topic and also end with an 'easy' theme or topic (which themes are 'easy' can be found out by discussing the themes with a local partner and / or conducting a local pilot). The questions for each theme are mere options for starting conversations than exact questions that need to be asked. However, the questions should be kept general enough to stimulate conversation, and focused enough to reveal the desired information. Questions can be left out and for each theme it is also important to ask questions in different ways, to pose questions about topics and experiences that come up during the conversation. Pose follow-up questions to follow-up on the unexpected, and on topics that the participant finds interesting. When participants have difficulty opening up, fall back to 'easy' topics or use drawings to elicit more response. When certain topics are clearly sensitive or close down the participant, switch topic. Any question affecting the dignity of participants must not be pursued. It is important to consider and respect people's privacy, and their personal space. If participants do not allow the designers to enter that personal space, that should be respected.
        - Conclude the conversation with the sorting exercise. Use the sorting cards and let participants place these cards on the ranking sheet, based on their importance: not

important (.), less important (!), important (!!) or very important (!!!). For each sorting card, explain what the pictograph/local visualization means. The ranking exercise works as a confirmation of the things being told during the interview and provides insight in what and how participants value.

b. For the note-taker: …document. Let the interview preferably be recorded by a recording device (but be aware of the possible effects of recording devices: participants becoming shy or holding back) and take notes to document anything surprising and participants' behaviour, attitude, body language and interpretations. The note-taker can also draw, and capture photographs and video. Look at the tips & tricks about 'what to pay attention to'.

13. Thank the participant. Thank participants for their invested time and effort and for sharing personal information. Bring a small gift, food and / or money to show appreciation and compensate for time and costs (see ODK guideline C).
14. Analyse, interpret, discuss and reflect immediately. Analyse and interpret the data after each interview and discuss the interview outcomes, the most striking insights and perceptions with the design team directly after each interview, before things become 'normal'. This aids to verify insights and detect design opportunities. The insights can also be discussed with the translator and the local partner(s). Reflect on the insights (see prerequisite N) with the full team and use the outcomes during the following interviews.

When using the ODK, all fourteen steps should be followed and step five to thirteen should be repeated for each interview.

8.2.2 ODK guidelines

The guidelines provide support to designers for conducting ODK interviews and are provided below:

A. Start broad, then go deeper. During the first interviews it is important to touch upon all themes and topics. After some initial interviews, some of the topics and questions can be left out in order to deeper investigate the topics and questions that seem surprising or interesting for the design project.
B. Time and place of the interview. It is useful to conduct interviews at homes to combine interviews with observation and to create a comfortable setting. However, if the home setting results in shyness, embarrassment, is too hot, or results in a lot of audience or other disturbances, it might be better to conduct the interview in a more contained space.
C. Flexible but focused individual conversations. The ODK provides steps, themes and guiding questions, but there is room for flexibility and unexpected turns in order to stimulate dialogue. There is no indicated order indicated for addressing the themes. Do not ask questions from a script, and feel free to add or change questions. The interview should feel like an open-ended, dynamic conversation to make participants feel comfortable. It is important to continue dialogue regarding topics that seem to be of interest to the participant, and regarding surprising, idiosyncratic or contradictory responses or behaviour from the participant. It might be useful to hide the list of questions and to learn the key questions by heart or keep them out of sight. Do, however, exert some control over activity topics. Use the question cards and drawings to keep an overview of the themes

and topics discussed and preferably start and end with 'easy' to discuss themes.

D. Duration of interviews. The interview should be sufficiently long to make participants feel to make participants feel they are being heard, but should not continue too long resulting in participants becoming tired and disinterested. Follow up on answers, but also keep focus: if focus is lost, the interview can become overly long without obtaining useful information. End the interview when no questions are left, or when you feel like delaying a participant. The ODK interview is scheduled to last between 1.5 and 3 hours. The participants should be properly informed before the interview about how much time the activity will take, before they give their consent. Participants can be compensated for their time, for example by providing food or compensation for expenses, and a gift can be provided. If an interview takes longer, participants should be informed and asked for additional consent. The participants can be offered a compensation for continuing the interview. If the participant is not willing to continue longer, the interview should be concluded. When being familiar to the themes and questions, interviews can be conducted quicker. When more drawings are being made and more follow-up questions are posed, interviews become longer. Decide, based on the participant's behaviour and attitude, how to approach the interview.

E. Number of interviews. The objective of the ODK interviews is to get to know people's available and valued beings and doings, and to become inspired. The amount of interviews is not fixed and it is up to the team to decide when sufficient insight is obtained. The context, the project, the participants, the translator, the variety of participants that can and should be included, and the skills of the facilitator all influence the outcomes and therefore the number of interviews required. It is not the intention to obtain statistically generalizable data, and after the first few interviews the amount of new insights will decrease. The 'quick scan' program includes at least five interviews, to be conducted in three days. However, it depends on the amount of insights if this is sufficient or that more interviews are required. The 'extensive scan' allows for conducting more interviews in combination with other methods.

F. Consider to use specific questioning techniques. As mentioned under 'questioning techniques'.

G. Dealing with sensitive questions. Sensitivity differs per culture, so it might be that the questions you think are sensitive, are not sensitive to the participant. Your own assumptions and feelings towards questions should not be leading. Discuss the questions beforehand with a local partner to identify sensitivities. Start with more general and easy to answer questions, and later in the interview, when rapport has been build, it might be possible to pose sensitive questions and probe broader and deeper. However, be understanding and sensitive towards the feelings of participants and the potential of causing psychological harm for the participant. Try to rephrase a question when the participant is hesitant to answer it, or ignore the question if it leads to an uncomfortable situation. Sensitive questions should not be forcefully asked, just because they are in the ODK. It is not always possible to obtain answers to all questions, but that is also not required. Participants must be free to share what they want and remain comfortable. An unwillingness to answer questions also provides valuable information. It might be wise to

let sensitive questions to male participants be posed by male facilitators and translators and to female participants by female facilitators and translators. Sensitivities can be pointed out beforehand by local partners and / or the translator, but the information provided by them should not be leading.

8.2.3 ODK tips and tricks

Besides the above mentioned steps and guidelines, several tips & tricks have been derived from literature, and have been adjusted according to insights based on the iterations (chapter 6) and evaluations (chapter 7) presented in this thesis. Below a short summary of all tips & tricks is provided. The full explanation of the tips & tricks can be found in Appendix G.

Tips and tricks for behaviour and attitude

The recommendations for designers' behaviour and attitude are:

- Minimise 'outside' hierarchy;
- Be aware of 'inside' hierarchy;
- Be aware of 'inside' customs;
- Build rapport;
- Demonstrate willingness to learn;
- Start with an open mind;
- Listen with genuine interest;
- Encourage answering;
- Mind your body language;
- Pay attention to body language;
- Stimulate storytelling;
- Encourage sharing of details and context;
- Sympathize;
- Limit interruption;
- Mind habitual behaviour;
- Avoid abstract talking;
- Make it relaxed;
- Learn from failures.

Tips and tricks for ethical behaviour

The recommendations for ethics are:

- Participatory, interactive research process with participants' interests central to the study;
- Diminish bias in participant selection;
- Obtain permission to conduct research and follow formal requirements and procedures.
- Explain yourself, the research, and the programme and purpose of the activity;
- Be open and honest, frank and realistic about research constraints and outcomes, do not make false promises, do not raise unreasonable or unrealistic expectations;
- Obtain informed consent from participants;
- Respect and secure participants' privacy ;

- Ensure that the data is protected from misuse and falling into the wrong hands.
- Be aware of risks and dangers that the research may pose to local communities and individuals and take appropriate action to eliminate them;
- Conduct research that is sound, well-conducted and results in relevant and useful data;
- Recognise and respect people's sensitivities and rights and not be intrusive;
- Be aware of your position, background and training, power and cultural distance;
- Appreciate varying contexts and be open to learn without judgement;
- Limit inequalities;
- Properly thank participants and local assistants, and provide appropriate compensation for time and effort taken;
- Judge responses, but do so carefully to limit misinterpretation;
- Be open about how interpretations are established;
- Critically reflect on limitations of the data, the approach, the methods, the design team, the project;
- Outcomes should be transparent, genuine and honest, not matched with needs or expectations of funding agencies or local authorities;
- Make the research outputs available locally in a form that the communities can understand and use;
- Acknowledge the contribution of everyone involved;
- Keep the people involved in an accessible and understandable manner.

Tips and tricks for questioning

The recommendations for questioning are:

- Pose questions that are neutral, specific, naïve, open-ended, simple, short and to the point;
- Avoid questions that are insensitive, offensive, ambiguous, biased, leading, blaming, oriented, abstract, multiple questions in one or hypothetical;
- Mind terminology, jargon, tricky language, vague language, multiple meanings;
- Use local indicators and terminology;
- Start with easy questions that are important to the participants;
- Pose follow-up questions;
- Pose questions that stimulate description, discussion and depth;
- Mix questions with discussions;
- Pose verifying questions;
- Verify interpretations;
- Do not suggest answers;
- Consider to use the following questioning techniques: The 'five why's', 'Directed storytelling', 'Guided speculation', 'What-if-scenarios', 'Sacrificial concepts', 'Talking diaries', and 'Thinking aloud'.

Tips and tricks for 'What to pay attention to'

Specific things to pay attention to are:

- Everything that is seen: things that are physically present, objects participants care about, body language, factual behaviour and things that change behaviour, interactions with the environment, adaptations and work-arounds;
- Everything that is heard: language, vocabulary, words and categories, expressions, motivations, perceptions, issues, difficulties or obstacles, interactions, social actors, unarticulated needs, events and circumstances that shape experiences, prior experiences, current experiences and how those are perceived and conceptualized, intonation
- Everything that is felt: emotions, moments or things that participant react upon emotionally and feelings;
- Everything that is smelled;
- Everything that is tasted;
- Anything surprising: that changes assumptions or seems irrational;
- Observable and explicit needs, but also tacit and latent needs.

Tips and tricks for selecting and instructing a translator

- Tips and tricks for selecting a translator: The translator should be selected based on his knowledge of the area, of the local language and of English. The translator should have sufficient time, be sufficiently educated or skilled to translate and should not have a stake in the research, but be interested in it. The translator's position and gender should preferably match the gender of the potential participant, it might therefore be wise to select both a male and a female translator. When the translator is familiar to the participants, but does not have a stake in the interview, it is easier for participants to open up. It is best to use one and the same translator for every interview, as this reduces training and interview time, a translator's availability is therefore an important selection criterion. Normally, a translator is paid for his or her services.
- Tips and tricks for instructing a translator: Designers should insist that the translator properly translates the questions and the participants answers, should not be afraid to pose 'naïve' questions, should not rush the interview, should not interpret questions or answers, and should not steer the participant by providing examples or indicating desired answers by tone or body language. The translator should however try to build rapport and show empathy. Designers should stress that a proper introduction and asking for consent are required. It might be wise to have food or a drink with the translator to build rapport with this person.
- Tips and tricks for working with a translator: It is difficult to decide at whom to look. Do not forget that the participant is the one you are interviewing, not the translator! Be aware of the way you pose questions to the translator, especially if the translator directly translates everything you say.

Tips and tricks for contextualizing visualizations

As the intended 'receivers' of the message displayed in the visualization vary, it is difficult to develop one universal set of visualizations suitable for every context. When visualizations are contextualised, the following guidelines should be kept in mind:

- Keep the audience in mind;
- Consider the use of words, images and graphic forms;
- Make the lay-out clear and simple: use one specific style, avoid unnecessary detail, keep the amount of elements limited and use a limited amount of perspectives;
- Consider the size the visualization will be displayed at: use bold and large enough picture elements;
- Emphasize what is important;
- Pay attention to colour and contrast;
- Consider feedback expressed by participants: iteratively improve upon visualizations.

Tips and tricks for techniques and tools

When designers develop their own techniques and tools during user context exploration, these need to:

- Be simple and engaging (fun);
- Be interactive to elicit feelings and emotions;
- Be made easily replicable;
- Be flexible to improve uptake, different options to choose from;
- Be usable in a small space;
- Be usable outside, without blowing away;
- Be usable when sitting down on the floor;
- Allow for triangulation;
- Be efficient;
- Stimulate creation and conducting tasks to elicit latent and tacit needs.

8.2.4 Techniques and tools

The techniques and tools are kept, but drawing tools have been expanded to stimulate drawing and mapping. Thereby, reminder cards have been added to the ODK. All techniques and tools that support the designer during the semi-structured ODK interview are explained here.

Reminder cards

To further assist the design team in following the prerequisites and steps and remembering the most important behaviour and attitude to stick to, reminder cards have been developed, which are explained below.

Prerequisite reminder card

This card shortly states the prerequisites of the CDD approach (see figure 8-9).

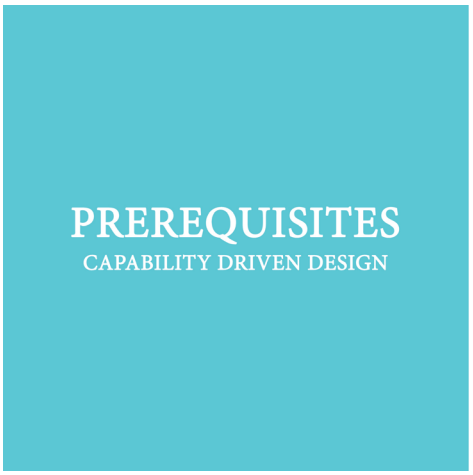


Figure 8-9: Prerequisite reminder card

Ethics reminder card

This card summarizes the ethical aspects that the design team should pay attention to during research activities (see figure 8-10). Designers are free to add to this card.

Figure 8-10: Ethics reminder card

Facilitator reminder card: tips and tricks for facilitating ODK interviews

This card comprises the most important rules towards interviewing will be placed down on a card that will be added. Designers are free to add to this card. The standard 'rules' presented on the card can be seen in figure 8-11.

Figure 8-11: Facilitator reminder card

Note-taker reminder card: things to pay attention to when documenting ODK interviews

This card summarizes the things the note-taker should pay attention to and document during an interview (see figure 8-12). Designers are free to add to this card.

Figure 8-12: Note-taker reminder card

Steps reminder card: steps to follow when conducting ODK interviews

A card shortly stating the interview steps of the ODK will be added (see figure 8-13).

Figure 8-13: Interview steps reminder card

Pictograms / Question cards

New pictograms have been developed, in one style, black-and-white[30]. Below, for each sub-theme three pictogram options are presented. For each sub-theme a question card is made, meant to guide the facilitator during the interview. The question cards are clustered in groups of four. For communication to the participant, the same pictograms can be used. The design team should choose one pictogram which fits their context best. The choice can be made together with the local partner and / or translator or based on a pilot interview. Some pictograms might still need adjustment to better fit the context of use.

The preference remains to contextualise the visualizations, but if time does not allow for it, the pictograms presented here can be used. It is, however, important to explicitly discuss the meaning of each pictogram, in order to align the dialogue. One set of pictograms can be printed to provide visual feedback to the participant about the theme being discussed and the interview progress, and one set of pictograms can be printed with the questions on the back (see example in figure 8-14), to guide the facilitator. The design team should cluster the selected question cards in sets of four, to keep a better overview. The pictograms are presented below, per sub-theme (see figure 8-15 to 8-38).

30 *The pictograms have been obtained from www.sclera.be. As not all desired pictograms could be retrieved from this database, several pictograms have been adjusted to fit the themes.*

WORK & FREE TIME

1. What kind of activities do you do? And family members?
2. Where do you work? And your family members?
3. Who does the household work? Who cooks?
4. Why do you do this work/activities? Are you happy with it?
5. Where did you learn to do this work? Which training did you have? How do newcomers learn to do the work?
6. What things are you good at? Do you feel appreciated / useful?
7. Are there other activities you would like to do?
8. How many hours do you work? Do you need more time?
9. How much time is free in a week?
10. Is there time when you feel free to do nothing?
11. What do you do when you do not work?
12. With whom do you enjoy free time?
13. What do you do when you meet others? Do you enjoy this?
14. Which festivities/parties/events do you celebrate? Why? When?
15. How many hours are you free? Do you need more time?
16. What do you like best / dislike about your activities?
17. Is there anything else you would like to do? Or like to change?
18. Did anything change in your job / activities in the past years?

"How / why / what / who / where / when .....?"

Figure 8-14: Question card for the theme 'Work & Free Time'

Introduction - Timeline

There is no specific card for the introduction questions. The timeline of a day, as presented in figure 8-39, will serve as the interview starter.

Person – Self-Reflection & Dreams

Figure 8-15: Three pictograms for theme 'Self-Reflection & Dreams'

Person – Spirituality

Figure 8-16: Three pictograms for theme 'Spirituality'

Person – Knowledge & Skills

Figure 8-17: Three pictograms for theme 'Knowledge & Skills'

Person – Body & Appearance

Figure 8-18: Three pictograms for theme 'Body & Appearance'

Health – Physical Health

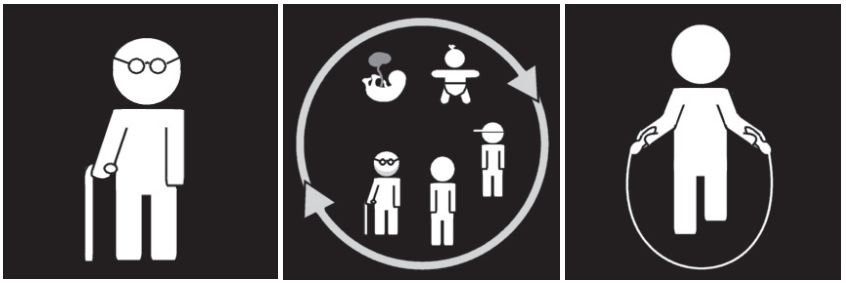


Figure 8-19: Three pictograms for theme 'Physical Health'

Health - Healthcare

Figure 8-20: Three pictograms for theme 'Healthcare'

Health – Happiness & Worries

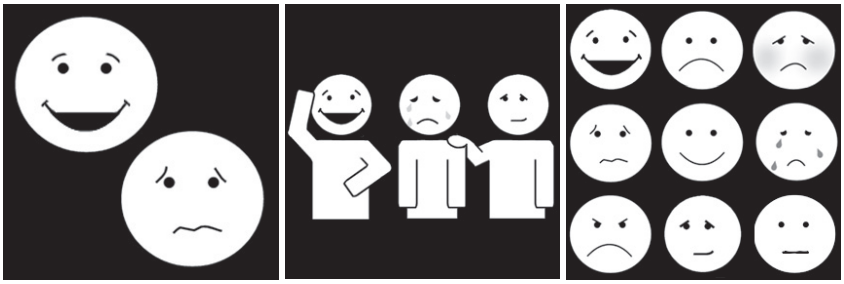


Figure 8-21: Three pictograms for theme 'Happiness & Worries'

Health – Food & Drinks

Figure 8-22: Three pictograms for theme 'Food & Drinks'

Relationships - Family

Figure 8-23: Three pictograms for theme 'Family'

Relationships – Social Life

Figure 8-24: Three pictograms for theme 'Social Life'

Relationships – Community

Figure 8-25: Three pictograms for theme 'Community'

Relationships – Colleagues

Figure 8-26: Three pictograms for theme 'Colleagues'

Activities – Work & Spare Time

Figure 8-27: Three pictograms for theme 'Work & Spare Time'

Activities – Movements

Figure 8-28: Three pictograms for theme 'Movements'

Activities – Participation & Organisation

Figure 8-29: Three pictograms for theme 'Participation & Organisation'

Activities – Communication & Information

Figure 8-30: Three pictograms for theme 'Communication & Information'

Living - Housing

Figure 8-31: Three pictograms for theme 'Housing'

Living – Safety & Security

Figure 8-32: Three pictograms for theme 'Safety & Security'

Living - Facilities

Figure 8-33: Three pictograms for theme 'Facilities'

Living - Environment

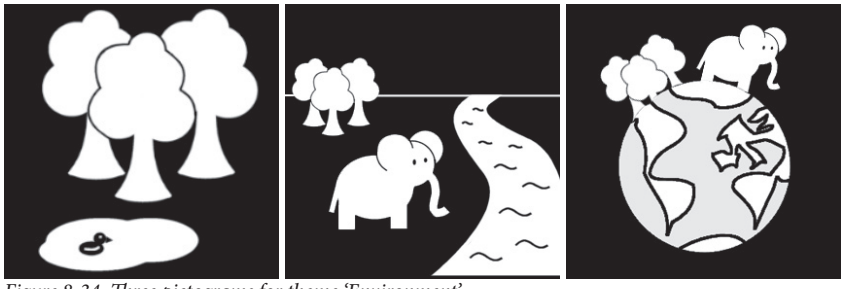


Figure 8-34: Three pictograms for theme 'Environment'

Possessions - Products

Figure 8-35: Three pictograms for theme 'Products'

Possessions – Financial Situation

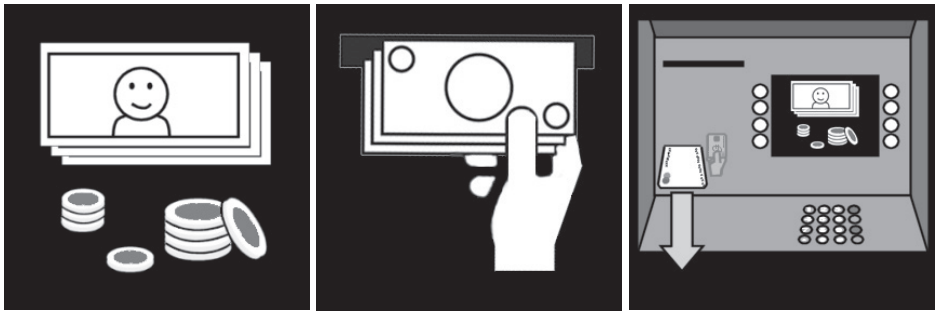


Figure 8-36: Three pictograms for theme 'Financial Situation'

Possessions – Natural Property

Figure 8-37: Three pictograms for theme 'Natural Property'

Possessions – Animals

Figure 8-38: Three pictograms for theme 'Animals'

Drawing / mapping on timelines and mapping sheets

The timeline has been adjusted to suit the purpose of drawing. It has been made bigger and the images and colours have been faded. The timeline can be used on an electric drawing device, or can be printed and laminated to allow for drawing with erasable markers (see figure 8-39).

Figure 8-39: Timeline for drawing

A timeline of a year has been added to the ODK to assist the design team to learn more about participants' activities throughout the year (see figure 8-40).

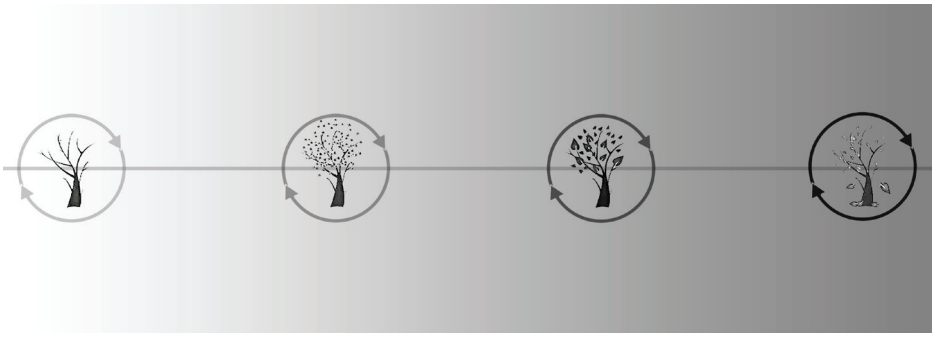


Figure 8-40: Timeline for activities throughout the year

A timeline of personal history has been added to learn more about participants' personal history by going back to past experiences (see figure 8-41).

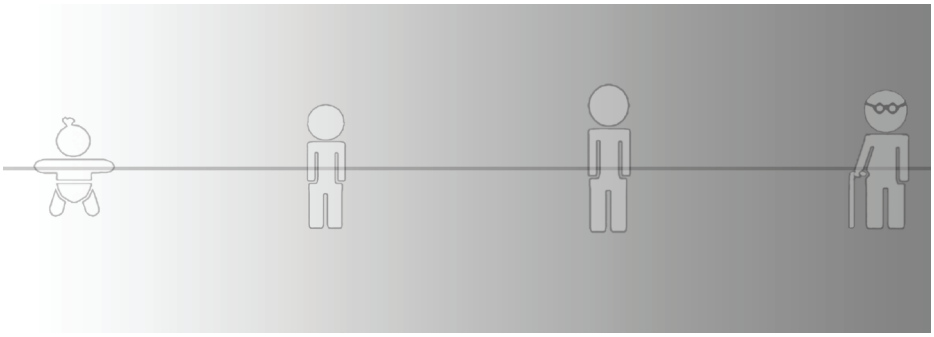


Figure 8-41: Timeline for personal history

Moreover, two drawing sheets have been developed. One to enable mapping of participants' housing, surroundings and movement patterns, and one to map participants' appearance and social life (see figure 8-42 and 8-43).

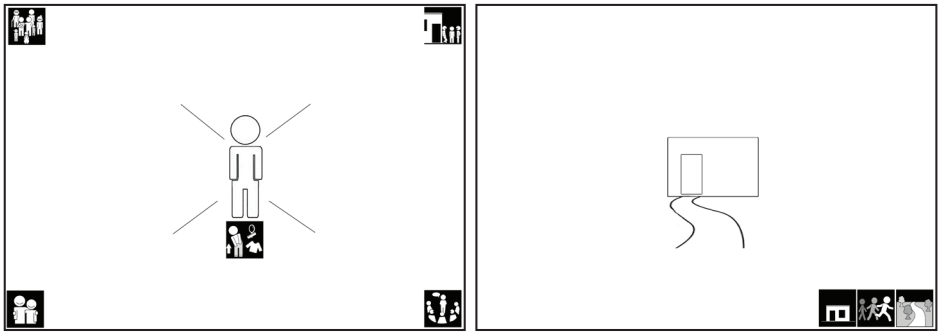


Figure 8-42 and 8-43: Mapping sheet for 'Living' and 'Movements' / for 'Appearance' and 'Social Life'

Sorting

The sorting exercise is to sort how people value the different themes. Participants should indicate which themes they value most in their lives. The sub-theme pictograms are available in a smaller size and can be placed on the sorting sheet. The exclamation marks indicate importance. The participants have to sort the sorting cards in six categories from very important (six exclamation marks) to not important (represented by one exclamation mark) (see figure 8-44). To avoid confusion, this can be done best by providing the sorting cards one by one and let people sort them one by one.

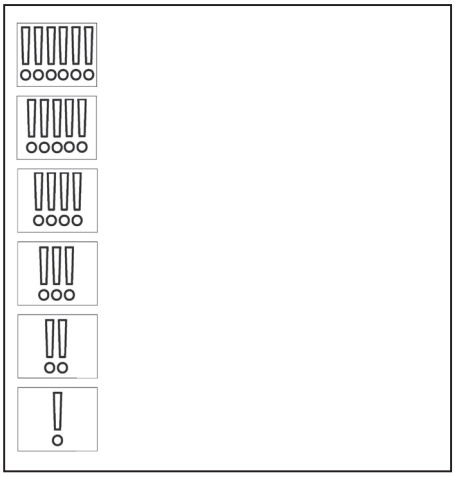


Figure 8-44: Sorting sheet

8.3 Practical outcomes: Manual and open online platform

The CDD approach and ODK interview toolkit are the practical outcomes of the study presented in this thesis. They are described in a manual (see Appendix G). The manual and toolkit are also available on the internet via an open online platform: www.design4wellbeing.info (see figure 8-45 to 8-48). On this platform they are presented in an interactive, easily adjustable and accessible manner. The open online platform serves multiple purposes:

1. It improves the uptake of the CDD approach by designers, as it provides readily available materials in an accessible manner, it is an open platform and free for users;
2. It serves as a platform for an exchange of ideas, experiences, methods and tools and provides an opportunity for discussion;
3. It provides a library of 'basic' pictograms which can be used within the ODK method, but also allows for additions to it and for building a database of 'contextualised' visualizations which will be input by users of the approach;
4. The CDD approach and ODK toolkit will be regularly improved and updated based on the user feedback and experiences. In order to prevent misuse, proliferation, and alienation of the CDD approach, a board will be established consisting of people with different expertise: design, ethnography, philosophy. This board will judge the suggestions for

improvements of the approach and its techniques and tools. For the regional insights, a local person from the specific region will be temporarily added to the board. Only if the board approves the suggested changes and the insights, they will be put on the online platform.

The CDD approach and ODK can be tweaked and adjusted by the designers using them, within certain boundaries. This is explained in the manuals and on the open online platform. The manual includes guidelines for appropriate behaviour and attitude in the field and for appropriate questioning behaviour. This 'training module' is not an alternative for qualitative research training, but it serves as a reminder to the design team to guide them in the field.

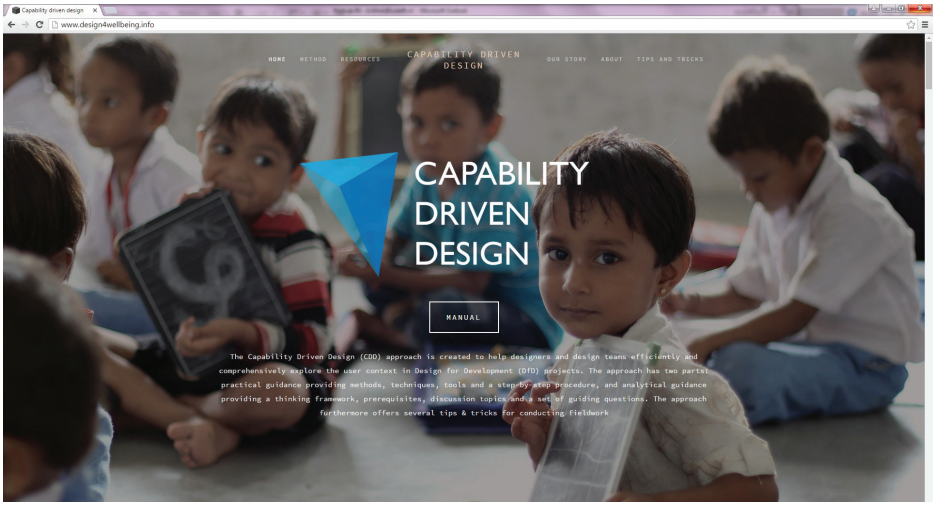


Figure 8-45: Screenshot online platform - home page

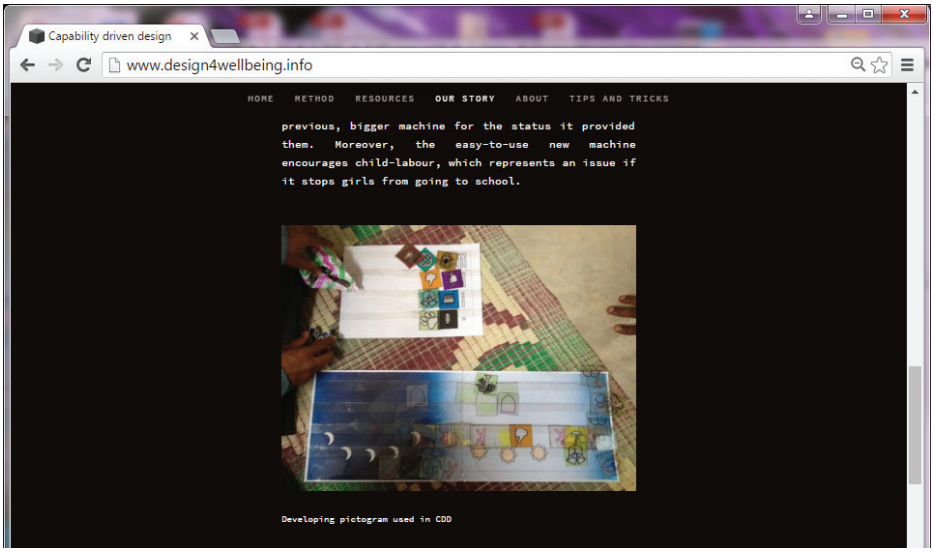


Figure 8-48: Screenshot of online platform - practical examples

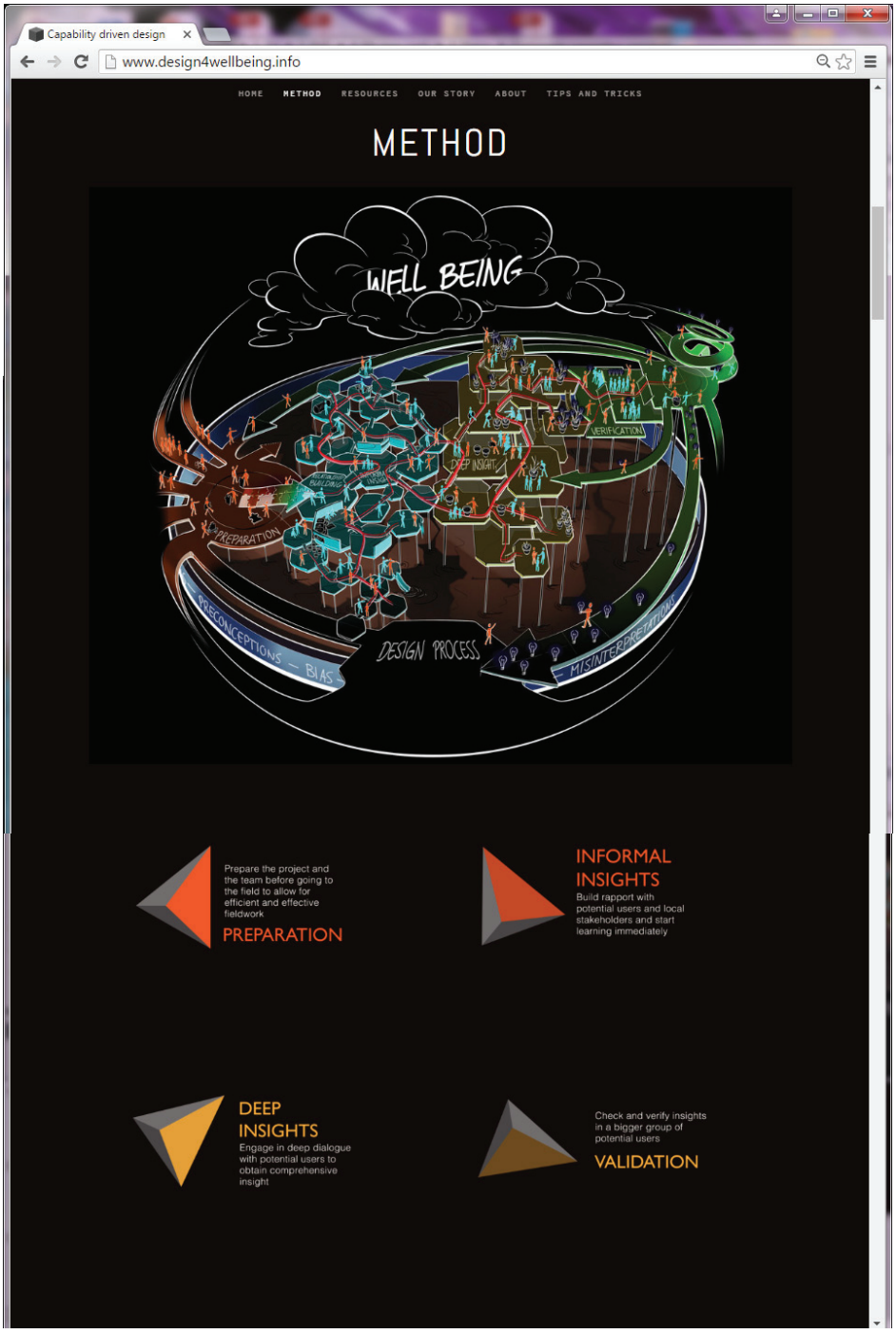


Figure 8-46: Screenshot online platform - method page

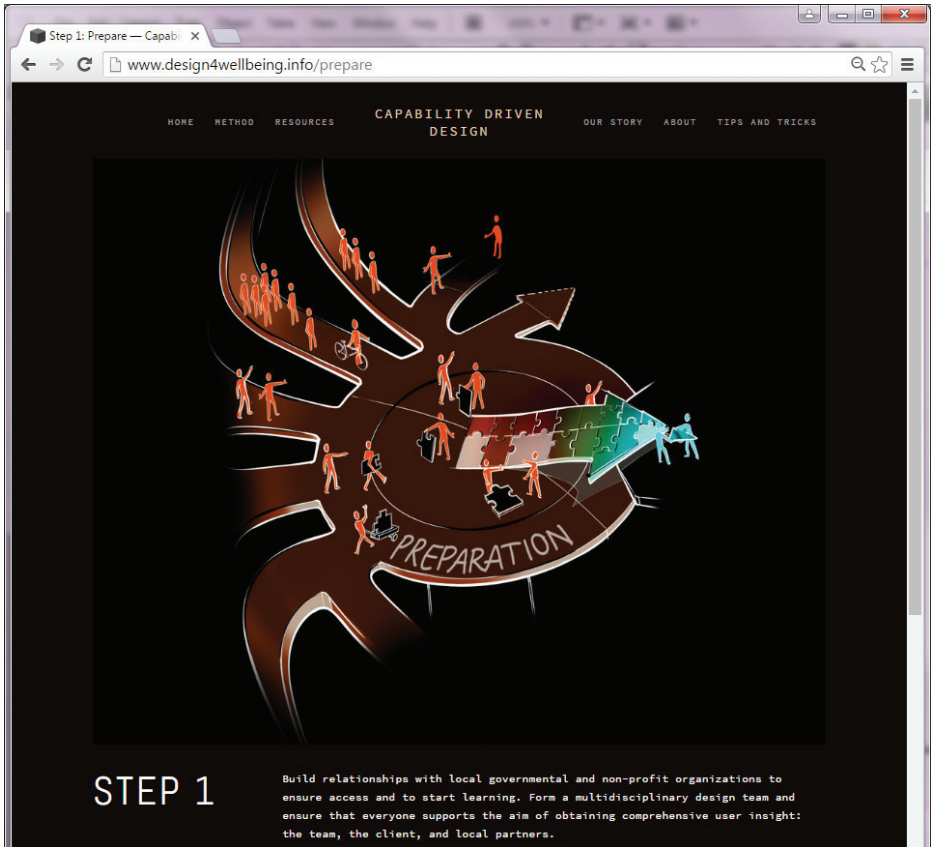


Figure 8-47: Screenshot of online platform - step-by-step approach

CHAPTER 9

Conclusions and Recommendations

In chapter 8 the practical outcome of this research was presented, thereby answering the final research question, question 3. In this chapter the theoretical and practical outcomes of this study are described, the research and its outcomes are reflected on, and recommendations for further research and practice are offered. In §9.1 the main research findings are presented by answering the three research questions introduced in chapter 1. In §9.2 the contributions of this research are discussed. Then, in s§9.3, the limitations of the research outcomes are reflected on, and in §9.4 the quality, validity and limitations of the research itself is reflected on. Finally, in §9.5 recommendations are presented for future research, design practice, education and use by a broader audience.

9.1 Main research findings

The aim of this exploratory research was to identify an effective, efficient and designer-friendly method to obtain comprehensive insight in people's well-being, specifically for product designers working in Design for Development (DfD) projects. By doing so, ways to guide product designers when obtaining user insight beyond the product–user interaction were looked for. In this section, the main research findings are discussed in light of the research questions.

Analytic guidance

As argued in chapter 1, 2 and 3, designers' views are often limited to the interaction between the user and the product, while a comprehensive view of the well-being of their potential users often leads to better accessibility, applicability, acceptance and adoption of the designed product and / or service, and to result in less design iterations and guidance during decision-making. In DfD projects, where the lives of potential users are often very different than the lives of the product designers', this comprehensive view is especially beneficial. Current design manuals and toolkits do not specify which type of information and insights designers should collect to obtain a comprehensive understanding of the well-being of their potential users, and they do not provide a procedure to follow. Rapid ethnographic approaches provide methods and a procedure, but are not specifically tailored to the needs of designers who are often not trained to conduct ethnographic research. To broaden designers' scope, a need for analytic guidance for comprehensive user context research was identified in order to stimulate the invention of products and services that result in development and improved well-being. Sen's Capability Approach (CA) seemed to be a promising approach to provide this guidance. Therefore, the first research question was:

> *"Which analytic guidance does the capability approach offer designers to understand people's well-being?"*

Based on an exploration of the CA literature, a thinking framework and a set of themes and guiding questions were derived in order to guide designers who need a comprehensive understanding of people's well-being. The framework, themes and questions provide the required analytic guidance to understand people's well-being, and thus form the answer to research question 1.

Practical guidance

As product design is a practical profession and design projects are often quick and result-oriented, the analytic guidance should be cast in an efficient, designer-friendly and practical form. Therefore, the second research question asked was:

> *"Which designer-friendly methods are available to efficiently explore people's well-being to inform Design for Development?"*

Inspiration was sought from several design manuals, toolkits, handbooks and articles regarding User-Centred Design (UCD) and Design for Development (DfD). Additionally,

the domain of Rapid Ethnography (RE) was explored for guidance, as this domain specifically focuses on efficient and effective exploration of cultural phenomena from the perspective of the people being studied. This exploration resulted in a set of obstacles, learnings, methods, tools and techniques. A selection of methods, tools and techniques was made based on criteria relating to efficiency, comprehensiveness, and applicability in DfD projects. The literature study not only revealed designer-friendly methods, but it also revealed the prerequisites, steps and guidelines to efficiently explore people's well-being in DfD projects. These provide the answer to research question 2.

Systemic approach

The final research questions was devised with the aim of bringing the analytic and practical guidance together:

> *"How can the analytic and practical guidance be integrated in a systemic approach to understand people's well-being to inform Design for Development?"*

A systemic approach has been developed, based on the acquired analytic and practical guidance. This approach is called 'Capability Driven Design' (CDD). It comprises:

- A backbone. The CDD backbone consists of the CA-based thinking framework, themes and questions, and practical prerequisites derived from the obstacles and learnings of UCD, DfD and RE literature. This backbone offers a perspective, and the themes, questions and prerequisites offer guidance for dialogue in order to bring out capabilities and valued beings and doings.
- A basic procedure. The procedure consists of four steps and includes four methods. The steps comprise preparation, obtaining informal insight, obtaining deep insight and verifying and using the obtained insight; all are based on the outcomes of the UCD, DfD and RE literature. The methods comprise immersion, informal talks, semi-structured observation during the step of obtaining informal insight, and semi-structured individual interviews during the step of obtaining deep insight. The procedure aims to guide designers to conduct rigorous research in a competent way.
- Add-on methods: Nine methods were elicited that can be added to the basic procedure if more time and resources are available to the design team, or when additional insight is required.

For the key method of the CDD approach a specific method was established, the Opportunity Detection Kit (ODK). This kit uses the backbone of CDD and comprises several guidelines, steps, techniques and tools derived from CA, UCD, DfD and RE literature. The ODK has been subject of several formative evaluations following the Design-Based Research approach (DBR). The evaluations involved designers and experts and resulted in the development and refinement of the ODK and of the backbone of the overall CDD approach.

The requirements for CDD, as specified in §5.1, were used as guidelines to develop the approach and the ODK method. All these requirements have been largely or fully fulfilled:

1. CDD needs to offer a comprehensive view, beyond product-user interaction. The CDD approach offers a comprehensive view by providing a thinking framework, themes and

questions, which urge the designer to comprehensively assess the user context.

2. CDD needs to offer a procedure. The CDD approach offers methods, as well as a step-by-step procedure, for a 'quick scan' and for a more 'extensive scan' of the user context.
3. CDD needs to be designer-friendly. The CDD approach offers methods which guide designers in situations of uncertainty: the design teams who used the ODK intensively agreed that the ODK helped them in making design decisions, understanding culture, prioritising, and providing design inspiration. The approach also provides guidelines, tips and tricks to help designers to efficiently use the approach. The ODK specifically offers techniques and tools which help designers to conduct semi-structured interviews. The design teams who used the ODK intensively considered these techniques and tools to offer a 'good grip and guidance'. The feedback of the design teams and experts have been incorporated to further improve the approach's efficiency and make the approach more easy and intuitive to deploy.
4. CDD needs to be efficient and rigorous. The CDD approach offers prerequisites, steps and guidelines to ensure rigorous user context research and involves the use of multiple designers, multiple methods, techniques and tools, critical reflection, and sharing of interpretations and outcomes. The approach furthermore offers a basic procedure to conduct user research in an efficient way, and add-on methods to allow for deeper insight.
5. CDD needs to be self-explanatory. The benefits of the CDD approach and ODK method were not immediately clear to all teams, and some of the design team members preferred different methods to use. During the first meetings, it also became clear that all teams still had several questions. Therefore, the approach is not yet self-explanatory. The difference between the design teams who used the ODK during their JMP projects in a 'normal' or 'intensive' way shows big differences in its uptake. The teams who combined their project with a research course had extra time for using it and they were interested in the method from the start. The CDD approach did not have to be 'sold' to them, as they were already convinced of its benefit. But this is not the case for all product designers: not all designers know the approach, are convinced of the added value of user-context research, and designers might prefer different methods. To improve the uptake of the CDD approach, the manual has been adjusted to immediately clarify CDD's benefits, and also offers more illustrations to support the understanding of CDD's theoretical and practical knowledge. Furthermore, an online platform has been developed. Based on experiences of people using the CDD approach, its self-explanatory character can be improved.
6. CDD needs to be adaptable and flexible. The CDD approach does not prescribe one fixed way of doing things, but does mention several prerequisites, basic methods, and a procedure to follow. The approach offers flexibility in choosing add-on methods, posing questions, and using techniques and tools. The design teams using the ODK method were happy with the flexibility to adapt the method to their own needs, but they did not all follow the prerequisites and the basic procedure. As Daalhuizen (2014) explains, method use in design involves a designer, a context and a design project, which influence if, when and how the methods are used and how much they contribute to the design outcome. The CDD approach tries to offer a flexible approach, but also to urge designers to follow certain rules. How well this works in practice needs to be further explored.

7. CDD needs to fit the 'Design for Development' context. The methods, techniques and tools developed for the CDD approach are developed to avoid writing and internet usage. It also offers visualisations and drawings to form a direct line of communication with the participants when designers do not speak the local language.
8. CDD needs to stimulate dialogue and rapport building for deep understanding. The CDD approach consists of several steps that are focused on building rapport and establishing dialogue. It offers methods that allow for conversations to go different ways. Improvements can still be made to obtain deeper insights.
9. CDD needs to adhere to ethical guidelines. The approach includes ethical guidelines in its prerequisites, steps and guidelines. The tips & tricks pay specific attention to ethics.

While the approach and kit remain open to criticism and modification based on user experiences, it can be concluded that they offer designers valuable support throughout the design process: to better define the design challenge, to develop design requirements, and to make informed design decisions. The value of this type of method has been demonstrated in the practical DfD projects included in this research. This research project therefore contributes to improving designers' comprehensive understanding of the lives of their potential users, specifically in DfD projects, being a step towards the design of products and services that truly improve the well-being of the marginalized and disadvantaged. The practical outcomes (CDD and ODK) of this research are presented in chapter 8, providing an answer to research question 3.

9.2 Theoretical and practical contributions

The research presented in this thesis has been direct towards developing a systemic, designer-friendly and efficient approach for obtaining comprehensive user insight in DfD projects. The CDD approach and the ODK were developed based on existing theory and practical knowledge, and have been advanced and evaluated by iterative field-testing and expert consultations. The theoretical and practical contributions are described below.

Theoretical: the approach advances responsible innovation

The thinking framework and the list of themes and questions provide theoretical knowledge that guides designers when moving beyond product-user interaction, and to obtain a comprehensive view of the lives of their potential users in order to better address their valued beings and doings. As became apparent from the fieldwork conducted in various contexts, the design teams obtained insights relevant for their design projects which they would otherwise not have detected. Three design teams used the ODK intensively and indicated that the ODK enabled them to keep the bigger picture in mind, and to understand the participants' culture and priorities. These insights aided them in making design decisions and offered design inspiration.

While Chambers (2004) argues to gather only the data needed and Sen (1999) argues to focus only on a few capabilities per situation, the work presented in this thesis offers an

approach to comprehensively explore the user context. This comprehensive view of the CDD approach, is a response to Papanek (1984)'s call to better address people's well-being in DfD projects. It helps designers to foresee the consequences of their products and / or services to the greatest extent possible and to improve product accessibility, applicability, acceptance and adoption. By responsibly innovating, taking into account the user context in a comprehensive way, designers can positively influence the capabilities – real opportunities - of their potential users. By prospectively using the CA, which according to Alkire (2008, p. 32) means identifying *"which concrete actions are likely to generate a greater stream of expanded capabilities",* responsible innovation is not ensured, but product innovations are likely to become more responsible and successful, which is a great step forward. Therefore, the research presented in this thesis contributes to the knowledge in the domains of DfD and responsible innovation. And, as Pina e Cunha et al. (2014, p. 209) point out *"If organizations need to learn how to do more with fewer resources due to social, political, and sustainability imperatives, then this field will be critical for the future of product innovation."* The knowledge generated in this thesis may therefore be not only relevant for DfD, but also for product design in other regions of the world. This also matches the view of Kleine, Light, and Montero (2012), who indicate that, from a capability perspective, all countries can be classified as 'developing countries'.

Theoretical: the approach advances the knowledge in the domain of user-centred design

The analytic and practical guidance offered by the CDD approach and the ODK moves the knowledge regarding user-context exploration forward, as it supports the collection of comprehensive user insight, beyond product-user interaction by offering an efficient and designer-friendly approach. The approach therefore advances the knowledge in the domain of UCD and, more specifically, the activity cluster 'applied ethnography'. The CDD approach considers potential end-users as partners in the design process: designers and potential users should 'learn as one' (as according to Harder, Burford, and Hoover 2013), and the users should have an active role to design their own social innovations, based on their own social demands, and in this way improve their own well-being (as according to Manzini 2007; and DESIS 2014). Although the CDD approach focuses on the first phase of the design process, it propagates equality, mutual dialogue, and involvement of the potential end-users throughout the design process. Therefore, the CDD approach is positioned more towards participatory design than 'applied ethnography' (as can be seen in figure 9-1).

Manzini (2009, p. 5) argues that design knowledge must be knowledge *"that can be clearly expressed by whoever produces it, discussed by anyone who is interested, applied by other designers, and it must become the starting point that allows other researchers to produce further knowledge."* This thesis and the online platform are ways of expressing the developed knowledge, and to invite everyone who is interested to discuss about it, designers to use it and other researchers to further develop it.

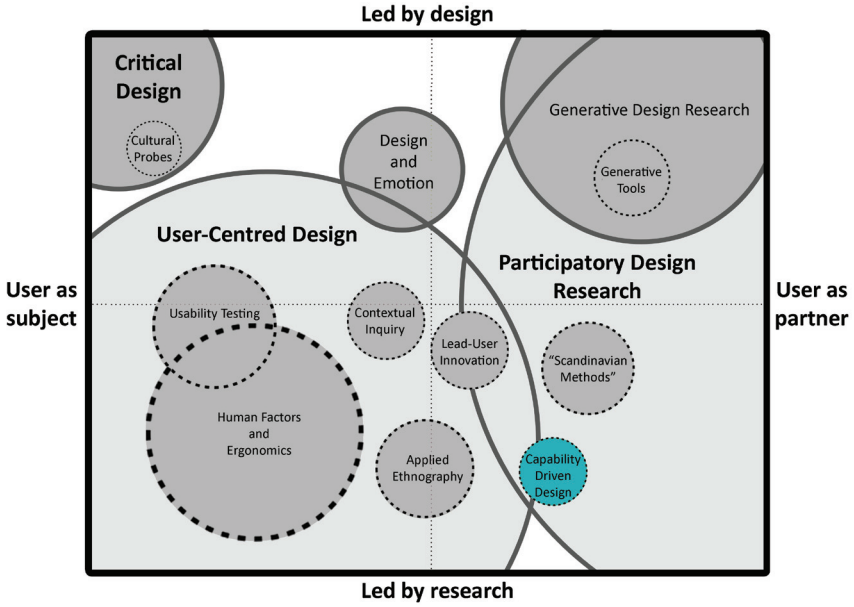


Figure 9-1: The place of the CDD approach in the human-centred design domain

Theoretical: the approach adds to operationalization of the capability approach

The CA has not yet been operationalized for design practice. The Choice Framework of Kleine (2011, p. 129) *"offers a suggestion as to how the capability approach could be applied in [development] practice"* and is therefore used as the main source of inspiration (see §2.2), but it is not yet readily applicable for product designers. In this research project, the CA's holistic view of well-being forms the basis of the 'thinking framework', and the list of themes and questions. As described in §3.1, the CA needed simplification and refinement for application in the DfD domain. This has been done for both the CA-based thinking framework, and the themes and questions so as to make the CA knowledge easily accessible for use in design practice.

This has not had an adverse effect on the CA's complexity and theoretical richness: the CA-based thinking framework fulfils the criteria of having clear components, not imposing on universal values and being based on the CA's rationale, and when developing the list, the criteria from the CA literature for establishing dimensions were adhered to. The list was established based on existing data and has been refined by the research team, field trials, and expert consultations. The list is made explicit, discussed, clarified, scrutinized, and defended and it contains a theoretically ideal description, as well as pragmatic questions. Based on an extensive quantity of existing data from theory and practice, its philosophical and theoretical meaningfulness have been accounted for. Finally, due to the fieldwork iterations in many countries and the expert appraisal by experts from a wide range of institutions and backgrounds, the list has not been derived from a specific worldview, but includes most issues related to agency and well-being goals. To keep the list clear and usable, the themes have been categorized into six main themes and 24 sub-themes.

It has not been investigated to which extent the usage of another 'well-being approach' would have resulted in the same comprehensive view of well-being, themes and questions, and thus to which extent the CDD approach advances specifically the operationalisation of the CA. However, the thinking framework, focusing specifically on 'choice', 'capabilities', 'conversion factors', and 'functionings' can be attributed to the CA, and in combination with the themes and questions the CA's comprehensive view of well-being and development is propagated in the world of product design. Therefore, it can be said that, by using the CA-based thinking framework, themes and questions in combination with practical guidance from UCD, DfD and RE, this research project contributed to the challenge of operationalising the CA.

Practical: an approach to efficiently and comprehensively explore the user context

In the study presented in this thesis, the focus has been on developing guidance for product designers to help them efficiently obtain comprehensive insight in people's well-being in DfD projects. In chapter 8, this guidance is presented, being a CDD approach offering a content (thinking framework, prerequisites, themes and questions), and two procedures: a quick scan and an extensive scan. For the key CDD approach method, semi-structured interviews, a toolkit was developed and evaluated. It offers steps and guidelines to be followed, as well as a set of methods, techniques and tools. In addition, a manual was produced explaining the CDD approach and ODK, and offers tips & tricks on several field practicalities: 1) appropriate attitude and behaviour; 2) appropriate questioning; 3) selecting, instructing and working with a translator; 4) what to pay attention to when being in the field; and 5) how to develop appropriate contextualised visualizations.

The aim of this practical approach is not to impose a 'Northern' developmental agenda towards the 'Southern' half of the globe. The product designers using the approach can come from any part in the world, aiming to develop the well-being of people in their own region, country or elsewhere on the globe. The purpose of the CDD approach is also not to extract information from potential end-users in order to solely develop profitable products and services based on that information; the products and services should be developed in collaboration with potential end-users and other stakeholders to make them part of the design process, and have them learn from the process. By being involved, the potential end-users are more likely to adopt the designed product and / or service, and they will be able to take care of its maintenance and improvements. The CDD approach is therefore not meant to be *"arrogant interventionism from the North"* (Sachs 2010, p. XVI), it is an approach helping designers to get to know their potential users in a comprehensive manner in order to start an interactive, participatory design process that effectively deals with wicked systems (see §2. 1) and results in the development of products and services that improve the well-being of its potential users.

Practical: online platform

The CDD manual and ODK techniques and tools are freely accessible and available on an online platform in order to improve the uptake of CDD and the ODK and to further develop and refine them. Another advantage of the online platform is that it is available wherever designers operate in the world and have internet access. The platform allows flexible use of the

approach and toolkit, and encourages interaction between designers about field experiences. As the use of the approach and toolkit partly depend on the context in which they are used, a database per region allows designers to share insights per region. Insights regarding cultural values, norms, practices, hierarchy, rules and regulations, but also regarding visualisations, techniques and tools that work or do not work in a specific context. In this way, designers can learn from each other instead of continuously having to reinvent the wheel. In order to prevent misuse, proliferation, and alienation of the CDD approach, a board will be established consisting of people with different expertise: design, ethnography, philosophy. This board will judge the suggestions for CDD improvement and into proposed regional insights. For the regional insights, a local person from the specific region will be temporarily added to the board, to judge the insights. Only if the board approves the suggested changes and the insights, they will be put on the online platform.

9.3 Capability Driven Design limitations

The CDD approach offers a systemic, designer-friendly and efficient approach for obtaining comprehensive user insight in DfD projects, but also has a number of limitations. These are presented below.

The time and resources required

Conducting user-context research takes time, while in a design process time and resources are often limited. However, while the three design teams who used the ODK intensively noted that the ODK interviews took a considerable amount of time and therefore need to be properly planned, they all acknowledged that conducting the interviews and observations was worth the effort, as they became familiar with their potential users and their context in a few days' time, which would have otherwise taken much longer. In other words, the additional time spent on the CCD approach in earlier stages of the design process is 'paid back' at later stages.

Limitations of obtained insights

The CDD approach focuses extensively on defining all well-being and agency related goals (comprehensive insight), while more focus could be given to obtaining the participants' feelings and emotions (deep insight). It does, however, depend on many factors to which extent designers can actually get to know their participants and how deep this understanding will be: e.g., the personal connection, the situation participants are in, time pressure, interest in the research, and time. According to Hall (1968), people's personal space is the region that directly surrounds them and kept for intimacy, friends and family. For entering that personal space, extensive rapport needs to be build, which takes time. More and deeper knowledge can be obtained when staying with the potential end-user for a longer time. The CDD approach offers a way to obtain many insights about users, but it is not a magical tool which provides all the answers. Moreover, the insights obtained are specific to a certain context and not generalisable for other contexts.

Context-dependency of the approach

To find a balance between the refinement of the ODK and its local adaptability, the ODK visualizations have been kept general, the questions detected as being sensitive in certain contexts remained part of CDD and the ODK, and themes that might not directly seem relevant in each context or design project are also included in the CDD approach and the ODK. In the manual accompanying the CDD approach and the ODK it is stressed that it is important to contextualise the contents of the CDD approach and ODK before using it in a specific context. It is important to detect cultural and local sensitivities, wordings and behaviour. When designers have limited time, they can use the general pictograms, but in the manual it is also stressed that it is valuable to contextualise the pictograms. The online platform tries to facilitate the exchange of contextual knowledge and visualizations.

Intrusiveness

It must be noted that obtaining comprehensive user insight and engaging participants in 3 hour dialogues asks a lot from the participants, and that not for every design project the relevance and level of direct engagement and participation is the same (Kleine 2011). It is up to the designers to judge the length and amount of each activity, and to keep the balance between immersion and extraction.

Research focus

The CDD approach concerns only the first phase of the design process, and only the user context exploration part. The designer has many more tasks at hand, during analysis and other phases of the design process, which are not covered in the approach. Furthermore, the CDD approach helps designers to obtain comprehensive user insights, but not how to translate the obtained information to practical design knowledge.

9.4 Research limitations

The DBR approach fitted this research project well, allowing for an exploratory, iterative development of the ODK method, and addressing the complex combination of the context, designer and design project in the setting of developing regions. Combining theory and real-world practice resulted in the development of a solid approach, evaluated by practitioners and academics, resulting in both theoretical contributions and practical outcomes. However, the DBR approach also has a number of limitations which have been discussed in chapter 4. In this section, these limitations, as well as the scope of the research project, are reflected on.

Quality and validity of the research

The researchers in this project often took on the role of designer and evaluator, being either actively or closely involved in the execution of the interventions. This gave the researcher a thorough understanding and access to the complexity of the data, but it also led to possible bias and subjectivities in the data and data analysis. This influence has been minimized in a number of ways as mentioned in chapter 4, however there will be some influence on the research outcomes due to the researcher's bias and subjectivities.

Generalizability of research outcomes

The outcomes of this research cannot be statistically generalized. According to Plomp (2013), the outcomes should be replicated in multiple cases in order for the intervention to be accepted for a larger number of similar contexts. The ODK has therefore been deployed in different contexts, with similar contributions for the design teams using the intervention. Three design teams used the ODK intensively and no generalizations can be made on the basis of these three projects, however the CDD approach and the ODK are fit for use in other settings as well, as they offer a generic basis for designers to adjust to the context of their projects and to their own preferences. The experts who examined the content of the ODK were from different backgrounds and various institutions, to allow for different views to be acknowledged in the themes and questions. By addressing the themes and questions, a comprehensive, general view of well-being can be obtained in different contexts. However, as obtaining user insight in DfD projects is a complex process and depends on different actors and elements, it is difficult to claim completeness and general applicability.

Replication of research and findings

The ODK outcomes are difficult to replicate from setting to setting. As stated above, Daalhuizen (2014) explains that method use in design involves a designer, a context and a design project. Furthermore, the try-outs showed that the local partner and practicalities such as accessibility of participants and use of a translator also influence the outcomes. To address the differences in setting in relation to the project outcomes, in this thesis, the ODK's unfolding over time has been described for each iteration, accounting for the context, setting, design team, design project, local partner, participants and translators. Thereby, only the general outcomes, also relevant for other contexts, have been taken from the try-outs in order to refine the ODK and the CDD approach.

Ensuring valuable outcomes

Nieveen and Folmer (2013) describe four criteria for high quality interventions: relevance, consistency, practicality and effectiveness. In this study, the ODK was used by product designers in DfD projects, and it can be concluded that the ODK addresses all four criteria. The ODK provides a means of quickly obtaining a comprehensive view of potential users and their context (relevance), product designers find the ODK usable (practicality), and indicate that the ODK leads to desired outcomes, as it offers product designers guidance in decision making and offers design inspiration by providing a comprehensive understanding of the user context (effectiveness). The different elements of the CDD approach are linked to each other in a consistent way, therefore it fulfils the consistency criterion. However, the extent to which this understanding contributes to the development of products and / or services that fit their users' valued beings and doings has not been investigated, and is difficult to pinpoint.

Long-term commitment is required

DBR research requires a long-term commitment of researchers and practitioners, as it is an iterative process and therefore it is often unclear when it has been completed. Plomp (2013) argues that reflection often results in new recommendations for improving the intervention,

and therefore states that this phase is also often called 'semi-summative'. In this research project, this is also the case. The CDD approach and the ODK have been adjusted after being evaluated and should therefore be applied again in several contexts to evaluate the adjustments. For the time being, the approach and kit offer useful guidance, but they will remain open to criticism and modification, as they are freely available and accessible. The online platform, was developed to stimulate the approach's uptake and to collect experiences from design practitioners who will then iteratively improve upon the approach and the ODK method.

Research scope

This research project focused on the development of the ODK, a method to obtain deep insight through semi-structured interviews. This made the project manageable and allowed for valuable feedback on the backbone of the systemic CDD approach. However, the other three steps forming the CDD approach (preparation, obtaining informal insight and verification and use of insights) have not been subjected to formative evaluation.

9.5 Recommendations

In this section, recommendations for future research projects, for education, for design practice, and for broader usage are provided.

Recommendations for future research

The recommendations provided below follow from the limitations described above. They indicate areas for future research with which designers can further improve the effectiveness, efficiency and designer-friendliness of the CDD approach.

Further development of all CDD steps

The main focus of this research project was on developing step 3 of the CDD approach: obtaining deep insight by semi-structured interviews. The three other CDD steps (preparation, obtaining informal insight, and verification of insights) should also be developed, to come to a solid, efficient and effective CDD approach. The development of the last step, verification of insights, was noted as being especially relevant for designers. The design teams who conducted the try-outs indicated that they did not verify the obtained data, and that it would have been valuable to share it with a larger group to be able to draw more generalisable conclusions. Several evaluators who participated in this study clearly indicated that the development of a framework to analyse and synthesize all the obtained information, in order to be able to make sense of the data, would also be useful. Results from the try-outs indicated that data sharing within the team was often difficult, as much of the obtained information remains implicit or is simplified. Data sharing within the team therefore is also a point of attention for further development.

Improving deep insight

As the design teams indicated, the number of themes and questions enable comprehensive

insight to be gained, but make it difficult and time-consuming to go deeper into every issue detected during the interview. The interviews can therefore be structured to be more general at the beginning and more focused after the first sessions, but it remains difficult to access the inner feelings and perceptions of potential users when limited time is available to build rapport. According to Hall (1968, p. 95), the complex topic of people's perceptions *"in different emotional states during different activities, in different relationships, settings, and contexts"* cannot be investigated by using one single research technique. To get to the deeper levels, generative techniques and contextmapping can be used, as described by Sanders and Stappers (2008) and Sleeswijk Visser et al. (2005).

Further evaluation in practice to improve effectiveness and efficiency

As often in DBR, revision is still needed and the development process of the CDD approach and ODK is not yet finished and should remain open to criticism and modification, based on user experiences. For further evaluation and refinement, CDD and the ODK should also be applied by experienced design practitioners in a variety of contexts. The CDD approach and the ODK are available and accessible via an online platform, and can be used by designers who, in turn, can provide valuable feedback for improving the effectiveness and efficiency of the approach and its generic applicability.

Further testing in practice to improve designer-friendliness

As indicated by Daalhuizen (2014), the use of the ODK does not only depend on the setting, but also on the design team using it and the design project itself. All eight project teams more or less adjusted the ODK to fit their own preferences, context and project. There is thus no single way to comprehensively explore the user context. The design teams noted that they liked the ODK's flexibility and adjustability. This was also indicated during the focus group sessions. The practical outcome of this research - the CDD approach and the ODK – are therefore offered as guidance, but remain flexible in use in order to fit the needs and wants of the users: product designers. It is important to iteratively investigate how designers' perceive the CDD's usefulness, and how they adjust and use the approach in practice. Their findings will lead to making the approach more designer-friendly.

Improvement of general pictograms

Although it has been tried to avoid applying a particular worldview to the pictograms, they will still be subjected to cultural adaptation and might not be applicable to every DfD context. Based on experiences of using the pictograms, and based on expert opinions they can be improved to offer a more neutral and applicable alternative for contextualised visualisations.

Assessment of CDDs impact on people's well-being

In this study it was not investigated to what extent the developed products and / or services improve the well-being of their users, and to what extent the ODK diminished unintended consequences. The approach seems to aid designers in understanding their potential users' lives, lifestyles, behaviour, thoughts, needs, desires and aspirations, and appears to support them in decision making, as well as to providing them with design inspiration. In this way,

the ODK guides designers in the development of products and / or services that address their users' valued beings and doings, but the actual impact is difficult to assess. By making the outcomes more explicit and using them as design requirements, their impact can be assessed by using the same ODK in an evaluative way. However, this can only be done in the course of time, as product impact is not directly measurable.

Developing a project assessment approach

As is true for design projects, it is relevant to assess project outcomes. The CDD approach and ODK can also be used in an evaluative manner, by conducting a baseline study at the beginning of the project and assessing project impact after implementation. To draw conclusions about the project's impact, the CDD approach needs adjusting to allow more quantitative outcomes or for quantitative analysis, to be able to compare the before and after situation.

Investigating the applicability of the approach for other domains

Several evaluators indicated that the ODK can also be more broadly applied in different domains, e.g., in marketing, social work, government surveys or in other creative domains, as well as in 'developed' contexts. However, this possible contribution to other domains has not been investigated in this research project.

Recommendations for use in DfD and broader design practice

The CDD approach and the ODK offer guidance to students, designers and other practitioners executing DfD projects to responsibly innovate for disadvantaged and marginalised populations. First, training and using the CDD approach helps practitioners to conduct rigorous research, resulting in valid and reliable outcomes. In this way, designers immerse into participants' lives in a competent way, and participants' valuable time is utilized in the best possible way. Second, the CDD approach offers practitioners a guide to rapidly and comprehensively get to know their potential users in order to address their valued beings and doings. This leads to the development of products and / or services that are desirable, improving product accessibility, applicability, acceptance and adoption, and in this way reduces the chance of wasting valuable time and resources of the designers and the participants. Furthermore, the approach informs decision-making and guides designers to thoroughly think about the possible consequences that their designed product and / or services might have in the context of their intended use. In this way, the design process is more likely to result in products and / or services that truly improve the well-being of disadvantaged and marginalized populations, with limited unintended consequences.

Besides being appropriate to DfD projects, the approach can also be applied in broader contexts of design practice. In many design projects, designers develop products and / or services for potential users with a different culture, even when they live in the same country or region. Designers focusing on, for example, product development for the elderly, adolescents, disabled or families, who themselves do not belong to this potential target group, can use the approach and toolkit to develop products that are better suited to address the valued beings and doings of this target group and improve product acceptance. Thus, the following list of recommendations, aimed at guiding designers to efficiently and effectively use the CDD

approach, is valuable for all product designers. However, caution is needed when deploying the CDD approach for different purposes as intended, as the approach has specifically been tailored for the needs of product designers working on DfD projects.

Get to know the CDD approach and the ODK

Design practitioners can follow a CDD instruction via the online platform. In this way they do, however, lack personal instruction. The online platform has been designed to suit the needs of designers, and provides all the information required to apply the approach.

Learn about appropriate behaviour, attitude and questioning skills

Product designers are not specifically trained for qualitative research techniques in the field, while their behaviour, attitude and questioning skills are key to obtaining reliable outcomes. Product designers need to be aware of the influence of their own presence and skills, and also the influence of the presence and skills of the translator and that of other people during research activities. Thereby, the obtained data needs to be interpreted, and, according to Hall (1968, p. 95), *"when two people of different cultures interact, each uses different criteria to interpret the other's behaviour, and each may easily misinterpret the relationship, the activity, or the emotions involved."* Designers therefore need to learn how they can avoid bias and misinterpretation in the field, and should be educated to be able to do so.

Apply CDD approach and the ODK pragmatically

The social setting, context, design project and designer influence the uptake of CDD and the ODK. However, a single method will never fit every designer, and thus the CDD's and ODK's flexibility and adjustability – within certain boundaries – allow for a broad uptake, but might not fit every designer or design project. Thereby, as Zimmerman (2011) argues, designers need to be pragmatic and decide per project if it is worth the time and effort to obtain user insight.

Plan for comprehensive user insight

When going into the field, user insight is not the only insight that designers need to collect, they also need to explore possible technologies and production techniques, business opportunities, the political and legal system, as well as obtaining knowledge from other stakeholders than potential users. As time and resources in the field are often limited, the design team must fully support the collection of comprehensive user insight and plan time for executing the CDD steps. If the activities are not properly planned, the outcomes will be limited.

Make the field outcomes explicit

When in the field, product designers obtain information from multiple sources in a variety of ways. By thinking more explicitly about the outcomes of the CDD approach and the ODK and using that information to establish design requirements, the uptake of the outcomes can be better ensured.

Embrace the inspiration, but make your own decisions

The CDD approach and the ODK provide comprehensive user insight which designers can use to develop products and services that better fit the valued beings and doings of their potential users. However, designers do not have to follow everything their potential users need, desire or aspire to. They should also apply their own creativity and design skills to arrive at solutions that improve their users' capabilities and well-being, and which are at the same time accessible and desirable for their potential users.

Provide feedback and stay up to date

When design practitioners return from the field, they can upload their experiences to the online platform in order to contribute to its development. When indicated, they can be kept up to date about changes to the approach.

Recommendations for educational practice

The same benefits and guidance of the CDD approach and ODK mentioned above for design practitioners, also apply to design students. Students will obtain knowledge and skills that they can use throughout their future careers. To ensure that the approach is integrated into design education, the following recommendations are provided.

Introduce the approach to the concerned research group and instructors

For acceptance of the CDD approach and to secure its uptake in the educational curriculum, the research group and the instructors should be introduced to the approach. They should be able to provide feedback on the approach and discuss its relevance and possible implementation in the curriculum. The full research group and the instructors should support the uptake of the CDD approach, in order to secure its correct implementation and use.

Discuss the implementation of the approach in DfD projects or in all design projects

The CDD approach should become a part of the educational curriculum in order to ensure its correct use in the future. Student design teams should have practical experience using the CDD approach. They should therefore go into the field at the beginning of their design project, and preferably stay in the field throughout their project. Students going into the field for user context research should be introduced to the approach, be given time to conduct comprehensive user context research, and be judged on the way they used the approach and their outcomes. The first four prerequisites of the approach must be ensured by the design school: the project should be conducted by a multidisciplinary team and be executed in the field. Then, the teams should follow a qualitative research training course before going into the field, and establish local partnerships.

Discuss training in qualitative research techniques

The design students from the faculty of Industrial Design Engineering of Delft University of Technology who worked on the projects, did not fulfil the prerequisite of having taken a course in qualitative research. This prerequisite should either be fully incorporated in the curriculum, or as part of the specific design course offering the CDD approach.

Provide proper instruction of instructors

Instructors guiding DfD / design projects should become familiar with the contents and procedures of the CDD approach, in order to be able to teach the approach to students. They should also follow a qualitative research training course, to be able to provide feedback to the students.

Provide proper instruction and guidance to the design teams going into the field

Student design teams, using the CDD approach should be properly instructed and gain experience using it before going into the field. This should be incorporated in the educational curriculum. When going into the field, working on the project, and returning from the field, they must be able to ask questions and be properly guided through their experience. Based on the feedback obtained from their instructors, they can get the most of their time in the field and out of their design projects.

Collect feedback from students' experiences to improve the course and the CDD approach

The educational material and the CDD approach both benefit from student feedback about their experiences throughout the course. This feedback should be collected and used to iteratively improve the course and the CDD approach. To prevent spreading multiple varieties of the CDD approach, the feedback should preferably be uploaded to the online platform.

Stay up to date

In return for uploading feedback to the online platform, which enables further development of the CDD approach, the researchers and instructors will be updated on refinements of the approach which can lead to the development of an educational package, which in turn, can also be used by other institutions.

Recommendations for NGOs and community workers

As indicated by the experts, the CDD approach is also relevant for use in social work as it can be applied to identify values and opportunities of people / minorities in neighbourhoods. NGOs do not necessarily develop products and services, but they can use the CDD approach to obtain comprehensive user insights to be able to better aid the people they are working with and to better fit their projects to the valued beings and doings of their potential users. As indicated by an employee of the NGO PRADAN: *"Can I use this as well? Because I have been working with this woman for the last 20 years, but I learned things during this interview that I never heard before"*. However, caution is needed when deploying the CDD approach for different purposes as intended, as the approach has specifically been tailored for the needs of product designers working on DfD projects.

Introduce the approach to the concerned NGO and adjust it to their needs

NGOs who are interested in using the CDD approach and the ODK toolkit can also download the manual, methods and tools from the online platform and acquaint themselves with it. However, the approach has been created specifically for designers. The manual and tools will need adjusting for use in the field by community workers. NGO employees, for example,

are already trained to work with people and to build rapport with them. When NGOs have been working with communities for a longer period, it might be more difficult for them to overcome their biases, assumptions and preconceptions, to pose sensitive questions, or to pose 'dumb' questions to which they know, or think to know, the answer. Moreover, NGO employees might feel less comfortable to draw, as they are not trained to do so. If participants do not want to draw, and the NGO employee also does not feel comfortable doing so, an external person can be hired to make the drawings.

Develop a project assessment approach for NGOs

It is especially relevant to develop the project assessment approach for NGO use, in order to present findings to funding organisations. An assessment approach, as stated under 'recommendations for further research', can be developed in order to compare project outcomes with the initial situation.

Train the NGO employees to use the CDD approach

NGO employees might have had the required training regarding qualitative research techniques, but are unlikely to be familiar to the CDD approach. They should be trained to use the – adjusted – approach, and especially to the themes and questions. They might need additional training for conducting observation, interviews or other CDD methods.

Collect feedback and stay up to date

The CDD approach and its use by NGOs both benefit from user feedback about field experiences. This feedback should be collected and used to iteratively improve the approach for use by NGOs. To prevent the spreading of multiple varieties of the CDD approach, the feedback should be uploaded to the online platform. NGOs can be updated about refinements made to the approach, which can lead to the development of a special approach for all NGOs to exploit, wherever they are working.

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SAMENVATTING

'Design for Development' (DfD) projecten hebben als doel het welzijn van minderheden en benadeelden te verbeteren. Ondanks dit streven binnen DfD en de goede intenties van ontwerpers, resulteert het gebruik van de ontwikkelde producten en / of diensten niet altijd tot een verbetering van het welzijn van de gebruikers. Dit geldt vaak wanneer ontwerpers de werkelijke behoeften en verlangens van deze gebruikers niet goed begrijpen. Het verwerven van een diepgaand begrip van de potentiele gebruikers is in veel ontwerpprojecten relevant, maar in het bijzonder in DfD projecten, omdat de leefomstandigheden van productontwerpers vaak significant verschillen van de leefomstandigheden van de minderheden en benadeelden waarvoor zij producten en / of diensten ontwikkelen. Deze verschillen maken het essentieel voor ontwerpers om hun vooroordelen en aannames over de behoeften en verlangens van deze gebruikers te onderkennen.

Sinds de tweede helft van de 20e eeuw is de gebruiker steeds vaker betrokken in het productontwerpproces. Het 'Human-Centred Design' (HCD) werkveld is sindsdien uitgegroeid tot een eigen vakgebied dat gebruik maakt van kennis uit de sociale wetenschappen. Het is algemeen erkend dat het meenemen van het perspectief van productgebruikers resulteert in betere toegankelijkheid, geschiktheid, acceptatie en adoptie van het ontworpen product en / of dienst. Daarbij resulteert het in ontwerpcriteria, minder frustratie tijdens het maken van beslissingen en in een vermindering van het aantal benodigde ontwerpiteraties. Echter, als ontwerpers gebruikers betrekken tijdens het ontwerpproces, beperken zij hun focus meestal tot de interactie tussen gebruiker en het product zelf. Deze focus is vaak het gevolg van een gebrek aan tijd en andere middelen die nodig zijn om een veelomvattend begrip van de levens, levensstijl, gedrag, waarden, gewoonten, behoeften, wensen en aspiraties van de gebruikers te verkrijgen. Daarbij specificeren bestaande 'toolkits' en ontwerphandleidingen niet welke informatie of welk inzicht verkregen moet worden om een veelomvattend inzicht te verkrijgen in wat gebruikers willen doen en zijn. Ze laten het aan de ontwerper om te bedenken welk type informatie en welke inzichten verkregen moeten worden. Daarnaast bieden ontwerphandleidingen en 'toolkits' wel een database aan methoden, maar geen procedure om te volgen en zijn etnografische benaderingen niet specifiek ontwikkeld om de behoeften van ontwerpers, die vaak niet getraind zijn om etnografisch onderzoek te verrichten, te vervullen.

Het doel van dit onderzoeksproject was daarom het ontwikkelen van een aanpak geschikt voor ontwerpers waarmee zij binnen DfD projecten op een efficiënte manier de levens van potentiele gebruikers kunnen verkennen. Het ultieme doel hiervan is om bij te dragen aan

de ontwikkeling van producten en diensten die het welzijn van gebruikers daadwerkelijk verbeteren doordat ze zijn gericht op wat de gebruikers willen doen en zijn. De 'Capability Approach' (CA) van Sen is als leidraad genomen om analytische ondersteuning te bieden voor het ontwikkelen van een aanpak die ondersteuning biedt bij het veelomvattend onderzoeken van het welzijn van mensen. De CA biedt een integrale benadering van welzijn die zowel persoonlijke karakteristieken van mensen, alsmede hun specifieke omstandigheden in beschouwing neemt. Deze benadering maakt de CA bij uitstek geschikt als leidraad voor de te ontwikkelen aanpak. De hoofdonderzoeksvragen voor dit onderzoek waren:

1. *Welke analytische ondersteuning biedt de 'Capability Approach' aan ontwerpers om inzicht te krijgen in het welzijn van mensen?*
2. *Welke praktische methoden geschikt voor ontwerpers zijn beschikbaar om het welzijn van mensen in 'Design for Development' projecten te onderzoeken?*
3. *Hoe kunnen de analytische ondersteuning en de praktische methoden geïntegreerd worden in een systemische aanpak om het welzijn van mensen te begrijpen in 'Design for Development' projecten?*

Bij het ontwikkelen van de aanpak is ervoor gekozen om de inhoud te baseren op de CA en de procedure te baseren op de praktijk van het ontwerpen en van 'snelle' etnografie. Om de onderzoeksvragen te beantwoorden is de 'Design-Based Research' aanpak gebruikt, welke bestaat uit vier fases: 1) voorbereidend onderzoek; 2) ontwikkeling van een interventie; 3) evaluatie van de interventie; en 4) reflectie. De uitkomsten van deze aanpak voor dit onderzoeksproject zijn praktisch, implementeerbaar: een denkraamwerk, een stappenplan, richtlijnen, methoden, hulpmiddelen en een handleiding voor het verbeteren van de wijze van onderzoek doen naar de gebruikerscontext in DfD projecten, alsmede theoretisch: ontwerpprincipes voor productontwerpers om theoretische kennis te ontwikkelen met betrekking tot het efficiënt uitvoeren van veelomvattend onderzoek naar de gebruikerscontext dat verder gaat dan inzicht verkrijgen in de interactie tussen gebruiker en product.

Fase 1: Voorbereidend onderzoek

De resultaten van het voorbereidend onderzoek worden beschreven in hoofdstuk 1 tot en met 4. In hoofdstuk 1 worden de aanleiding en een eerste verkennende literatuurstudie naar het onderwerp beschreven. Praktijkervaringen van ontwerpers met DfD projecten hebben de behoefte aan ondersteuning bij het verkrijgen van veelomvattend inzicht in gebruikers ter sprake gebracht. Deze behoefte wordt bevestigd door de uitkomsten van een verkennend literatuuronderzoek. Dit voorbereidend onderzoek heeft geleid tot het bepalen van de onderzoeks-focus en -vragen.

Na deze initiële verkenning zijn in hoofdstuk 2 twee literatuurstudies beschreven om te onderzoeken welke analytische ondersteuning de CA zou kunnen bieden aan productontwerpers. Allereerst is het productontwerp-werkveld onderzocht vanuit het oogpunt van de onderzoeksdoelen. Binnen het HCD werkveld blijkt met name User-Centred Design (UCD) zich te richten op het bevragen van de potentiele gebruiker in de beginfase van

het ontwerpproces. Verder verschaft DfD literatuur inzicht in de specifieke omstandigheden en ontwerpmogelijkheden voor minderheden en benadeelden en is 'Rapid Etnography' (RE) een grote bron van inspiratie voor productontwerpers om op efficiënte wijze de gebruikerscontext te onderzoeken. Vervolgens is het CA werkveld diepgaand onderzocht en worden de achtergrond, ontwikkeling en de karakteristieken van de CA, alsmede de invloed van de CA op zienswijze ten aanzien van 'menselijke ontwikkeling' beschreven. Daarna is de samenhang tussen productontwerpen en de CA onderzocht. De synergie tussen deze velden is gevisualiseerd in een op de CA gebaseerd denkraamwerk. Om de potentie van het CA-denkraamwerk te beoordelen en deze synergie verder te onderzoeken eindigt hoofdstuk 2 tenslotte met een diepgaande evaluatie van een voormalig DfD project, op basis van het denkraamwerk. Deze evaluatie heeft nieuwe inzichten opgeleverd in de context, de behoeften en de verlangens van de gebruikers en daarmee de potentie van het gebruiken van de CA voor de beoogde ontwerpaanpak bevestigd. Het onderzoek naar de ontwikkeling van de drie productontwerp-werkvelden en het CA-werkveld heeft geresulteerd in een aanvliegroute voor het onderzoek die laat zien op welke wijze deze werkvelden met elkaar verbonden zijn en hoe ze elkaar kunnen aanvullen. Het ontwikkelde denkraamwerk en de aanvliegroute vormen samen een antwoord op onderzoeksvraag 1.

Waar in hoofdstuk 2 de achtergrond en karakteristieken van de productontwerp- en CA-werkvelden in detail zijn onderzocht worden in hoofdstuk 3 vier literatuurstudies beschreven die zich richten op het in de praktijk brengen van het denkraamwerk. Allereest geeft hoofdstuk 3 een overzicht van de praktische toepassingsmogelijkheden van de CA. Uit dit literatuuronderzoek is duidelijk geworden dat de CA in de praktijk toegepast kan worden, maar dat de aanpak nog niet specifiek is toegepast binnen productontwerpen om veelomvattend inzicht in de gebruiker te verkrijgen. Daarnaast zijn verschillende belemmeringen naar voren gekomen die de praktische toepassing van de CA belemmeren en is kennis opgedaan over mogelijkheden voor succesvolle operationalisering van de CA. Daarnaast zijn drie literatuuronderzoeken uitgevoerd naar de drie werkvelden DfD, UCD en RE om te onderzoeken welke praktische ondersteuning deze werkvelden kunnen bieden. De drie literatuuronderzoeken hebben inzicht verschaft in belemmeringen en geleerde lessen met betrekking tot het doen van onderzoek naar de gebruikerscontext. Dit heeft een selectie van methoden, technieken, en hulpmiddelen opgeleverd die geschikt zijn om efficiënt en op ontwerper vriendelijke wijze inzicht te verkrijgen in het welzijn van potentiele gebruikers. Dit resultaat is een antwoord op onderzoeksvraag 2.

In hoofdstuk 4 zijn de opgedane inzichten uit hoofdstuk 2 en 3 gecombineerd, hetgeen geresulteerd heeft in een tweedelig conceptueel raamwerk. Het eerste deel is theoretisch en omvat de analytische ondersteuning die de CA biedt: WAT er door de ontwerper onderzocht moet worden. Het tweede deel is praktisch en omvat de ondersteuning die de CA, UCD, DfD en RE werkvelden bieden: HOE er onderzocht moet worden. Het conceptueel raamwerk bestaat uit activiteiten, een lijst met thema's (gespreksonderwerpen) en vragen, alsmede uit te volgen stappen en randvoorwaarden die de ontwerper moet volgen. Op deze manier zijn de analytische en praktische ondersteuning theoretisch samengebracht en is de basis gelegd voor een systemische aanpak die ontwerpers kunnen gebruiken in DfD projecten om het welzijn

van potentiele gebruikers te begrijpen. Het conceptueel raamwerk vormt de basis voor het ontwikkelen van de interventie: fase 2 binnen 'Design-Based Research'.

Fase 2: Ontwikkeling van een interventie

Hoofdstuk 5 en 6 beschrijven respectievelijk de voorgestelde ontwerpaanpak en de ontwikkeling van de interventie. In hoofdstuk 5 wordt de 'Capability Driven Design' (CDD) aanpak beschreven welke een uitwerking is van het conceptuele raamwerk uit fase 1. De CDD aanpak bestaat uit het op de CA gebaseerde denkraamwerk uit hoofdstuk 2, randvoorwaarden waaraan moet worden voldaan, richtlijnen die gevolgd moeten worden, praktische methoden, te volgen stappen en de opgestelde lijst met thema's aangevuld met vragen per thema. Bij de uitwerking is onderscheid gemaakt tussen 'essentiële' methoden om veelomvattend onderzoek naar de gebruikerscontext te doen en een verzameling additionele methoden die toegepast kunnen worden als er meer tijd en andere middelen beschikbaar zijn of als meer onderzoek vereist is. Hierbij wordt opgemerkt dat een langer verblijf in het veld resulteert in meer begrip, inzicht en inspiratie. In hoofdstuk 5 is de 'basis' voor de CDD aanpak ontwikkeld, die de 'essentiële' methoden omvat. De basisaanpak bestaat uit de volgende vier stadia: 1) voorbereiding; 2) verkrijgen van vrijblijvend inzicht door middel van 'onderdompeling', observatie en vrijblijvende gesprekken; 3) verkrijgen van diep inzicht door middel van semigestructureerde interviews; en 4) verifiëren van de verkregen inzichten door middel van focusgroep sessies.

Hoofdstuk 6 beschrijft de ontwikkeling van de interventie, die de naam 'Opportunity Detection Kit' (ODK) heeft gekregen. Deze interventie richt zich op stadium 3 van de CCD aanpak, de semigestructureerde interviews. Deze interviews vormen de meest omvattende dataverzamelingsmethode binnen de CDD aanpak. Een interventie met deze interviews maakt het tevens mogelijk de voorgestelde thema's en vragen te toetsen, alsmede het op de CA gebaseerde denkraamwerk en de randvoorwaarden. De kit bestaat uit stappen, richtlijnen, technieken en hulpmiddelen voor het uitvoeren van de interviews, en volgt daarbij de randvoorwaarden, thema's en vragen van de CDD aanpak.

Binnen fase 2 zijn de inhoud en de procedure van de kit uitgebreid en verfijnd door middel van zes 'formatieve evaluatie methoden' gedurende vier iteraties. Elke evaluatiemethode was gericht op een bepaald deelaspect van de ODK: op de ODK's inhoud (denkraamwerk, randvoorwaarden, richtlijnen, thema's en vragen) of op de procedure (stappen, interview richtlijnen, technieken en hulpmiddelen). De gebruikte 'formatieve evaluatie methoden' worden voorgeschreven door de Design-Based Research aanpak. De procedure van de ODK is getest middels een 'micro-evaluatie', waarbij vijf ODK interviews zijn uitgevoerd in Nederland, en middels twee 'micro-testen', waarbij 47 ODK interviews zijn uitgevoerd in de beoogde context: DfD projecten in India. De inhoud van de ODK is getest door middel van 'doorlichting', waarbij twee onderzoeksteamleden de inhoud kritisch hebben bekeken, en door middel van een 'stap-voor-stap-doorloop' evaluatie en een 'expert-raadpleging', waarbij 10 ontwerpers en 12 academici uit een andere context (de Verenigde Staten) kritisch naar de inhoud van de ODK hebben gekeken. Elke formatieve evaluatie methode heeft geleid tot aanpassingen aan de interventie, die uiteindelijk hebben geresulteerd in de 'ODK 1.0'.

Fase 3: Evaluatie van de interventie

Hoofdstuk 7 beschrijft de evaluatie van de ODK 1.0 door acht ontwerpteams die de ODK hebben toegepast als onderdeel van hun DfD project (het beoogde gebruik) en door het raadplegen van 53 experts uit verschillende landen en met andere achtergronden. De evaluaties hebben aangetoond dat de ODK interviews relevant en effectief zijn binnen de DfD ontwerpprojecten. Daarnaast hebben de evaluaties gewezen op verbetermogelijkheden ten aanzien van geschiktheid voor de ontwerper en het gebruiksgemak in het veld. Ook verbetermogelijkheden ten aanzien van de inhoud van de ODK / CDD aanpak (denkraamwerk, randvoorwaarden, richtlijnen, thema's en vragen) zijn naar voren gekomen. Gebaseerd op de aanbevelingen van de ontwerpers en experts zijn zowel de 'Capability Driven Design' aanpak als de 'Opportunity Detection Kit' aangepast om effectiever de gebruikerscontext te onderzoeken. De aanbevelingen hebben daarnaast tot een verfijning geleidt van de aanpak om beter te achterhalen wat de potentiele gebruikers willen doen en zijn en wat er mogelijk is in de context. De uiteindelijke CDD aanpak en ODK maken het mogelijk dat de ontwerpers die de aanpak en ODK gebruiken, deze kunnen bijstellen en aanpassen naar gelang hun eigen voorkeur en de context waarin ze worden toegepast, maar wel binnen bepaalde grenzen: aan de randvoorwaarden moet worden voldaan, de thema's en stappen moeten worden gevolgd en de essentiële methoden moeten worden gebruikt, maar de keuze tussen additionele methoden en het gebruik van de voorgestelde vragen, technieken en hulpmiddelen is aan de ontwerper.

In hoofdstuk 8 is de praktische uitkomst van dit onderzoeksproject beschreven: de uiteindelijke CDD aanpak en ODK. De aanpak en kit worden uitgelegd en beschreven in een handleiding en zijn ook vrij beschikbaar voor gebruikers middels een online platform (www.design4wellbeing.info). De handleiding bevat een 'trainingsmodule' die richtlijnen, tips en trucs beschrijft om ontwerpers te helpen bij de uitvoering van degelijk kwalitatief veldwerk en die bijvoorbeeld wijzen op gepast ethisch gedrag, de gepaste houding in het veld en de juiste manier van vragen stellen. Deze 'module' is niet bedoeld om de noodzakelijke ethische en kwalitatieve onderzoek training van ontwerpers te vervangen, maar dient als een aanvullende ondersteuning voor ontwerpteams in het veld. Hoofdstuk 8 vormt het antwoord op onderzoeksvraag 3. Uiteraard zullen de aanpak en de kit open blijven staan voor kritiek en aanpassing, gebaseerd op ervaringen van gebruikers in het veld.

Fase 4: Reflectie

In hoofdstuk 9 worden conclusies getrokken en wordt er gereflecteerd op het complete onderzoeksproces. De antwoorden op de drie hoofdonderzoeksvragen worden samengevat, de hoofdbevindingen en theoretische en praktische bijdragen van het onderzoek worden beschreven en de beperkingen van het onderzoek worden besproken. Het hoofdstuk eindigt met een aantal aanbevelingen voor verder onderzoek en voor de praktijk.

Uit dit onderzoek wordt geconcludeerd dat de inzichten die verkregen worden door het gebruiken van deze nieuwe systemische aanpak en kit waardevolle ondersteuning bieden aan ontwerpers gedurende het ontwerpproces. Door het gebruik van de systemische aanpak en kit kunnen zij de ontwerpuitdaging beter definiëren en geïnformeerde beslissingen nemen.

De verkregen inzichten en begrip leiden tot ontwerpcriteria en ontwerpinspiratie. De toegevoegde waarde van de kit is aangetoond door middel van de DfD projecten die onderdeel zijn geweest van dit onderzoek. Er kan dus geconcludeerd worden dat dit onderzoeksproject succesvol heeft bijgedragen aan het verbeteren van het begrip van productontwerpers met betrekking tot de levens van hun potentiele gebruikers, specifiek in DfD projecten, en dat het onderzoeksproject ontwerpers ondersteunt om producten en diensten te ontwikkelen die daadwerkelijk het welzijn van minderheden en benadeelden verbeteren.

Kernwoorden: Design for Development, productontwerpen, user-centred design, contextueel gebruikersonderzoek, snel etnografisch onderzoek, capability approach, welzijn

ABBREVIATIONS

ATRM	Anna Tasar Reeling Machine
BC	Before Christ
CA	Capability Approach
CDD	Capability Driven Design
CESD	Centre of Excellence for Sustainable Development
CK	ChotuKool
DBR	Design-Based Research
DfD	Design for Development
HCD	Human-Centred Design
ICSID	International Council of Societies of Industrial Design
JFP	Jaipur Foot Prosthesis
MC	Mitticool
MDG	Millenium Development Goal
NGO	Non-Governmental Organisation
NID	National Institute of Design India
ODK	Opportunity Detection Kit
OECD	Organisation for Economic Co-operation and Development
PC	Philips Chulha
PRA	Participatory Rural Appraisal
RE	Rapid Ethnography
RRA	Rapid Rural Appraisal
SHG	Self-Help-Group
UCD	User-Centred Design
UN	United Nations
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
UNRISD	United Nations Research Institute for Social Development
US	United States
WCCD	World Commission on Culture and Development
WCED	World Commission on Environment and Development
WT	Walkthrough

GLOSSARY

This glossary contains the key terms used in this thesis and their definitions.

Capabilities	The valued 'beings and doings' (or: real opportunities) that a person can choose from (Sen 1995). Different from its use in daily language, as it refers to attainable outcomes and not to inborn or trained potentials (skills, abilities and aptitudes) (Gasper 2007b)
Capability approach	The CA is a philosophical approach that focuses on what people want to do and be, or, in other words, on the real opportunities that people have reason to value themselves. The approach goes beyond income, commodities and utility, by focusing on the real opportunities ('capabilities') that people enjoy (Sen 1999)
Choice	The opportunity or power to choose between two or more possibilities (Merriam-Webster dictionary). There are four dimensions of choice: the existence, the sense, the use, and the achievement of choice (Kleine 2011)
Conversion factors	The degree in which a person can transform a resource into a functioning. They say something about the circumstances in which a person lives. They can be divided into personal, social and environmental conversion factors (Frediani 2010; Robeyns 2011)
Personal	Factors internal to a person, such as metabolism, physical condition, gender, reading skills, or intelligence (Robeyns 2011)
Social	Factors from the society in which one lives, such as public policies, social norms, practices that unfairly discriminate, societal hierarchies, or power relations related to class, gender, ethnicity or caste (Robeyns 2011)
Environmental	Factors that emerge from the physical or built environment in which a person lives. Aspects regarding geographical location are, for example; climate, pollution, the proneness to earthquakes, and the presence or absence of seas and oceans. Aspects regarding the built environment are, for example; the stability of buildings, roads, and bridges, and the means of transportation and communication (Robeyns 2011)
Comprehensive	Including many, most, or all (Merriam-Webster dictionary)
Context	The personal, social, environmental circumstances people live in (adapted from Robeyns 2011), includes structures of living together (Kleine 2011; Deneulin 2008)
Culture	The systems of mental constructions people use to interpret and respond to themselves and the world around them (Handwerker 2001)
Cultures	The mental constructions and behaviour of sets of people that share certain aspects of their individual culture (Handwerker 2001)

(Product) Designer	A qualified individual who is trained and educated to execute the product design process (this thesis, chapter 2 & 6)
Novice	Individuals who are being trained and educated to become a design professional. They are allowed to make more mistakes, have more time to complete their projects, and have more guidance than expert designers / design professionals (this thesis, chapter 6)
Expert / professional	A qualified individual who is trained and educated to execute the product design process. They can be designers just starting as a professional, being guided by more experienced designers, but they do have to deliver output under significant time pressure and are allowed to make less mistakes than novice designers (this thesis, chapter 6)
Design for Development	Design projects aiming to improve the well-being of disadvantaged and marginalised populations (Donaldson 2006, 2009)
Design for Social Innovation and Sustainability	Design aimed at providing all people the same opportunities to be and do what they want while maintaining their environmental footprints in the limits of the ecosystems resilience and regenerating the quality of the physical and social commons (Manzini 2009)
Design for Well-Being	The successful creation of products and / or services that induce change to a context in order to improve the well-being of its users (this thesis, chapter 2)
(Product) Design process	The process of the successful creation of products and / or services that induce change to a context (this thesis). The focus in this thesis is on the 'strict development process' of products and / or services. This process is preceded by a product planning phase, and succeeded by a realisation phase (this thesis, chapter 1 & 2, based on Amabile 1996; Berkun 2010; Harvard Business Press 2003; Diehl 2010; Redelinghuys 2006; Rogers 1995; Roozenburg and Eekels 1998; Papanek 1984; ICSID 2015; Simon 1996; Buchanan 2001a; Donaldson 2002; Dreyfuss 2012)
Analysis phase	First phase of the design process during which the design problem is analysed and defined, resulting in design requirements (Roozenburg and Eekels 1998)
Synthesis phase	Second phase of the design process during which a draft design proposal is made, and ideas are formed. The best ideas are chosen and conceptualized. The best concept is then chosen and worked on further to produce a preliminary design (Roozenburg and Eekels 1998)
Evaluation phase	Third and final phase of the design process during which an idea of the behaviour and characteristics of the designed product is formed by reasoning, or by building a prototype. The value or quality of the preliminary design is determined by comparing the expected properties with the desired properties (Roozenburg and Eekels 1998)
Fuzzy-front end	The first part of the analysis phase of the design process during which the actual design challenge is explored and – if required - re-formulated. As this part of the design process is most fuzzy and it is the first part of the process it is called 'fuzzy-front end' (this thesis, chapter 1; Sanders and Stappers 2008)
Design thinking	The specific way of thinking that designers use to to address the complex and complicated issues that human beings face (Buchanan 2001b)
Development	A process of mutual sharing and learning towards improved well-being of people, all people – within the limits of growth (based on Bürdek 2005; Sachs 2010a,b; Escobar 2011, 2015)
Ethnography	The study of people and cultures, by exploring cultural phenomena from the perspective of the people being studied (Beebe 2014; Handwerker 2001)

Rapid	Techniques which enable the process of obtaining important ethnographic insights in a feasible and cost-effective way, without the intensity of pure ethnography (Beebe 2014; Ball and Ormerod 2000)
Functionings	Achieved capabilities (Sen 1999)
Human-centred design	Design approach which takes a broad view, by not only looking at the situation of use, but also at the experience a product provides, and the meaning of the product in people's social, cultural and natural environments (Buchanan 2001b; Stewart 2011; ICSID 2015)
Needs and wants	The things that people need and the things they desire. Often used by product designers to indicate the information that needs to be obtained from the potential users (this thesis, chapter 2)
Preferences	Things that people like or want, more than another thing (Merriam-Webster dictionary)
Products	Goods, services and product-service systems that are developed by product designers (this thesis, chapter 1)
Product innovation	The successful creation of products and / or services that induce change to a context (this thesis, chapter 2)
Resources	An asset portfolio that can be converted into capabilities (Kleine, Light, and Montero 2012)
Responsibility in design	Designers should address the moral and ethical problems faced to prevent doing harm (Buchanan 2001) and thoroughly think about what they create and what the consequences of their creations are (Papanek 1984; Thackara 2005).
Sustainable product design	Design aimed at the development of products that are beneficial to people, planet and profit (De Pauw 2015)
(Potential) User	The people who are the intended users of the end-result of the product design process
User-centred design	Design zone within the domain of human-centred design which focuses on the user as a subject of inquiry and which is led by research (Sanders 2006a; Sanders and Stappers 2008)
Valued beings and doings	The capabilities that allow people to choose the lives they have reason to value; to be who they want to be and to do what they want to do (Sen 1999)
Well-Being	Ability of people to choose the live they have reason to value (adapted from Sen 1999)
Objective measures	Non-feeling dimensions of well-being which are externally assessed and approved (Gasper 2007a).
Subjective measures	A person's feelings and / or judgement. May include feelings of happiness, satisfaction or fulfilment (Gasper 2007b, 2007a).
Wicked problem	That class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing (Rittel in Churchman 1967)

PUBLICATIONS

Book chapter

- Mink, A., Parmar, V. S., & Kandachar, P. V. (2014). Responsible Design and Product Innovation from a Capability Perspective. In J. Van den Hoven, N. Doorn, T. Swierstra, B.-J. Koops & H. Romijn (Eds.), Responsible Innovation 1. Innovative Solutions for Global Issues. (1 ed., Vol. 1, pp. 113-148). Dordrecht: Springer.

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- Mink, A., Parmar, V., & Kandachar, P. (2015). Approaching Design for Development from a Capability Perspective. Current Science.

Conference Papers

- Mink, A., van der Marel, F., Parmar, V., & Kandachar, P. (2015). Using the Capability Approach to Detect Design Opportunities. Conference Proceedings of the Design for Sustainable Well-being and Empowerment Conference, Bangalore, India.

Other

- Mink, A. (2012). Making the Capability Approach Accessible to Designers – Report of an On-going Exploration. Maitreyee, E-bulletin of the Human Development and Capability Association.
- Mink, A., Parmar, V., & Kandachar, P. (2011). Abstract for NWO Conference on Responsible Innovation (2011). The Hague, the Netherlands. Responsible Design and Product Innovation from a Capability Perspective
- Mink, A., Parmar, V., & Kandachar, P. (2014). Abstract for HDCA Conference (2014). Athens, Greece. Exploring the Role of the Capability Approach in Design for Well-being
- Mink, A., Diehl, J.C., & Kandachar, P. (2014). Design and Engineering for Well-being, Justice and Agency Event (2014). Delft, the Netherlands. Design for Well-being Inspired by the Capability Approach.

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ABOUT THE AUTHOR

Annemarie Mink was born on the 26th of December 1980 in Oudesluis, the Netherlands. She studied Industrial Design Engineering at the Delft University of Technology and graduated (cum laude) in 2006 on the re-design of a Tasar silk reeling machine for rural women in eastern India. After graduation she continued working on the development of this machine, on behalf of the Dutch NGO ICCO, and in collaboration with the Indian NGO PRADAN. In 2010 the reeling machine was patented on her name and named Anna Charkha. Currently, more than 200 machines are operational, running on solar power. Then, Annemarie worked 2 years for an engineering and consultancy company before returning to the faculty of Industrial Design Engineering as a PhD candidate. Her interests lie in responsible 'Design for Development'.

In 2010 she started her PhD research. She investigated how product designers can be guided to efiiciently obtain comprehensive user insights in Design for Development projects. She used analytic guidance from Amartya Sen's influential capability approach, which provides a view on well-being that takes into account the freedom a person has to fulfil desirable 'aspects of life', and practical guidance from the domains of Human-Centred Design, Design for Development and Rapid Ethnography. This PhD project has been a multidisciplinary research project in collaboration with the TPM department of TU Delft and IISc Bangalore, India. She currently works at the faculty of Civil Engineering at the Delft University of Technology as a postdoctoral researcher, working on providing safe drinking water to the people living in the Ganges-Brahmaputra-Meghna Delta in Bangladesh. Besides doing research, she teaches Bachelor and Master students on research methods and guides them in Design for Development projects.

Many of the Design for Development outcomes which are unsuited to the users and their environment are based on poorly defined needs and preferences. Product designers are trained to take the user perspective into account, but they are not specifically trained to conduct ethnographic research. Thereby, they have limited time and resources to explore the user context. A systemic approach that efficiently guides designers to develop a social needs inventory would therefore be valuable. An approach that urges designers to move beyond the investigation of product-user interaction and to look comprehensively towards their potential users' context and their valued beings and doings.

This book is about the development of such an approach. The Capability Driven Design approach guides product designers to conduct rapid, rigorous and comprehensive user context research, specifically in Design for Development projects. By using this approach, designers are guided to make informed design decisions and to improve the accessibility, applicability, acceptance and adoption of their designs. To develop this approach, analytic guidance was derived from Sen's 'Capability Approach', and practical guidance was derived from the domains of Human-Centred Design, Design for Development and Rapid Ethnography. The Capability Driven Design approach aims to support designers in designing products and / or services that improve the well-being of their users by enabling them to choose the lives that they value.

TU Delft