HOST HABITS

AND THE ACCEPTANCE OF
PRODUCT SERVICE SYSTEMS

RICK SCHOTMAN

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PRODUCT SERVICE SYSTEMS
AND THE ACCEPTANCE OF

LOST HABITS

AND THE ACCEPTANCE OF PRODUCT SERVICE SYSTEMS

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LOST HABITS

AND THE ACCEPTANCE OF PRODUCT SERVICE SYSTEMS

PhD Thesis

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Honderd jaren

zul je leven

Honderd jaar

gelukkig zijn

En een rondje

heb jij gegeven

En dat zal niet

het laatste zijn

SUMMARY

Product Service Systems (PSS) are a combination of products and services, jointly fulfilling a user's need. PSS can offer numerous benefits for businesses, society and the environment, but consumer acceptance of PSS remains rather low. Required behaviour change and existing user habits are one of the key barriers for limited acceptance.

This thesis studies the role of habits in the PSS acceptance process, and in the PSS design process. Thereby, this research was aimed on conducting a long-term living lab study of a well-accepted mobility PSS for elderly, and a literature study on habits, behaviour and acceptance. Together, these studies have resulted in the proposition that addressing Lost Habits in the design process can lead to increased PSS acceptance.

The living lab study involved a small-scale mobility PSS for elderly. This PSS was well-accepted because it was able to restore values that were related to people's discontinued habits. Thereby, it showed that addressing important values, for example providing independence and facilitating social connections, stimulated the acceptance of this particular PSS. Remarkably, the provision of "just" mobility was not a primary reason for acceptance, but merely an enabling framework.

Literature research pointed out that habits play a subordinate role in theory on behaviour and acceptance. However, this thesis found that habits play an important role in people's lives, and restoring already changing behaviour, thereby enabling people to regain or sustain familiar behaviour may be more successful in fostering acceptance than triggering behavioural change. As a result, PSS acceptance can be enhanced, when the PSS is presented during or after a process of change, due to unwanted circumstances. In such situations, there is an intrinsic and personal driven motivation to use a PSS, as long as it provides the opportunity to continue desired behaviour.

Based on both approaches, the phenomenon of Lost Habits was identified as decisive phenomenon for high acceptance. This phenomenon was further analysed and elaborated upon in consecutive studies. Furthermore, it was worked out into a theoretical model and a design tool that design teams can use to increase PSS acceptance, based on people's values, their behaviour, and their habits.

SAMENVATTING

Product Service Systemen (PSS) zijn combinaties van producten en diensten, die gezamenlijk de behoefte van een gebruiker invullen. PSS kunnen veel voordelen opleveren voor bedrijven, de maatschappij en het milieu, maar consumenten lijken PSS slechts matig te accepteren. Benodigde gedragsverandering en bestaande gewoontes van gebruikers zijn belangrijke barrières voor de beperkte acceptatie.

Dit proefschrift bestudeert de rol van gewoontes in het gebruikersacceptatieproces en het ontwerpproces van PSS. Dit wordt enerzijds gedaan aan de hand van langetermijnonderzoek in een “living lab” setting en anderzijds aan de hand van een literatuuronderzoek naar gewoontes, gedrag en acceptatie.

Het living lab onderzoek gaat over een kleinschalige mobiliteitsdienst voor ouderen. Deze PSS blijkt goed geaccepteerd te zijn, omdat het gebruikers in staat stelt waarden te herstellen die ze relateren aan gewoontes die ze niet meer konden voortzetten. Hieruit volgt dat het aanspreken van belangrijke waarden, zoals een gevoel van onafhankelijkheid en het aangaan van sociale connecties, de acceptatie van deze PSS vergroot. Opmerkelijk genoeg is het aanbieden van “slechts” mobiliteit geen primaire reden voor acceptatie, maar een kader waarbinnen de genoemde waarden bereikt worden.

Uit het literatuuronderzoek blijkt dat gangbare gedrags- en acceptatiemodellen beperkt een rol aan gewoontes toekennen. Ze verklaren gedrag op basis van andere factoren, zoals gebruiksintentie, gebruiksgemak en houding ten opzichte van nieuw gedrag. Uit literatuur over gewoontes blijkt echter dat gewoontes een belangrijke rol spelen in een mensenleven. Het verliezen van gewoontes kan dan ook leiden tot het verlies van belangrijke waarden.

Dit proefschrift stelt voor dat verloren gewoontes ingezet kunnen worden voor verbetering van acceptatie. Een PSS dat wordt aangeboden gedurende of na een proces van ongewenst verlies van gewoontes wordt waarschijnlijk goed geaccepteerd. Zeker wanneer die PSS de waarden van de verloren gewoonte kan aanspreken. In zulke situaties is er een intrinsieke en persoonlijke motivatie om een PSS te gebruiken, zolang het mensen in staat stelt gewenst gewoontegedrag voort te zetten.

Uit beide onderzoeken volgt dat het aanspreken van zogenaamde “verloren gewoontes” in het ontwerpproces kan leiden tot verbeterde acceptatie van PSS. Verloren gewoontes zijn verder geanalyseerd en uitgewerkt in vervolgonderzoeken. Op basis van die onderzoeken is een theoretisch model ontwikkeld en een ontwerpgereedschap gecreëerd. Dit ontwerpgereedschap kunnen ontwerpteams gebruiken om acceptatie te vergroten op basis van menselijke waarden, hun gedrag en hun gewoontes.

VOORWOORD

Hier ligt het dan. Een meer dan 200 pagina's tellend boekwerk, als resultaat van een onderzoek dat de afgelopen 6 jaar onafscheidelijk van me is gebleven. Nu ik er eens aan terug denk, vind ik het opvallend hoe dit hele verhaal onderdeel van mij is geworden, terwijl het over zaken gaat waarvan ik 6 jaar geleden het bestaan nog niet wist. Facinerend hoeveel informatie in 6 jaar tijd tot je kan komen, in je hoofd blijft hangen en je gedachten beïnvloedt.

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Rick

Zwolle, 30-07-2017

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After you finished breakfast, an Uber taxi is waiting for you to bring you to the office. Once arrived there, you walk to the coffee vending machine to pour a cup of coffee. After that, you print a booking confirmation from AirBnB, via which you booked a place to sleep tonight. When the working day is over, you use Car2Go to get to the train station. There, you board the train that will bring you to the city where the AirBnB is. Arrived at your destination, you rent a shared bicycle to cycle to your overnight place. At the end of the day, you may notice that you have used seven product-service systems.

1. INTRODUCTION

Product Service Systems (PSS) have gained increasing attention since the end of the last century. PSS are combinations of products and services that jointly fulfil user needs (Goedkoop, Halen, Te Riele, & Rommens, 1999), and PSS can replace traditional, economic principles such as purchasing and owning, for more contemporary economic principles such as sharing and using.

PSS can potentially be very beneficial for businesses and the environment (Chesbrough, 2007; Mont, 2002; Tukker, 2004; Wolfenstetter, Böhm, Krcmar, & Bründl, 2015). For example, car sharing initiatives such as Zipcar, MyWheels, and Car2Go can reduce the required amount of private cars by sharing vehicles among subscribers. Uber offers chauffeured vehicles to clients, and AirBnB, participating in another sharing field, offers shared spaces. Moreover, the increasing amount of bicycle sharing initiatives in many countries can decrease the need for private cars, and consequently the amount of noise or exhaust gases caused by motorized vehicles.

Because PSS have the potential to create competitive business models and to decrease the negative impact of consumption on the environment, they are considered to be an important improvement over more traditional, solitary objects, such as products and services (Goedkoop et al., 1999; Mont, 2001; Morelli, 2002; Tukker & Tischner, 2006a). However, despite the existence of well-known PSS, the wider implementation of PSS has remained limited (Vezzoli, Ceschin, Diehl, & Kohtala, 2015), and required user change is often considered a key barrier for PSS acceptance (Vezzoli, Ceschin, Diehl, & Kohtala, 2012).

Research on the subject of PSS has matured since the last decades, and PSS examples have been practically implemented. However, although many researchers have studied user acceptance of PSS, a gap exists between practical and theoretical research on PSS acceptance (Vezzoli et al., 2015). As a result, knowledge gained from implementing PSS in

practice is often not elaborately validated by theory, and theoretical recommendations for PSS acceptance are often not thoroughly validated in practice. In order to bridge this gap, one solution is to study PSS acceptance in an integrated way, where focus lies on both field research and theoretical research. This type of research can be useful to interpret and generalize practical findings towards theoretical knowledge. In this thesis, this type of research is addressed by performing a longitudinal study on the acceptance of a real-life PSS in a living lab. Consequently, the findings from this study will be translated to theory, and used in the development of a design approach to apply the findings in design practice.

The current chapter gives an introductory overview of the research that is reported in this thesis, and it presents the scope and focus. Section 1.1 will elaborate on the concept of a product service system. Section 1.2 will describe the motivation for this research, and Section 1.3 will zoom in on the objectives and main contributions of this research to different fields. Finally, Section 1.4 will present the outline of this thesis.

1.1 RESEARCH CONTEXT: PRODUCT SERVICE SYSTEMS

General interest in the topic of PSS has started around the end of the 1990s, when Goedkoop et al. (1999) reported on the positive impact of PSS on sustainable economic growth (Manzini & Vezzoli, 2002; Tukker & Tischner, 2006b). PSS can be applied to many different domains, such as office furniture (Besch, 2005), home appliances (Mont, 2001), food distribution (Manzini & Vezzoli, 2002), or mobility (Meijkamp, 2000).

Despite the relatively new interest in PSS, Luud Schimmelpennink already introduced a PSS in the mobility domain in 1970s Amsterdam, The Netherlands. This PSS was named the White Car Project (*Witkarproject*), and comprised of an infrastructure of small electric vehicles, so-called *Witkarren* (singular: *Witkar*), which people could use on a subscription basis (Bendixson & Richards, 1976). *Witkarren* were distributed from several locations in the city, and were charged on location. Inhabitants of Amsterdam could pick up a *Witkar* from a distribution station, and drive it to another station, close to their destination.

This system was the spiritual successor of the white bicycle plan (*Wittefietsenplan*). This program intended to collect all unused bicycles from the streets in Amsterdam, paint them white and return them, open access, to the streets. Although the *Witkar* project has been operated for ten years, it was cancelled due to lack of success. The white bicycle project has never been implemented, although at that time, similar private and small-scale initiatives were reported in other parts of The Netherlands.

Next to the Witkar project, experiments with mobility sharing services have been conducted in other countries, but most were terminated because of the lack of success (Shaheen & Cohen, 2007).

Since the beginning of the 2000s, many new PSS initiatives have been introduced in the mobility domain, such as Greenwheels, MyWheels, and Car2Go. These PSS also work on subscription basis, and aim to reduce the required amount of private cars by sharing vehicles. The mobility services Uber and Lyft are a different type of car sharing, in which people use their private car to offer chauffeured rides to clients. Next to car sharing initiatives, many bicycle-sharing initiatives have emerged, especially in urban and metropolitan areas. Examples of such PSS are OV-fiets in The Netherlands (Lieshout, 2016), EcoBici in Mexico-City (“Ecobici: Sistema de Transporte Individual,” 2017) and Melbourne Bike Share in Australia (“Melbourne Bike Share: Bike Share from here to there,” 2017). Likewise, Velib’ in Paris, France (“Velib: Mairie de Paris,” 2017), and the Bicyklen plan in Copenhagen, Denmark are successful bicycle sharing systems (Dijk, Orsato, & Kemp, 2013; Haines & Skinner, 2005). See Figure 2 for an illustration of PSS in the mobility domain.

Figure 1: Left: first drive in the streets of Amsterdam, conducted by minister of transportation Irene Vorrink and city councillor Brautigam. (Source: Wikipedia) Right: Witkar in a museum. (Source: Wikipedia)

Figure 2: Overview of various sharing PSS. From top left clockwise: OV fiets, Uber, Greenwheels, BikeMi Milano (Sources: Wikipedia, and own work)

Increasing attention to PSS is not only limited to the domain of mobility. Vargo & Lusch (2004) described a wide transition in marketing in general, moving from offering tangible objects to providing intangible objects. These developments are also described by Baines et al. (2007) and Secomandi & Snelders (2011) as the “servitisation” of products and “productisation” of services. Traditionally, products were considered tangible objects, while services were considered intangible objects. However, more and more companies have started to develop “servitised” products and “productised” services by adding service models to their products, or by adding product features to their service plans. Among these

Figure 3: Left: Google's self-driving car (Source: Wikipedia). Right: a random reader

companies, many have developed PSS as an experiment, that runs next to their current, more traditional business models (Chesbrough, 2007).

For example, a well-known service provider as Google has received lots of attention for their experiments with self-driving cars ("Waymo. We're building a safer driver for everyone," 2017), and banks have started to offer devices, such as random readers, that help customers to access their bank account safely from a remote location. See Figure 3 for respectively Google's self-driving car and a random reader.

Another example is Amazon, traditionally known for selling products via internet, who has started to sell e-readers that give access to their digital book offerings. On the other hand, typical product manufacturers, such as car manufacturers Daimler and Toyota, have started to offer car-sharing programs in bigger cities via service contracts ("Cité Lib by Ha:Mo," 2017; Haines & Skinner, 2005; Pol & Hoen, 2013; Rubik & Gossen, 2011).

Additionally, traditional product manufacturers, such as Apple, Rolls Royce, and Xerox have also shifted towards adding service aspects to their products. Apple has become famous for selling digital music (iTunes) through their self-developed hardware devices (iPod and iPhone) (Gembarski, 2015; Gemser, Kuijken, Wijnberg, & Erp, 2012). Aircraft engine builder Rolls Royce changed its business model by leasing their engines to builders, under maintenance contracts (Clayton, Backhouse, & Dani, 2012), instead of selling engines. Xerox have changed their business model from selling printers to leasing printing devices and billing per printed paper (Mont & Emtairah, 2006), and various coffee companies have started to lease coffee vending machines while being paid per cup sold. In the domain of

consumer goods, companies can be found that enable consumers to lease a washing machine or a mobile phone, instead of buying one (Goedkoop et al., 1999).

PSS overlap largely with the spectrum of “servitised” products and “productized” services. Tukker & Tischner (2006a) proposed to classify PSS in three categories, ranging from mainly product-based to mainly service-based. These categories are:

- 1) Product-oriented PSS
- 2) Use-oriented PSS
- 3) Result-oriented PSS

In PSS literature, this classification became widely adopted. Lay, Schroeter, & Biege (2009) found that PSS, which are an exponent of new business models, can be defined in other ways, and they differentiated PSS in ownership-oriented models and service-oriented models (Battaglia, Borchardt, & Patricio, 2016). However, the simplicity of Tukker and Tischner’s classification, and the incorporated consumer perspective, makes their classification quite useful for this thesis.

In the classification of Tukker & Tischner (2006a), products and services are generally referred to as respectively tangible and intangible objects. In the next sections, these three categories are further explained. See also Figure 4 for a schematic overview.

Figure 4: PSS classification as proposed by Tukker & Tischner (2006)

1.1.1 PRODUCT-ORIENTED PSS

Product-oriented PSS are considered services that are added to products, such as service contracts for home or car maintenance, or insurance contracts for private products, such as a laptop or a bicycle. See Figure 5 for an example. Typical of product-oriented PSS is that the service is added to a product that remains in possession of the user. As product-oriented PSS share many characteristics with traditional products, it can be difficult to distinguish such PSS from traditional products.

1.1.2 USE-ORIENTED PSS

Use oriented PSS are still product-related, but the ownership of the product has moved from user to provider. The user is actively involved in selecting the product, and the provider facilitates the user during his or her use of that product. Use-oriented PSS are characterized by the way a user selects a certain product and pays a fee, for which he or she may use the product for a specified amount of time. House rental, car lease, and a selected seat in an airplane (see Figure 5), are examples of such PSS.

Use-oriented PSS show some similarities with traditional products, especially since one particular product is involved. However, differences with traditional products and product-oriented PSS arise in terms of ownership. Compared to product-oriented PSS, new interactions and responsibilities are introduced, and more parties are involved in the use-phase of the product.

1.1.3 RESULT-ORIENTED PSS

Result-oriented PSS are the most abstract type of PSS, and can be difficult to distinguish from use-oriented PSS. As with use-oriented PSS, the user is not the owner of the product, and he or she pays a fee for using the product.

The vital difference between use-oriented and result-oriented PSS is the way in which a product is defined. To use a result-oriented PSS, user and provider do not have to agree on using a particular product. Instead, they agree on receiving a “functional result,” which is provided by a range of not necessarily predefined products. This range of products suits the needs of the user, depending on the particular situation at hand. Functional results are commonly defined in terms of performance indicators or conditions. An example is the previously mentioned aircraft engine builder Rolls-Royce, who sells “power by the hour.” This means that a customer pays a fee for a pre-arranged performance, i.e. aircraft propulsion, and Rolls Royce decides how to arrange this for the customer. Mobility cards, such as the Dutch NS Business card, are another example. This plastic card provides the

user access to a variety of transport modes, such as train, bus, (shared) bicycle and (shared) car. Other examples can be found in the workplace: coffee vending machines, printing solutions, or light plans that respectively result in warm drinks, printed paper, and light in the office. Hence, for the end-user, the result is important, and not the particular product that delivers this result.

Figure 5: Left: a service vehicle from the Royal Dutch Touring Club (ANWB, Wegenwacht). This is a typical example of a product-oriented PSS. Right: An airline seat, a typical example of a use-oriented PSS (Source: Wikipedia)

Figure 6: A professional copier, example of a result oriented PSS (source: Wikipedia)

1.1.4 PSS BENEFITS

Product Service Systems have been elaborately described as beneficial for businesses and the environment (Baines et al., 2007; Beuren, Gomes Ferreira, & Cauchick Miguel, 2013; Mont, 2002), both based on theory and on results of pilot studies. More specifically, use-oriented and result-oriented PSS seem to generate most benefits, while product-oriented PSS seem to generate very little benefits to business and the environment (Tukker & Tischner, 2006a). Business benefits of use-oriented and result-oriented PSS could be competitive advantages, or having more interaction with the end-user, resulting in better adaptation to their needs (Carlgren, Rauth, & Elmquist, 2016). For example, the provider of a coffee vending machine could ask clients which taste they like, and adjust the coffee to their taste. Likewise, an airliner could analyse which seat a client tends to like in a plane, and offer this client his or her favourite seat on the next flight.

Environmental benefits can be found in the way in which the PSS is optimized in terms of resource use and emissions (Manzini & Vezzoli, 2002). For example, sharing products increases the number of users per product and hence results in a lower amount of products required. Furthermore, when a PSS provider is economically responsible for emissions that relate to PSS use or distribution, he or she might want to decrease the environmental impact of a PSS. Parallel to this, PSS can create opportunities to reuse and recycle, which can result in reduced amounts of necessary resources (Goedkoop et al., 1999; Herodes & Skinner, 2005), the reduction of waste (Baines et al., 2007), or the increased longevity of products (Mont & Emtairah, 2006) in order to minimize the end-of life impact of products.

On an end-user level, PSS can be beneficial for unburdening the user from use-related issues. Examples are decreased costs or increased convenience (Hirschl, Konrad, & Scholl, 2003), which are so-called “burdens of ownership” (Moeller & Wittkowski, 2010; Vriesen, 2015). Moreover, by using a PSS, users can find higher product quality, a wider choice of products, or a better fitting product for the situation at hand (Mont, 2002).

These benefits show that PSS might be interesting and useful propositions. Nevertheless, PSS often seem unfeasible in practice and encounter an unmistakable difficulty in scaling-up from pilot-project or niche to mainstream market (Bhamra & Lofthouse, 2007; Lilley, 2009; Vezzoli et al., 2012). One of the reasons seems to be that, on the long run, people do not favour PSS that claim to be less expensive or more efficient, over products and services they already use (Vezzoli et al., 2015). Moreover, businesses often have to reorganize their business models in order to start providing PSS, which appears to be difficult (Besch, 2005; Manzini & Vezzoli, 2002).

These issues are especially the case for result-oriented PSS, and slightly less so for use-oriented PSS. However, as these two categories are considered to offer major environmental and business benefits (Tukker & Tischner, 2006b), it is of vital importance to study and understand what is needed for such PSS to become accepted, when introduced in real-life.

1.2 MOTIVATION FOR THIS RESEARCH: PSS ACCEPTANCE

The finding that the implicit benefits of, especially, result-oriented PSS cannot be matched with the practice of everyday life, shows a dilemma for all those involved in the design and development of PSS. Rexfelt & Hiort Af Ornäs (2009) elaborated on this dilemma, and they found that behaviour change and existing habits are at the core of it. They proposed that PSS acceptance in many cases requires fundamental changes in people's day-to-day practice and behaviour. For instance, car sharing as alternative for car possession requires users to make reservations, to find the car on the street, or to take along all personal items after use. On the other hand, it requires car manufacturers to offer mobility arrangements, and it most probably affects car sales. This shows that different stakeholders, both users and providers, are required to change behaviour, in order for PSS to be accepted.

As a result, PSS developers, and designers in general, aim to change people's behaviour in order to make new products or services accepted. Thereby, they often intend to persuade and convince people by emphasizing the benefits of this new offer (Fogg, 2009; Montazeri, Papalambros, & Gonzalez, 2015). Although the large sheer of products available in the market shows that people can indeed accept new technology, it is not without risk to depend on behaviour change. For people, it is particularly difficult to change behaviour, as was explained by Aarts & Dijksterhuis (2000) and Verplanken & Wood (2006). They pointed out that habits play a predominant role in the process to change people's behaviour, which will be elaborated upon in chapter 2.

Given that behaviour change can be difficult to achieve, this thesis will explore whether and how PSS acceptance can be increased by making it compatible with existing, or past behaviour. Thereby, this thesis will study the role of habits in the acceptance process, and study how habits can be addressed in order to increase PSS acceptance.

1.3 THIS RESEARCH

Behaviour and habits seem to play an important role in PSS acceptance, and for a better understanding of the relation between people's behaviour and PSS acceptance, it is important to focus on what behavioural factors contribute to user acceptance. In order to do so, current knowledge on acceptance, behaviour, and habits can be studied. At the same

time, studies on real-life PSS acceptance could provide a more practical and thorough insight in the processes that influence people's behaviour. For this reason, it seems equally important to study the acceptance of a PSS in practice, and to relate this to existing theory.

Practical, real-life studies on PSS acceptance have not been widely conducted. However, such studies could provide a frame of reference to interpret theoretical knowledge on PSS acceptance. For the study reported in this thesis, a living lab setting was established. A living lab is a research methodology that involves users in a real-life setting in order to co-create innovations (Dell'Era & Landoni, 2014). This approach is also suggested by Vezzoli, Ceschin, Diehl, & Kohtala (2015), who advocated that studying living labs are a promising approach for studying PSS acceptance. As such, the established living lab setting provided the opportunity for researchers to be directly involved in the acceptance process of a PSS. Based on the living lab findings, a model of lost habits is developed and evaluated, and a design tool is developed that designers can use at the beginning of the PSS design process. This will be elaborated upon in the following paragraphs.

1.3.1 OBJECTIVE

This research was conducted as part of CRISP (Creative Industry Scientific Programme), a scientific programme that focused on enhancing knowledge about PSS design and on studying the emergence of an increasing focus on PSS and its effect on the discipline of design.

The main research questions for the research reported in this thesis are:

- 1) What behavioural factors contribute to PSS acceptance?
- 2) What role do habits play in PSS acceptance?
- 3) How can these insights be used in the PSS design process?

By answering these questions, this research aims to connect practice and theory in the field of PSS acceptance.

To answer these questions, the research reported in this thesis is based on theoretical research on acceptance, behaviour change, and PSS design and on the previously announced living lab study on a well-accepted, result-oriented PSS in the mobility domain: Skewiel Mobiel. Skewiel Mobiel is offered to elderly citizens and various field research methods, such as observations, interventions and interviews were conducted to gain insight in 'the motivations to use this PSS, and to study what particularities of the PSS have resulted in acceptance. Based on these studies, addressing so-called lost habits was derived to contribute considerably to the acceptance of Skewiel Mobiel. In order to extend the

insights gained from the living lab to a more general perspective on PSS acceptance, a model of lost habits was developed and tested in a controlled study. Finally, the model was translated into a design tool, which was evaluated in an explorative way with different types of stakeholder.

Overall, this thesis concludes that PSS acceptance can be increased by making it compatible with existing, or past behaviour, represented by lost habits.

1.3.2 CONTRIBUTIONS

The research reported in this thesis, will contribute to the domains of design research, design practice, and society. First, the contribution to design research will be in the combination of field research, theoretical research, and the integration of both domains. This will result in thorough insights in the factors that stimulate PSS acceptance, and in the lessons learned about how a living lab can contribute to studying acceptance of a specific result-oriented PSS. Moreover, this particular study will gain practical insight in the design process of a PSS.

Second, the contribution to design practice will be the development of a theoretically underpinned design tool that designers can use to design PSS, based on lost habits. As such, the results from this research might provide people, who are involved in the design and development of PSS, an overarching perspective on how to enhance PSS acceptance.

Furthermore, this thesis will emphasize the importance of a user focus in the PSS design process, and advocate that a design focus on continuing existing or past behaviour is very fruitful for PSS acceptance. This latter point seems largely underexposed in design theory and practice.

Third, this research will contribute to two societal issues, which are sustainability and an ageing society. As PSS have the potential to contribute to sustainability, insight in how PSS acceptance can be enhanced will be valuable for further implementation of PSS. Moreover, as the studied PSS provides mobility to elderly, a lot of insight will be gained in their lives, the activities they conduct, and in the effect of the PSS on daily life. Understanding these aspects, combined with knowledge on PSS acceptance, will contribute to knowledge on how to design PSS, specifically for elderly.

1.4 THESIS OUTLINE

This thesis describes a research process that combines theoretical research with field research. As such, the thesis comprises of two chapters that mainly report on field research, and two chapters that mainly report on theoretical research.

Chapter 1 (this chapter) has introduced the concept of PSS and the gap of knowledge that this thesis aims to address. Additionally, it listed the most important research questions, and briefly explained how this research will contribute to the fields of science, design, and society.

Chapter 2 will zoom in on theory on PSS acceptance. This chapter aims to explain (the lack of) PSS acceptance from the perspective of technology acceptance frameworks, human behaviour frameworks and the field of design. Furthermore, it will discuss how existing (product, service and PSS) design methods address acceptance.

Chapter 3 will report on the living lab of an existing, result-oriented PSS, named Skewiel Mobiel. This field research will focus on the acceptance of this particular PSS. The PSS was investigated by means of observation, interventions, questionnaires, and interviews. Based on the findings from these studies, the construct of lost habits was defined. Finally, supporting constructs will be formulated that partially seem to explain acceptance.

In **chapter 4**, the construct of lost habits will be further embedded in theory, including constructs from behavioural psychology, such as habits and acceptance. Based on this, a model of lost habits will be developed. This model is evaluated in an experimental setting that studies the acceptance of systematically designed PSS in a controlled and predefined context by specific personas.

Based on the research findings reported in this thesis, a design tool for lost habits was developed, as **chapter 5** will report. The use and usefulness of this tool was iteratively explored in practice, by means of a design workshop and by explorative evaluation sessions. Finally, **chapter 6** will reflect on and discuss the findings, contributions, and limitations of this thesis. After that, it will draw an overall conclusion, answer the research questions, and sketch directions for future research.

This chapter is based on:

Schotman, H., & Ludden, G. D. S. (2014b). User acceptance in a changing context: why some product-service systems do not suffer acceptance problems. *Journal of Design Research*, 12(3), 188–203.
<http://doi.org/10.1504/JDR.2014.064231>

2. BARRIERS AND OPPORTUNITIES FOR THE ACCEPTANCE OF PRODUCT SERVICE SYSTEMS

Chapter 1 has introduced that the Western world is increasingly moving towards a service-oriented economy, and the development of successful product-service systems (PSS) plays an important role in this transition. However, as was presented in Chapter 1, PSS find significant barriers to become widely accepted, and many PSS initiatives fail after initially successful pilot projects (Vezzoli et al., 2015). PSS researchers have identified a number of barriers for PSS acceptance, and according to them, one of the main barriers is the way in which PSS require people to change behaviour (i.e. Mylan, 2014; Rexfelt & Hiort Af Ornäs, 2009; Vezzoli, Ceschin, Diehl, & Kohtala, 2012; Williams, 2006).

Although not all PSS suffer the same lack of acceptance (Manzini & Vezzoli, 2002; Skinner, Haines, Bowyer, Fergusson, & Senft, 2004; Tukker & Tischner, 2006b), at the same time, not all PSS are equally promising. Disappointingly, the user acceptance of especially use-oriented and result-oriented PSS is lacking, whilst these types of PSS are considered to be beneficial for businesses and the environment (i.e. Tukker, 2004).

These issues make the topic of PSS acceptance a very timely and interesting field of study. In order to obtain a better understanding of this issue, and on the factors that have an effect on PSS acceptance, this chapter studies PSS acceptance from a variety of perspectives. These perspectives include the fields of design, human behaviour, and (technology) acceptance models.

This chapter is organized as follows. Section 2.1 presents the state of the art in research that is targeted at understanding PSS acceptance. Section 2.2 reports on predictive models that describe the factors that influence people's behaviour and contribute to the acceptance of technology. Section 2.3 reports that the discipline of design approaches acceptance in a more prescriptive way. Moreover, this section reports on how the fields of product design, service design and PSS design consider user acceptance in the design process. Finally, Section 2.4 draws a conclusion, stresses the main constructs for PSS acceptance, and presents the research outlines for the rest of this thesis.

2.1 LIMITATIONS AND BARRIERS FOR PSS ACCEPTANCE

Chapter 1 briefly discussed the transformative impact of a PSS on a user. As PSS are organized differently from products and services, and generally require different user interactions, PSS require people to change their behavior. This is a fundamental shift that originates from the fact that PSS are in many cases not possessed by users, but are intended

to replace products that are or were in possession. Thereby, a PSS provides its user access to specific functionalities and results, adapted to a specific situation at hand. This replaces traditional ownership for continuous and unique availability of a predefined functionality.

For example, in the case of a car sharing PSS, owning a car is replaced by having access to a car, only when mobility is needed. By using such a PSS, the user still has access to the functionality of mobility, but new interactions are added, such as a registration procedure, and/or an additional walk to the selected shared car before the actual ride can commence. Furthermore, other interactions might be lost, such as the possibility to personalize a car, leave sunglasses in the car, or set and keep the seat in the right position.

Meijkamp (2000) empirically studied the concept of car sharing, by analysing the interest for car sharing in The Netherlands. He illustrated that car sharing might have many benefits for users, but accessibility, financial benefits of the service, and people's habits appeared to be very decisive for the acceptance of car sharing, and resulted in limited acceptance. Additionally, he stated that car sharing required a use-context of ownerless consumption, which included new interactions, such as reservations and planning. Meijkamp concluded that such activities were not necessarily a barrier in themselves. Instead, car owners found difficulties in making the transition to car sharing. Thereby, similarly to what Manzini & Vezzoli (2002) concisely described, the barrier was induced by the shift from one interaction to another. This transition is often referred to as cultural shift, and is pointed out as main barrier by more authors, such as Goedkoop, Halen, te Riele, & Rommens (1999), Manzini & Vezzoli (2002), and Mont (2002).

An elaborate study on PSS acceptance was conducted by Rexfelt & Hiort af Ornäs (2009). They conducted a user study in which they evaluated hypothetical PSS with participants and a theoretical study in which they analysed important factors for consumer acceptance of PSS. One of the findings was that most of their respondents did not intend to use a PSS, because they were afraid of the implications the PSS had on their lives. In addition, they found that consumer acceptance of PSS depended on the alternatives that consumers have at hand. They concluded that factors such as the relative advantages of a PSS, compared to the product or service already in use, and uncertainty about the implication of the PSS on daily life play a central role in acceptance.

This study was elaborated upon by Catulli (2012), who further analysed the factor uncertainty. He empirically studied people's interest in the concept of a PSS, and found that respondents considered the idea of a PSS interesting, but in practice, the vast majority of respondents did not appear to prefer using a PSS to more expensive or less efficient

products and services they currently use. Reasons included a lack of trust in PSS providers, or people's inability to oversee the life cycle costs of a PSS, compared to those of products currently in use. In addition, according to Herodes & Skinner (2005) loss of status could also be an aspect for limited acceptance.

These studies show that the lack of PSS acceptance is not necessarily inherent to the concept of PSS. Instead, it can often be attributed to the transition process a user must go through, from owning a product towards a PSS and "having a need or want met in a sustainable way" (Goedkoop et al., 1999). Moreover, lack of acceptance arises when the user does not consider the new interaction to be valuable enough (Tukker, 2015), and the PSS apparently does not provide enough relative advantages (Rexfelt & Hiort af Ornäs, 2009).

The impact of a PSS on a user seems to be a generally underestimated topic in acceptance issues. This includes the interaction between the PSS and its users, and the impact that using or starting to use a PSS could have on someone's life (Mont, 2001). Tukker & Tischner (2006) and Vezzoli et al. (2012) moreover advocated that PSS development focuses too little on social aspects and user requirements, and hence fails to increase acceptance. This issue might be essentially caused by the fundamental shift from using (self-owned) products and services towards using PSS.

Next to end-users, also companies seem to be hesitant regarding the adoption of PSS, mainly due to similar principles. Although Tukker (2015) claimed that an increasing amount of businesses have established one or more PSS propositions, especially in business-to-business markets, as was also illustrated in Chapter 1, many companies do not seem willing to reorganize their traditional business models. Their main reasons are the possibilities of significant investments and perceived major risks (Besch, 2005; Ceschin & Vezzoli, 2010; Ceschin, 2013; Vezzoli, Ceschin, Diehl, & Kohtala, 2012), or a lack of knowledge about, and experience with PSS (Manzini & Vezzoli, 2002). In addition, Williams (2007) found that companies were unable to see the PSS in a context of the entire lifecycle, and therefore being unable to oversee the consequences of shifting towards a PSS. Hence, being unfamiliar with the possible impact, both organizational and financial, refrains many companies from making the shift from selling products to providing a PSS.

2.2 PREDICTING PSS ACCEPTANCE

The previous section argued that the general concept of a PSS does not seem to be a major issue in acceptance. Instead, both consumers and companies seem to have difficulties in shifting from traditional products towards using or providing a PSS. Reasons are PSS that

require a change in interaction patterns, or consumers and companies that lack understanding of the added value a PSS could bring them. These principles especially affect the acceptance of use-oriented PSS and result-oriented PSS, and not so much the acceptance of product-oriented PSS, because the first two require more changes in interaction. Meanwhile, since these types of PSS can have most impact on business and the environment, it is essential to understand how acceptance for these types of PSS can be improved.

Since PSS acceptance issues are rooted in the interaction between PSS and user, an interesting research frame is introduced. This frame should not only focus on the concept of a PSS, or on behavioural processes, but importantly also on the way in which people deal with technology.

This section will discuss present theory on this topic, in order to obtain a better understanding of the relation between human behaviour and PSS acceptance. Firstly, behaviour frameworks and technology acceptance frameworks will be analysed. Behaviour frameworks are discussed in order to understand how behavioural processes result in decisions people make, for example about whether or not to accept an item, such as a PSS, or a situation in which a PSS must be used. Technology acceptance frameworks merely focus on the interaction between a person and technology. Thereby, they have been considered to explain what factors contribute to the acceptance of technology. This is also relevant for PSS, as PSS generally contain technology as well.

2.2.1 THEORETICAL FRAMEWORKS

Firstly, two important behaviour frameworks will be discussed briefly, after which technology acceptance frameworks will be analysed. See Figure 7 for an overview of the frameworks. Martin Fishbein and Icek Ajzen have introduced a widely used behaviour framework in the field of psychology. This framework is the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980), which later evolved into the Theory of Planned Behaviour (TPB; Ajzen, 1991). These frameworks are considered to be able to predict behaviour (Ajzen, 2001), and describe factors that contribute to people's behaviour and decisions.

Intention plays a central role in these models. Both consider that a person must first have an intention to execute behaviour. This intention is mediated by attitudes and subjective norms, which means that someone's perception on the world ultimately defines how he or she behaves. Later, when the TPB was developed, Ajzen added the factor of perceived behavioural control to this framework. This type of control means that a person is partially

Figure 7: Overview of theories

able to oversee his or her behaviour and think about the possible consequences. Based on this estimation, the intention is formed to execute behaviour, or not.

TRA and TPB are very much focused on personal behaviour, and the factors that contribute to actual behaviour. Technology acceptance frameworks share many theoretical commonalities with these frameworks, but are more focused on actual behaviour of using technology. The most commonly used technology acceptance frameworks also consider Intention and Attitude as decisive factors for behaviour. A well-known framework for technology acceptance is the Technology Acceptance Model (TAM; Davis, 1989), that was later transformed into the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh, Morris, Davis, & Davis, 2003), and Unified Theory of Acceptance and Use of Technology (UTAUT2; Venkatesh, Thong, & Xu, 2012).

These models originate from the field of Human Computer Interaction and highlight many different factors, such as Social influence, Attitude, Price, Motivation, Perceived ease of use, and Perceived usefulness. These factors are generally more interaction-based, rather than psychology-based, but they show much overlap with the behaviour frameworks of Ajzen (1991), because they include the constructs of attitude and intention.

2.2.2 CRITICS ON THEORETICAL FRAMEWORKS

With regard to PSS acceptance, both technology and behaviour frameworks can be very useful for PSS developers, as these frameworks could provide support in estimating whether a PSS might become accepted or not. Nonetheless, despite such possibilities, a critical review of their limitations is needed to put these frameworks in an appropriate perspective. Firstly, it is important to understand that all frameworks consider people as rational entities that continuously make cost/benefit analyses (Darnton, 2008). This means that these frameworks would predict that something might become accepted if the added value is clear and factors such as intention to use, perceived ease of use, and perceived usefulness are apparent. Conversely, in many situations, people do not act as rationally as expected (J. Van Dijk, Mulder, & Van der Lugt, 2013), or people rationalize actual behaviour (Kermer, Driver-Linn, Wilson, & Gilbert, 2006) which is known as cognitive dissonance (Festinger & Carlsmith, 1959).

Moons & De Pelsmacker (2012) studied the effect of emotions and habits on usage intentions. In a large empirical study on the consumer acceptance of electric vehicles, they found that emotional aspects are just as vital as rational and cognitive reasons for usage intention. This study was used as an evaluation of their developed Extended Decomposed Theory of Planned Behaviour (Moons & De Pelsmacker, 2015). This model is based on the

Decomposed Theory of Planned Behaviour (DTPB) from Taylor & Todd (1995) and Ajzen's Theory of Planned Behaviour (Ajzen, 1991).

Next to emotions, Moons & De Pelsmacker (2012) also studied the relation between habits and usage intention. Habits are defined as repeated, pleasurable actions from the past, and while many researchers have advocated that these can be used to predict future actions (i.e. Aarts, Verplanken, & Van Knippenberg, 1998; Verplanken & Faes, 1999; Verplanken & Orbell, 2003), Moons and De Pelsmacker did not find habits as a predicting factor for electric car use intention. They explain this by similar use patterns for electric car and conventionally powered vehicles. In other words, existing car habits cannot be used to predict the intention to use electric cars.

While this study did not show a clear relation between habits and intention, many researchers have found a direct relation between habits and actual behavior, and therefore acceptance. Landis et al. (1978) were among the first to elaborate on this. According to these researchers, the existence of an intention to use does not automatically lead to behaviour, especially when habits are apparent. Landis et al. (1978), worked on the Theory of Interpersonal Behaviour (TIB, see Figure 8), which shares many principles with TRA and TPB, for example by considering intention as predictive factor for behaviour. However, TIB explicitly contributes an influencing role to habits, next to the role of intentions. Thereby, they suggest that intention and habits are both strong predictors for actual behaviour. This is also confirmed by i.e. Bagozzi (1981), Limayem, Hirt, & Cheung (2007), and Verplanken & Aarts (1999), who state that habits have a stronger effect on behaviour than intention, when habits are apparent. This means that, in many cases, behaviour could be better predicted by considering habits, than by considering an intention. Unfortunately, although habits were later also identified as an important factor by Ajzen (2001), and confirmed by i.e. Aarts (2009), Gardner (2009), and Verplanken, Aarts, Van Knippenberg, & Moonen (1998), the other frameworks generally do not include these factors, and the attention to the role of habits has remained rather low.

Next to the role of habits, the role of attitude and the lack of attention for the transition process need further elaboration. Firstly, the role of attitude is often mentioned to be important for predicting acceptance, but the influence of attitude is limited for a number of reasons. Kaiser, Wolfing, & Fuhrer (1999) reported a weak correlation between attitude and actual behaviour because of three reasons: there is no unified definition for attitude, attitude is measured using constructs that differ from the constructs used for measuring behaviour, and other factors than attitude influence behaviour.

Figure 8: Theory of Interpersonal Behaviour (Landis et al., 1978)

Additionally, Tromp, Hekkert, & Verbeek (2011) advocated that one of the characteristics of attitude is that it can have different levels that relate to behaviour, such as collective and individual concerns. These researchers illustrate this by considering that people may collectively be very well convinced by the necessity to live in a sustainable society, but when they have to act individually, other values may outweigh collective concerns. For example, someone might find it equally or even more important to drive a large car, even if that large car harms the environment more than a small car. Following this line of reasoning, the relation between attitude and actual behaviour is mitigated by the existence of, often conflicting, collective, and individual concerns.

Secondly, issues arise with the focus of behaviour and acceptance frameworks. While such frameworks are used to predict behaviour by measuring the conditions of a desired state, they do not consider the transition process to reach that state. As such, these frameworks do not support predictions about what is needed to start the transition process from present behaviour towards new behaviour. In other words, these frameworks can be useful for establishing a desired status-quo in behaviour, but not for establishing transitional characteristics that will result in the desired status-quo.

Rogers is one of the few theorists in this field who explicitly built his model around transition. He developed the innovation diffusion model (Rogers, 2003) to explain how an innovation finds its way through the market. In this model, he connects user types to the

implementation stages of an innovation. Rogers found that innovations are first used by an “innovators” group, continues rolling out on the market via various other groups, such as early-adopters, the early and late majority. Ultimately, the innovation leaves the market after laggards. This implies that he relates the interest among consumers to a given amount of newness, where innovators like a high level of newness and a low level of familiarity and the laggards value products with a low amount of newness and a high level of familiarity.

The limitations mentioned before indicate that behaviour frameworks and technology acceptance frameworks might only be partially able to explain acceptance issues and acceptance barriers. Most importantly, this is caused by the limited attention to the effect of habits on behaviour, the lack of attention to the transitional process, and to the finding that people might not always behave as the models assume.

As such, the models reported here are considered of limited use to understand how to trigger a person to actually start the transition towards the desired state, and consequently to explain and predict PSS acceptance.

In order to obtain insight in the required characteristics of a transitional process, and thus in the required characteristics to improve PSS acceptance, other fields must be studied, and studying the field of design seems to be useful. The field of design follows a different approach to dealing with people and change, and is more concerned with transitional processes. The following section will discuss how insights from different fields of design, such as industrial design, service design and user-centred design, can be used to explain and improve PSS acceptance.

2.3 INCREASING PSS ACCEPTANCE

The field of design follows a merely practical approach to acceptance, and is concerned with questions regarding conditions to make people shift from one situation to another. Generally, design methods aim at supporting designers to design products and services that become implemented and accepted.

Since many designers aim to change a current state into another, and thereby focus on behaviour change, the field of design offers many tools and methods that can be useful to study how PSS acceptance could be increased. It is straightforward to study PSS design methods and tools, and analyse how these deal with acceptance. However, the discipline of PSS design is relatively new, compared to the disciplines of product and service design. Therefore, many present PSS design tools and methods have initially been developed with the design of products or services in mind.

More recently, design methods and tools have been introduced that focus more specifically on PSS (Kim, Lee, Kim, Jeong, & Kim, 2012; Kim, Lee, & Koh, 2011; Lay et al., 2009), but most of these methods still show resemblances with already existing methods. Therefore, in order to frame PSS design methods correctly, it is relevant to review the developments of product and service design first. After that, it will be studied how PSS design methods work and aim to address PSS acceptance.

Figure 9: Overview of traditional design methods. Left: Pahl & Beitz. Right: IPD

2.3.1 PRODUCT DESIGN

Eger, Bonnema, Van der Voort, & Lutters (2013) reported an elaborate overview of the most commonly used design methods. They claimed that, although every design process requires a different approach, the order of the process is generally the same. Gerard Pahl and Wolfgang Beitz (Pahl, Beitz, Feldhusen, & Grote, 2007) and Andreasen & Hein (1987) have developed widely adopted methods (respectively named “Pahl & Beitz” and Integrated Product Design, IPD) that elaborately described the steps in the design process, see Figure 9 for an overview of both methods.

Both describe a similar design process that became familiar for most product design methods (Sampaio & Pontes, 2015). The phases are:

1. Analysis of the task
2. Conceptual design
3. Embodiment design
4. Detail design

Moreover, Sampaio & Pontes (2015) described that some design methods consisted of a phase 0 and/or a phase 5, which are respectively a “Necessity phase” that is devoted to establishing a target user or market need, and an “Implementation phase” that describes the steps to introduce the developed product in the market.

The method of Pahl and Beitz is a rather prescriptive and linear process, in contrast to the IPD model that shows more flexibility, and includes the consideration of user requirements as an integral part. IPD starts with establishing a user need, which is continuously addressed during the entire process. Furthermore, several activities can be executed simultaneously, which makes the process very agile. This provides the designer more freedom, and indicates the importance of considering the user in the process. Nevertheless, at the same time, the designer may become lost in this freedom, due to lack of direction and provision of timely decision moments.

Pahl and Beitz and IPD are typical of most traditional product design methods, as was described by Sampaio & Pontes (2015). Both present a procedure of consecutive steps that result in a designed and marketed product (Eger et al., 2013), and both focus on tangible, technical products as design objects (Tan, 2010). Unfortunately, most traditional methods do not address much detailed attention to the user requirements, and rather generally relate to the message that users are important. Even though some consider user research essential, such as the IPD method, the rest of the process lacks a view on the user, and feedback moments with the user, to align the design process with user needs. Hence, these traditional

product design methods seem to focus merely on a linear process to create an artefact, rather than on an iterative process that incorporates the user and establishes how user requirements can be addressed best.

2.3.2 USER CENTRED DESIGN

IPD and Pahl & Beitz are typical of traditional product design methods. De Bont, Den Ouden, Schifferstein, Smulders, & Van der Voort (2013) concisely described that the field of design has evolved from pure product development in the 1960s, towards value creation in more recent times. During this development, design focus shifted from designing products and enhancing product functionality, towards creating value for users, organization and society (Eger, 2007).

In the wake of this shift, the discipline of User Centred Design (UCD) had gained wide attention. It became one of the main design paradigms, next to technology driven design and environmentally sustainable design (Giacomin, 2012). As such, many current product design methods and service design methods are based on UCD principles. Characteristic for UCD is that it provides a clear message to focus on the user perspective, on understanding how people are motivated by values, on how to find user needs, and thus on what is required to design objects that are appealing to users and will likely be accepted.

Norman & Draper (1986) introduced the concept of user-centred systems design, UCSD, and advocated that the design process of a system should focus on serving the user need, instead of developing a specific technology, or something aesthetically valuable. It was initially a philosophy intended for designing computer systems, but Norman (1988) generalized it to other design disciplines, and named it UCD. Later on, other aspects such as emotions and aesthetics were added to the field of UCD, and finally, the definition of UCD is registered in ISO 9241-210 as human-centred design (ISO, 2010).

Designers have been introduced to and have been developing many UCD tools that can be used during the design process, and a very wide variety of tools and methods have been presented by i.e Brown & Rowe (2008), Giacomin (2012), IDEO (2014), Lloyd, Hekkert, & Van Dijk (2006). These methods and tools encompass all kinds of interactions and artefacts, spanning from relatively simple tools such as storyboards, cards, and probes to more complex interactions, such as empathic adventures, deep interviews, and co-creation sessions.

According to De Bont et al. (2013), user centred design can be characterized by three different types of interaction with the user:

- ❖ For the user, such as ethnographic design;
- ❖ By the user, such as usability testing;
- ❖ With the user, such as co-design.

The first two approaches are rather traditional, and based on gathering knowledge about the user. The latter approach is more contemporary and consists of participatory design methods in which users take part in the design process. This approach is also useful for thoroughly studying user needs and contributes a large role to user-interaction.

A design method that focuses explicitly on user needs and interactions, and thereby complies very well with this approach, is the Vision in Product Design (ViP) method, presented by Lloyd et al. (2006), see Figure 10. The ViP method is an interaction-centred design methodology (Lloyd et al., 2006) and gives a lot of attention to user-product interaction, and to the context in which this interaction takes place.

Figure 10: ViP Method (Lloyd et al., 2006)

For design, the ViP method encourages the designer to imagine a desired context, and to think of the interactions that will take place in that context. Finally, the designer should imagine a product that will effectuate those interactions in that particular context. Following this method, a new product could be designed, based on user values and qualities.

These principles seem to be well applicable to PSS design, and as such, the ViP method provides interesting insights for PSS design, that go beyond the more traditional product design methods. For example, analysing the interaction between user, context, and PSS, instead of only the product, can be useful to establish the values that users give to a PSS. Consequently, the values of the desired state are established and can be translated into a new product. This provides the designer guidance in the design process to bridge the transformation from the present situation, towards a future situation.

2.3.3 SERVICE DESIGN

Previous sections reported on the transformation towards “servitised” products. Together with the rise of user-centred design, many user centred service design methods have been developed. As such, many service design methods and tools are compatible with more contemporary product design and UCD methods and tools (Stickdorn & Schneider, 2012).

Sleeswijk Visser & Stappers (2012) elaborated upon similarities between product design and service design methods and tools, and they argued that the contemporary field of product and service design generally share the mind-set and toolset of UCD as an important common ground. Furthermore, they claim that similarities especially appear in the “fuzzy front end” of a design process. In these initial phases of a design process, many methods and tools that were originally developed with product development in mind, could be used for service design. Such methods and tools can be co-design, probe usage, ethnographic research, prototyping, tinkering, etc.

In later phases of development, more differences are revealed. For example, the activities of concept refinement, prototyping and implementation require a specific approach, due to inherent differences between products and services (Sleeswijk Visser & Stappers, 2012). Müller & Blessing (2007) elaborated on these differences, and described that product design is often a linear process that results in a finished product that can be delivered to the market. Service development, on the other hand, is characterized by an open-ended process. When a service is used, it must be adapted to user requirements, and this means that services are produced during delivery (Müller & Blessing, 2007). Consequently, the role of the user shifts from owner of a product to stakeholder of the service, which results in a

long-term relationship between provider and user. Incorporating this type of interaction in the design affects how a service is designed.

In order to better understand the differences between product design and service design, Moritz (2005) reported on a number of specific service design methods, such as Service Design Methodology, by Birgit Mager (Mager, 2004), and the design process of design consultancy IDEO (IDEO, 2014). The first represents a nine-segment framework that covers aspects such as market analysis, customer analysis, modelling and testing, whereas the second contains phases “Understand & Observe,” “Visualise & Refine,” and “Implement.”

Based on his findings, Moritz formulated a general approach for service design that covers the entire service design spectrum. The steps are:

- 1) Understanding, in which the designer learns about stakeholder requirements and the context
- 2) Thinking, in which the designer makes a problem definition and defines the solution space
- 3) Generating, in which concept solutions are designed
- 4) Filtering, in which promising concepts are selected
- 5) Explaining, in which concepts are visualized and engineered
- 6) Realising, in which a plan is created to implement the concept in the market

In Table 1, these steps are compared to the order normally found for product-design methods, as was extracted from Sampaio & Pontes (2015).

Table 1: Comparison product design process and service design process

<i>Product design process, as proposed by Sampaio & Pontes (2015)</i>	<i>Service design process, as found by Moritz (2005)</i>
Necessity phase	Understanding
Analysis of the task	Thinking
Conceptual design	Generating
Embodiment design	Filtering
Detail design	Explaining
Implementation phase	Realising

Interestingly, as Table 1 shows, these steps show many similarities with the product design process, and move from analysing user needs, via generating and selecting concepts to engineering and implementation of the designed object in practice. Conversely, in contrast to traditional product design methods, the service design approach is far less prescriptive,

and uses terms that are much more open to interpretation. Thereby, the service design approach is merely a reference guide that provides freedom to the designer, within boundaries. Contrastingly, the process and terms used for product design might be too directive and suggest a unidirectional development line towards the creation of a product.

Next to differences in guidance, other differences between product and service design arise in the object of design (Secomandi & Snelders, 2011). Traditionally, services are considered to be intangible (Vargo & Lusch, 2004) and only exist when they are rendered (Rifkin, 2000), as opposed to products that were considered to be tangible, and produced before use. This can be combined with Müller & Blessing (2007), who clarified that products and services differ in the way that products are produced and sold to the customer, whereas services are produced during delivery to the customer, and co-created with the customer during the use phase. The combination of both the object of design and the process of design shows a difference between products and services. Products are made tangible and sold before use, and services remain intangible and are rendered during the use-phase. This again illustrates that services rely on the interaction between the user and the provider of the service (Henze, Mulder, Stappers, & Rezaei, 2012).

According to Secomandi & Snelders (2011), services arise as an interface between a provider and a client, and infrastructures are used to support these interfaces. For example, a mobile phone can be an infrastructure that displays graphical elements that guide the user to a certain goal, such as making a phone call or getting a weather update. Consequently, the graphical elements represent the service for the user and the ability to make a phone call relates to the infrastructure.

Although in some cases representations can be made, it is often difficult to visualize services. Shostack (1984) made a successful attempt to visualize services by means of the service blueprinting method. This method describes services in a rather tangible way, and this method has proved to be a valuable method for a profound understanding of services (Spraragen & Chan, 2008; Yoon, Kim, & Rhee, 2012).

In a service blueprint, a visual representation of a service process is given, including all elements, interfaces and infrastructures that are needed to guide a user to a certain outcome. A service blueprint furthermore displays moments of interaction and a line of visibility that divides what a user can and cannot see from the service.

Shostack's service blueprinting method is a useful canvas for the service design process as it shows what elements to include in the design. As such, it became a widely used method to make the often virtual and intangible service visible by translating it to concrete elements

and visible processes. By making elements visual, it becomes clear what actions are taken by users and what by the service provider. Moreover, it discriminates between elements a user can use, see, and interact with, and the processes that are needed to execute the service. Elements in the service blueprint are separated by the “line of visibility,” that separates an onstage and a backstage side. The onstage side considers the user perspective, and describes the elements and interactions the user can encounter. This side also includes a line of interaction that identifies how the user can interact with the service. The backstage side represents merely the process that makes the service work and contains the elements and interactions that enable the provider to execute the service for the user.

2.3.4 PSS DESIGN

The previous section reported on differences and similarities between the disciplines of product design and service design. This section will focus on PSS design, and analyse how PSS design compares to product and service design.

Tukker (2015) made a state of art overview of developments in PSS research. He found that the PSS design process generally followed the same approach as product and service design, as is presented in Table 2.

Table 2: Comparison between general product, service, and PSS design methods

<i>Product design process, as proposed by Sampaio & Pontes (2015)</i>	<i>Service design process, as found by Moritz (2005)</i>	<i>PSS design process, as found by Tukker (2015)</i>
Necessity phase	Understanding	
Analysis of the task	Thinking	Analysis
Conceptual design	Generating	Idea generation
Embodiment design	Filtering	Selection
Detail design	Explaining	Refining
Implementation phase	Realising	Implementation

Although being methodologically similar, differences between product/service design and PSS design arise on detail level, as will be elaborated upon next.

In a PSS, both products and services are designed simultaneously, and this introduces complexities in development that are not foreseen by more traditional product and service design methods. As a result, the implementation of every step in the PSS design process can be different from traditional product and service design (Müller & Blessing, 2007). Müller & Blessing (2007) argued that combining products and services, and using them in a system, means that interactions and mutual dependencies start between products and services. This

point was also mentioned by Kim, Lee, & Koh (2011), who stressed that products and services are “complicatedly connected to each other” in order to satisfy user needs.

Although many companies normally still use their traditional design approaches to design PSS (Wolfenstetter et al., 2015), in recent years, several researchers have developed and reported specific PSS design methodologies.

According to Morelli (2006), the high complexity of PSS design requires specific and highly flexible tools and methods. Moreover, he suggested that PSS design should be done by two types of approaches: The process of the service is rather technical, and should be designed by merely technical, procedural approaches. The service elements (products and interfaces) can be designed by more narrative approaches, such as scenarios and use cases. Moreover, he emphasized to include the end-user in the design process. Therefore, according to Morelli, not one standard PSS design methodology can be defined, and every designer should compose his or her own “toolbox” as every PSS design project requires a different set of tools and methods.

Lay et al. (2009) recognized the need for an insightful representation tool for so-called new business concepts, from which PSS are an example. Although their tool is aimed at business-to-business concepts, the morphological framework they developed supports PSS designers in making decisions in the PSS design process. Lay et al. (2009) subdivided the morphological box in characteristic business model features and options on how these features can be completed. Characteristic features include Ownership, Personnel, Location of operation, Single/Multiple customer operation, and Payment model. For every feature, they developed a number of options that a PSS provider can select, hence resulting in an overview of the features of a PSS, and the way these features are operationalized.

Additionally, Kim, Lee, Lee, Han, & Lee (2011) created an overview of different PSS design support tools and methods. These tools and methods support designers to map complexities in the PSS design process in various ways, and formulate relations between different PSS aspects. Generally, these support tools make use of computerized systems that enable designers to simply add and remove items, or to zoom in on different levels in the PSS. In other work, Kim, Lee, & Koh (2011) discuss a PSS representation method that supports designers by means of a very schematic overview what product and service features are needed and how they work together to form a PSS. In this method, the authors propose to divide the functionality of a PSS in different sub-functions and to design corresponding sub-PSS. Additionally, the authors claim that merging these sub-PSS results in different PSS

proposals that realize the same functions. Comparing these proposals can support designers to find the most feasible PSS, based on their own criteria.

Issues with PSS design methods are exposed by Vasantha et al. (2012), who conducted a literature review on eight leading PSS design methods. Firstly, they found that most methods share attention to the design process for integrating products and services. Secondly, they argue that these methods give attention to definitions, and attention to the first phases of a product life cycle. Yet, they concluded that the analysed methods largely omit attention to feedback loops, implementation plans, and, similar to product and service design methods, the end-user. Additionally, Glauco et al. (2015), who studied PSS design methodologies that largely overlap with those Vasantha et al. (2012) studied, concluded that these methodologies did not explicitly consider the user and other stakeholders in the design process, although the PSS design process was generally agreed on to be a co-creation activity. Furthermore, Vasantha et al. (2012) suggested that common ontology and models for representing PSS are required, just as specific support for developing sustainable PSS. However, they admitted that the field of PSS design is in a very early stage of development, and PSS research should aim in the direction of developing practical design methodologies.

A mere practical design tool, that supports designers in making design decisions is introduced by Schmidt, Malaschewski, & Mörtl (2015), which is based on a number of other decision processes. The authors found that many decision processes are not explicitly intended for PSS development, and that most processes do not sufficiently consider the customer. Both points are explicitly addressed in their process. The complexity is broken down by separating development steps, and customer integration is addressed by 3 decision points for which the current state of the PSS concept is reflected on customer requirements. Following this procedure, the authors advocate that following this process will result in a PSS that fits customer requirements.

Additionally, in Schmidt, Malaschewski, Fluhr, & Mörtl (2015), these researchers introduce a model that explains how customer integration can be done in a more practical way. This model is based on barriers that keep customers from using a PSS. By using three connected layers (customer layer, barrier layer, solution layer), the authors show how a solution can be developed, based on the barriers that customers experience. Thereby, they propose to start with defining a target group for a PSS. Next step is to define the barriers this group experiences, causing lack of acceptance. Finally, PSS designers should adapt the PSS to eliminate these barriers.

Interestingly, this approach stresses the importance of a user focus in the PSS design process, and it acknowledges that barriers keep people from using certain objects. Thereby, it forces designers to think of reasons why people should not accept a PSS. Unfortunately, Schmidt, Malaschewski, Fluhr, et al. (2015) restrict their contribution to a procedural method that seems a bit too abstract for implementation in PSS design.

A more concrete PSS design tool is proposed by Bocken, Short, Rana, & Evans (2013). These researchers developed a value-mapping tool that supports businesses to define sustainable business models. Although not all sustainable business models are a PSS, the authors use PSS as an example of a sustainable business model. Interestingly, Bocken et al. (2013) integrate 4 types of stakeholder in their tool: environment, society, customer and network actors. Thereby, they stress that PSS development is a multi-stakeholder process, and they furthermore underline, just as Schmidt, Malaschewski, Fluhr, et al. (2015) and many other authors, the importance of considering consumers in the design process. For evaluation purposes, Bocken et al. (2013) executed a number of multi-stakeholder workshops, where they let each stakeholder define the purpose and value of the sustainable business model. By facilitating interactions and discussions among the present stakeholders, overall agreement on the designed object could be established. This implies that following this procedure results in customers that would be interested to use a PSS, and hence accept a PSS.

The notion of a multi-stakeholder setting shows that the PSS design process has increasingly been conducted by disciplines that have no particular background in design. Whereas product design was generally conducted by trained designers, service design and PSS design are an especially interdisciplinary expertise, from which a substantial part of the involved is not even aware to be actually conducting the act of design (Moritz, 2005).

The amount of practical evaluations of PSS design methods and tools is rather low. For example, Clayton, Backhouse, & Dani (2012) and Vasantha et al. (2012) touch upon a gap between theory and practice. These researchers claimed that PSS design methodologies are developed in theory, but hardly used in practice, and they found that PSS design methods are generally not formalized and shared, and remain within the working structures of PSS development companies. On top of that, Tukker (2015) argued that for successful PSS design, it was more important to consider the impact of a PSS on a company in terms of “structure, culture, capabilities and management”, rather than “having a sound design method”. By this, he stressed that further development on specific PSS design methods is currently subordinate to practical PSS implementation.

These points show that the state of art of current PSS design entails that many PSS design methods and tools are developed that help designers structure and plan the PSS design process. Attention to customers, habits and emotions, or attention to the impact of a PSS in real life, has remained rather low, although an increasing amount of researchers starts to focus on these topics. Nevertheless, much is shared about the procedure of conducting PSS design and practical guidelines on how to design for acceptance, or how to involve the user in the process, are widely absent. Therefore, further research is needed on behavioural aspects in relation to PSS design, and PSS acceptance. This will be explained in the next section, and in following chapters.

2.4 DISCUSSION AND CONCLUSION

This chapter first reviewed present theory on how acceptance can be explained, predicted, and stimulated. Second, it discussed several methods in the field of design and explored how these can be used to increase acceptance. This section will conclude this chapter by discussing the main findings of this chapter, and by sketching the gaps in knowledge that need to be overcome.

Firstly, traditional behaviour and technology acceptance frameworks were discussed. Such frameworks can be useful to understand what factors influence acceptance, and to anticipate on what a future situation should be like. As such, these frameworks are very well able to describe the required state that a rational, calculating human being should be in, when accepting something new. However, such frameworks lack attention to the transition process from the present state to a future state, to the conflict between individual and collective attitudes, and/or to the existence of non-rational user behaviour. On top of that, apart from the sparsely used Theory of Interpersonal Behaviour (Landis et al., 1978), most theories largely underexpose the role of user habits.

According to PSS researchers, attention to these aspects is required for understanding how acceptance can be increased, but as behaviour and technology acceptance frameworks generally do not address these aspects, they are of limited use in explaining and predicting PSS acceptance.

Practically oriented research was expected to provide a different perspective on user acceptance. Therefore, the field of design was studied to analyse how this field considers the user, his or her habits and behaviour, and acceptance. For example, although many design methods and tools can support the designer in addressing people's values, beliefs, needs, wants, and habits, it seemed to be quite difficult to use these methods and tools to understand and explain PSS acceptance. One of the reasons was that many design tools and

methods describe how the PSS design process could be planned or how a PSS overview should be made. Although such methods are valuable for simplifying the rather complex PSS design process, not much attention is paid to the role of users or to how PSS acceptance can be improved.

Additionally, existing PSS design tools and methods lack systematic analysis, both in practice and theory, and are rarely well disseminated and generalized. This might be because many methods and tools are used in corporate environments, rather than scientific environments.

Furthermore, PSS design methodologies mainly focus on the process of PSS design, specifically on the early stages of PSS design, which are PSS planning and PSS development, rather than at later stages, such as PSS testing and PSS implementation (Glaucio et al., 2015). This implies that phases, in which PSS are actually accepted in practice, are not incorporated. Next to that, little is known about what aspects of the design process do eventually lead to PSS acceptance. Lastly, the end-user is often not an integral part of the design process, which makes it difficult to design successful PSS.

This points out that theory and practice yield much knowledge about either PSS design or acceptance, but it remains rather unclear how this knowledge can be applied to increase PSS acceptance. Moreover, this chapter stressed that the transitional process plays an important role in PSS acceptance, as a user must transform his or her behaviour from a present situation in which he or she uses a product or service towards a future situation in which he or she uses a PSS.

Therefore, to increase PSS acceptance, it is important to focus not only on the contextual factors that are needed in the future situation, but similarly to understand what factors can trigger the transition phase. In order to do this properly, aggregating theory and practice is considered useful for studying PSS acceptance. This way, factors that act as a barrier for transition and hence result in limited acceptance, can be studied both from theory and in practice.

Test beds and living labs are generally useful methods for conducting this kind of research. For example, Baines et al. (2007) and Beuren, Gomes Ferreira, & Cauchick Miguel (2013) concisely described how test beds and living labs, as methods to study situations and transitions at the long-term, can be useful for studying PSS acceptance.

According to them, such field study-like methods enable design researchers to monitor and analyse the entire design process, from planning and development, to testing and implementation. This process generally takes a while, and Living Lab is a good method to

study the impact of a PSS in the real world, and to involve the user for a long time in the PSS development process. Thereby, it provides the opportunity to study behavioural developments, such as the acceptance process and habit formation, over a longer time. This will finally result in a thorough study towards the role of habits and behaviour on PSS acceptance.

The next chapter will report on a longitudinal Living Lab study concerning an existing PSS in the mobility domain, named Skewiel Mobiel. This PSS was very well accepted by its users, and was studied for 4 consecutive years. The conducted design research process has resulted in knowledge about the factors that contributed to this acceptance. These findings will be generalized in later chapters, and will be transformed in a PSS design tool that is based on practice, is theoretically founded, and that could support the development of acceptable PSS by multi-stakeholder design teams.

3

This chapter is based on:

Schotman, H., & Ludden, G. D. S. (2014a). Demand Responsive Transport as a Social Innovation: The Case of Skewiel Mobiel. In J. Salamanca, P. Desmet, A. Burbano, G. Ludden, & J. Maya (Eds.), *Proceedings of The colors of care: 9th International Conference on Design & Emotion* (pp. 70–78). Bogotá, Colombia: Ediciones Uniandes, Bogotá.

3. LIVING LAB STUDY ON THE ACCEPTANCE OF A PSS, THE CASE OF SKEWIEL MOBIEL

3.1 INTRODUCTION

Chapter 2 put forward that user acceptance of PSS is often lacking, because using a PSS in many cases requires new interactions, and shifting from familiar behaviour to new behaviour can be difficult for someone. These issues especially arise for use- and result-oriented PSS. Although many researchers underline the importance of integrating customers in the PSS development process, it remains unclear how PSS acceptance exactly could be improved. Chapter 2 reported that Living Lab research has been proposed by several authors as a useful approach to study PSS acceptance and to combine theory with practice (Beuren et al., 2013; Vezzoli et al., 2015).

This chapter reports on a living lab study that was an elaborate, longitudinal, and explorative field research on the acceptance of an existing PSS in the mobility domain. The main objective of this living lab study was to analyse the relation between PSS acceptance and user behaviour, motivations and barriers with regard to using this particular PSS. The living lab study was conducted over 4 years, and started 2 years after the introduction of this PSS. The living lab approach provided the opportunity to study the natural development of user behaviour and acceptance regarding the PSS in time, in a natural, and (semi-)unobtrusive setting. Applied methods included observations, interviews, and interventions.

The structure of this chapter is as follows: Section 3.2 will zoom in on the object of study: Skewiel Mobiel, a PSS in the mobility domain. It will briefly report on the societal context that motivated the need for the PSS, it will zoom in on Skewiel Mobiel as a PSS, and elaborate upon the research setup. Section 3.3 will explain the research methodology by which Skewiel Mobiel was studied. Consequently, Sections 3.4, 3.5, and 3.6 report on the conducted studies, and Section 3.7 reports on the development of the construct of lost habits, which are the principles that were found to result in acceptance of this particular PSS. Section 3.8 will report on two case studies in which the implications were studied of copying Skewiel Mobiel to a different context. Finally, Section 3.9 will draw a conclusion and discuss the findings yielded from this living lab, and the implications of using a living lab approach for PSS research.

3.2 SKEWIEL MOBIEL, A PRODUCT SERVICE SYSTEM

3.2.1 SOCIETAL CONTEXT: AGEING AND URBANISATION

Ageing will increase rapidly in the coming years, especially in the more developed regions in the world (United Nations, 2012). Together with overall increased life expectancy, this marks increasing population figures. These developments result in various societal challenges, such as increasing use of healthcare, the requirement of special houses for elderly, and a higher demand for supported mobility.

One of the efforts to react to named societal challenges was to encourage people to live healthier and to live longer independently. Being mobile is a crucial factor for an independent and healthy ageing population, but inescapably, mobility decreases when people grow older. One effect of growing older is physical decline, such as reduced eyesight or dysfunctional limbs, which might force elderly to stop driving a car or a bicycle. This may result in increased dependency on others or in feeling constrained.

Next to the issue of ageing, the Western society has reached an era of urbanization. Due to urbanization, rural areas become depopulated, and facilities such as banks, medical facilities, or supermarkets disappear due to a decreasing number of clients. As a consequence, rural areas transform from functional communities to purely residential areas (Simon, 2004). This development results in rural dwellers to become even more dependent on being mobile in order to continue using these facilities and executing their daily patterns.

Kullberg (2002) studied the Dutch situation, and found that elderly mostly stay behind in rural areas, or move to rural areas. As a result, they can become especially affected by this development. The combination of decreasing mobility and disappearing facilities can result in elderly that become homebound and start to feel lonely. Public transport is seen as an alternative to keep these people from solitude, but access to public transport in Dutch rural areas is low compared to that in cities, and has been decreasing (Harms, 2008). Moreover, Jorritsma and Olde Kalter (2008) found that Dutch elderly are not a substantial group of public transport users. Skewiel Mobiel was introduced as a solution to address these developments, and was aimed at offering easily accessible support for mobility.

3.2.2 HISTORY OF SKEWIEL MOBIEL

Skewiel Mobiel was created by care organization Skewiel Trynwâlden¹ in Oentsjerk. Oentsjerk is a small village in the municipality of Tytsjerksteradiel, located in the northern part of The Netherlands. See Table 3 for a compact characterization of the area, and see Figure 11 for a geographical overview of Tytsjerksteradiel and a more detailed overview of the main service area from Skewiel Mobiel.

In this area, facilities for daily life are available, such as shops, supermarkets, a library, and medical facilities. Many elderly have been living in this area since they were born and they did not intend to leave the area for a care home in the city. This is in line with the national trend (Kullberg, 2002).

In 1999, the care organization started an experiment. Goal of this experiment was to develop a “supermarket for wellbeing and happiness.” This supermarket for wellbeing and happiness was a philosophy that enabled elderly, living in the surrounding area, to compose their own care package of products and services that supported them to live a good life.

In the years after the philosophy was introduced, new housing and a service centre was built for the elderly living in Oentsjerk and its surroundings. Within this context, the board of the care organization noticed the need for an alternative and sustainable mobility service. This need was due to the decreasing amount of public transport offerings in the region. When the mobility service was introduced, it was named Skewiel Mobiel (Joris, 2008).

3.2.3 VALUE PROPOSITION OF SKEWIEL MOBIEL

Skewiel Mobiel offered demand-driven, short-range mobility to elderly that could have mobility levels that vary from homebound walks to recreational rides in the neighbourhood. The PSS was funded through a subsidy from the provincial government, which allowed a charge for one ride of 1 euro. The subsidy was intended to increase mobility for inhabitants of the rural environment of Friesland using environmentally friendly vehicles, thereby fitting with the goals of Skewiel Mobiel and the care provider’s philosophy of a supermarket for wellbeing and happiness.

¹ During the research reported in this thesis, Zorggroep Tellens incorporated Skewiel Trynwâlden, which was based in the village of Oenkerk. Zorggroep Tellens was an umbrella organization for different care locations in the area, and in the meantime, the name of Zorggroep Tellens changed into Patyna. For clarity reasons, this thesis will use the more general term “care organization” for referring. Despite these organizational developments, Skewiel Mobiel was always operated from the head office in Oentsjerk.

From the beginning, Skewiel Mobiel has been operated by one small, electric four-seater golf cart (see Figure 12), that was driven by volunteer drivers, who were from the same area as the passengers. These drivers drove the vehicle and supported the passengers when needed.

Skewiel Mobiel could be booked via the receptionist who worked in the main building of the care organization. After a booking is made, a volunteer driver picks-up the passenger at the desired location, and takes him or her to all desired destinations within the service area. As a result-oriented PSS, Skewiel Mobiel returns freedom and independence to its users. Figure 13 presents a visual representation of the service blueprint of Skewiel Mobiel, in which the service process and the service elements are included, and their interactions are displayed.

Table 3: Characterization of Tytsjerksteradiel at the time of the start of the Living Lab in 2011

Municipality of Tytsjerksteradiel
161,41 km2
~32000 inhabitants (CBS, 2011a)
17 villages (largest: +/-9455 inhabitants, smallest: +/- 200 inhabitants)
Burgum: 9455 (largest village)
Gytsjerk: 1955 (3 rd village in size)
Oentsjerk:1605 (6 th village in size)
Source: (CBS, 2011b)

Figure 11: Left: geographical location of Tytsjerksteradiel in the northern part of The Netherlands.
Right: detailed overview of the general service area of Skewiel Mobiel

3.2.4 SKEWIEL MOBIEL AS A RESEARCH OBJECT

The Skewiel Mobiel PSS is an interesting case to study PSS acceptance. As it has been in operation as a regular service for a few years before the living lab study started, it had the chance to mature and grow in a natural way. Moreover, it had the chance to become accepted, as it appeared that all stakeholders, such as users, drivers, and the care organization, were enthusiastic about the PSS. Moreover, clients and the care organization considered the PSS to be an asset of the area that could not be missed. This illustrates that the PSS was well accepted and integrated in the area. This was remarkable, especially since the PSS could be categorized as a result-oriented PSS.

Figure 12: Initially used vehicle for the Skewiel Mobiel PSS

Figure 13: Service blueprint of Skewiel Mobiel (adapted from: Joris, 2008)

Secondly, as the Skewiel Mobiel PSS was launched as a pilot project, it provided an easily accessible research environment for a number of reasons. One reason is that the PSS was very well documented since its creation, as it has started as a pilot project. As such, the design and implementation process were well reported, and the PSS has been monitored since its implementation, resulting in good facilitating conditions for archival research. In addition, stakeholders of the PSS were easily accessible for conversations and interviews, and the researcher could become easily acquainted with these people, because of the highly social character of the service and the environment. This enabled the researcher to conduct relatively unobtrusive observations.

Lastly, the care provider was willing to apply interventions to the PSS, and to involve researchers in the PSS development process. As a whole, these aspects made Skewiel Mobiel a good object for a field study, aimed at identifying factors that might have contributed to PSS acceptance.

3.2.5 SKEWIEL MOBIEL PSS ELEMENTS

During the research project, various interventions have been applied on Skewiel Mobiel. For a good understanding, this section presents Skewiel Mobiel in the way it was originally introduced. The applied interventions will be reported in the following sections.

Skewiel Mobiel was designed according to the service blueprint developed by (Joris, 2008), see Figure 13. She separated Skewiel Mobiel five elements. These elements were the following:

1) Vehicle

As a PSS in the mobility domain, a vehicle was considered a crucial element. It was used to move people from one place to another. The used vehicle was a small, electric vehicle that seated a driver and two to three passengers. Initially, Skewiel Mobiel was operated by only this vehicle, but later this element was manipulated and a different vehicle was introduced. The impact of this manipulation will be reported in Section 3.6.

2) Driver

The vehicle was driven by volunteer drivers that doubled as a buddy during user activities. Most drivers were retired and worked one day of the week for Skewiel Mobiel. They lived in the same area as the users, and were therefore familiar with the inhabitants and the facilities in the area.

Since the start of Skewiel Mobiel, the driver pool has been transforming as new drivers were hired and existing drivers retired. At various moments, drivers were interviewed and observed. Section 3.5 will report on the findings from driver interviews. The results from observations will be reported in other parts.

3) Receptionist

One receptionist managed the reservations. Every user that requested to use Skewiel Mobiel made an appointment through the receptionist. Next to that, the receptionist kept track of all rides, the availability of the service and acted as the organization's spokesperson to users.

Booking a ride worked in a two-way direction. The user proposed a time to the receptionist and both discuss whether that is suitable. If someone else had already booked the service, a mutual agreement was made about another time. The reception or user estimated how long a ride would take and the booking was made.

4) Registration system

The receptionist captured every booking in the registration system. In this system, contact details, home address, and mobility abilities of every user were registered. Moreover, when a booking was made, various additional data was registered, such as origin and destination, pick-up time, duration of the activity and date. This resulted in the creation of an elaborate archive.

For analysis purposes, the archival data was sampled and analysed in a quantitative study to PSS use. This study will be reported in Section 3.4.

5) Communication device

Every driver was provided with a mobile phone that he or she could use during a ride. When, during a ride, another ride was booked in the time slot right after the current ride, the driver could be contacted and updated with the new information. Although the communication device was initially considered useful, it gradually became obsolete, because drivers used their own mobile phone, or there was enough time to return to the head office, before a new ride would start. Because at some point the device was not used anymore, this element will not be elaborated upon in this thesis.

Next to these elements, users and the care provider were considered important stakeholders of the PSS. Although they were not explicitly part of the service elements reported in the service blueprint, they have played an important role in the entire research project as key stakeholders.

1) Users

Skewiel Mobiel provided mobility access to all elderly in the Trynwalden area. Most users were between 80 and 90 years old, and required support in walking or during activities to different extents.

As PSS acceptance relates to people's behaviour and habits, Skewiel Mobiel users were considered the most important data source for this research. Thorough insight in this group was developed by different types of analysis, such as interviews, observations, and measurements. The results of these studies will be reported in Sections 3.4 and 3.5.

2) Care provider

Skewiel Mobiel was operated by a care provider. Their task was to manage the organizational aspects of the service, such as making sure that drivers were available, that the electric vehicle was fully charged, or that drivers, users and the receptionist cooperated and used the service accordingly. Throughout the following sections, the role of the care provider will be referred to in relation to other service elements.

Chapter 2 presented that in a result-oriented PSS, not the used elements are leading, but the result such a PSS provides to the user. This implies an independency between the elements the PSS exists of, and the result the PSS can deliver. This illustrates that the elements that form Skewiel Mobiel can be deployed in a variety of ways, and that the amount of support Skewiel Mobiel offers varies per user. As such, the PSS can be considered a palette of elements, from which the user can select and apply the elements differently, in a personalized way. As a result, not every user would use the PSS elements the same way and to the same extent. For example, one user might require much support during an activity, thereby emphasizing the help of the driver, while another user only requires transport to a neighbouring village, and addresses value to being able to span a longer distance.

3.3 RESEARCH METHODOLOGY AND APPROACH

Chapter 2 delineated that living lab research can be a promising approach to combine research on practice and theory. The previous paragraphs have introduced Skewiel Mobiel as subject of study in a living lab. As such, Skewiel Mobiel has been thoroughly studied as a PSS, and the research focus was on PSS acceptance in particular.

In this section, the research methodology will be described. It will be explained what a living lab is, and what it can be used for. Next, the section will concentrate on the research methodology that was applied in the particular Skewiel Mobiel living lab.

3.3.1 A LIVING LAB APPROACH

Living labs are real-life experimentation environments where innovations are created by a multi-stakeholder approach (Ballon et al., 2005). Dell'Era & Landoni (2014) studied leading Living Lab definitions, and they found that no fixed definition has been established. However, they identified two main characteristics that are apparent in all living lab definitions:

1. A living lab is “a real-life test and experimentation environment;”
2. Users are “aware that they are co-involved in the innovation process.”

According to Sanders (2006), living labs can be positioned in a research-led, participatory mind-set, as opposed to a design-led, expert mind-set, as is presented in Figure 14.

Figure 14 further shows that a living lab approach can be positioned to overlap both user centred design and participatory design. This means that the user has a reasonably active role in the design process. Dell'Era & Landoni (2014) use Sanders (2006) to position living lab research in design research, and they point out that in Living labs, the context has a high impact on the user, and physical tools are used to study user behaviour.

Figure 14: Positioning of the Living Lab research methodology compared to other methodologies.
 Adapted from Dell'Era & Landoni (2014) and Sanders (2006)

As such, a living lab approach is a promising methodology to inherr the variables that relate to PSS acceptance in real life, and to disseminate these findings into the discipline of design. Next to this, a living lab situation can very well facilitate the research process for three main reasons:

- 1) As PSS are defined by an elaborate and continuous interaction with users, it makes sense to integrate these users in a study context and to gain familiarity with typical characteristics of the PSS and its users. As a result, interesting research directions and design interventions can be explored and tested in practice;
- 2) Behaviour change and formation of habits is an ongoing process. The longitudinal nature of a living lab facilitates to observe and interact with the PSS and its users longitudinally. This provides the opportunity to infer the behavioural variables that contribute to PSS acceptance;

- 3) The explorative nature of a living lab approach can result in valuable insights regarding PSS design methods, and how these methods can increase PSS acceptance.

Living lab studies that go beyond an initial pilot phase, are quite unique for PSS research (Vezzoli et al., 2015). The living lab study to Skewiel Mobiel was initiated after the PSS under study had passed the pilot phase, and became a well-established PSS. In addition to a well-reported pilot phase, this specific living lab study was very useful to study many of the aspects that currently lack in PSS research. It facilitated analysis of the role of stakeholders, the decision making process of the service provider, the working principles of the service, the service experience of users and drivers, and the relation between the service and local society.

3.3.2 TIMELINE OF THE LIVING LAB STUDY

Initially, the living lab study was conducted in a very unobtrusive way, in order to observe the PSS, its users, and the context. Aim was to become familiar with its users, their behaviour, the PSS elements, and the social environment. While research progressed, various interventions were introduced, and other methods were applied in order to identify what factors might have played a role in the acceptance of this particular PSS. See Table 4 for an overview of the conducted research methods, including the corresponding sections in this thesis, and see Figure 15 for a timeline that presents these studies and other important events.

Table 4: Overview of research methods per section

<i>Research topic</i>	<i>Source</i>	<i>Method</i>
3.4 Quantitative characterisation	3.4.1 Trip data	Archival research
3.5 User insights	3.5.1 Trip observation	Field research
	3.5.2 User interviews	Questionnaires
	3.5.3 Driver interviews	Questionnaires
3.6 Design interventions	3.6.1 Vehicle & Marketing	Program evaluation
3.8 Influence of the context	3.8.1 Aevus	Case study research
	3.8.2 Belbus	Case study research

Figure 20: Overview of the research steps and important developments with regard to Skewiel Mobiel living lab.

PhD research

Figure 16: Overview of geographical layout of Tytsjerksteradiel. Oentsjerk is located in the Northern part of the region

Figure 15 shows that the first design of Skewiel Mobiel was presented in 2008 by means of the service blueprint by Joris (2008), and consequently started as a pilot phase. This pilot phase was ceased and continued later as a Living Lab setting in Q3 2011. During the living lab study, the PSS increasingly became a more established PSS. As a result, the first living lab studies date from Q1 2012, and the last studies were finished in Q4 2015, covering about 4 years of studies.

3.4 FAMILIARIZATION WITH THE PSS

At the start of the living lab, archival data on rides was analysed, in order to obtain an insight in how people use the Skewiel Mobiel PSS. This analysis focused on obtaining an overall impression of the whereabouts of Skewiel Mobiel.

3.4.1 TRIP DATA: DESTINATIONS

For a profound insight in how the PSS is used, quantitative data was collected and analysed. Archival records were used, that were extracted from the registration system. This data included locations and the functional purpose of the visit, the travelled distance per ride, the time on the day, travel duration, and the number of active users that used the PSS.

Based on this data, an initial characterisation of the use of Skewiel Mobiel could be made, supporting following steps towards a further understanding of why the PSS is accepted. In this section, this data is reported and a general impression is shared about the use of Skewiel Mobiel. Figure 16 represents the villages in the area and the most important infrastructure. The entire area spans roughly 20 x 25 km.

METHOD

The travel data was extracted from booking information managed by the care provider's reception desk, and contained the date, user, origin, destination, departure time, and expected travel time for each ride made with Skewiel Mobiel. Based on this information, popular locations, average travel times, and popular travel days were studied. Finally, this data provided insight in main usage patterns and presented a frame of reference for further studies.

SELECTION

For this study, travel data was used that was collected from 1st November 2012 until 20th December 2013. In this time span, 67 unique users were registered, and 482 rides were made. Most rides were return rides, which usually means that the driver waits or joins the user's activity until the activity is finished. Some rides were unidirectional, and eight rides

were registered to contain more than one destination. For 120 rides, this data was not enclosed.

RESULTS

Visual representations of the data were made to make the data easier to interpret, see Figure 17 and Figure 18. Figure 17 shows the amount of rides within and between villages. According to the travel data, a high amount of short distance rides was made, and larger amount of rides were made within or around the village of Oentsjerk (labelled 'OEN'). In Oentsjerk, the main office could be found, as well as most care services. Moreover, most users live here. Other frequently visited villages (i.e. Gytsjerk: 'GYT' or Aldtsjerk: 'ALD') are located within a range of three kilometres around Oentsjerk. See Appendix A for a numerical representation of the rides.

The largest travel distance during the monitoring period was approximately fifteen kilometres. This was registered two times. On the other hand, approximately two thirds of all rides were made within a distance of three km, from which half of the rides were made within the borders of a village. Additionally, travel data showed that 62% of the rides took an hour or less.

Next to travel distances, data was analysed on the purpose of every ride. This data is presented in Figure 18. 12 categories have been discriminated. These categories are rather arbitrary, but considered general enough for an informative glance on the visited destinations. The most important categories are related to shopping and related to a visit to the community centre. Another large category is "unknown," and this represents rides from which no purpose was registered, and from which, based on the address or description, no purpose could be extracted.

According to this figure, roughly half of all rides were shopping related. This category is divided in rides explicitly to one of the two supermarkets in the area, and in rides to other shops, such as the flower shop, a convenience store, the bakery, or the butcher. Next to shopping, many users used Skewiel Mobiel for rides to the community centre. Such rides were often intended for visiting medical facilities such as the family doctor, dentist, or pharmacy, or visiting the care centre for facilities, such as the restaurant, physical therapy, or for organized social activities.

Other categories, such as work, leisure, visit, and public have been visited less often. However, it would have been not possible to integrate these categories in other categories due to the nature of these destinations. For example, leisure included a visit to the pub, visit

included a visit to a friend, and public included a visit to the city hall for official documents. See Appendix A for a numerical representation of the travel purposes.

3.4.2 INTERMEDIATE DISCUSSION AND CONCLUSION

Analysing archival records showed that users used Skewiel Mobiel for travelling very short distances, generally within one village, or between two neighbouring villages. Users used Skewiel Mobiel for daily activities, such as doing groceries and visiting medical facilities, such as the doctor, dentist, or physiotherapist. Interestingly enough, socially oriented rides such as visiting friends or family were not often seen.

Another important finding is that only 8 rides were registered as multidirectional. However, according to practical findings and the experience from the care organization, more multidirectional must have been made. Reason for this lack of registration is that many rides are booked in an informal way, in which usually the main destination is named. Only during the ride, many users mention that they want to visit another location. Although this is an undesired situation from a research perspective, it is an important finding. It stresses that many users use Skewiel Mobiel in a flexible way, just as they would have done when they still could have used their bicycle or foot.

Based on these findings, Skewiel Mobiel rides can be generally characterized by short distance rides that could easily be done by bicycle or by foot. Moreover, Skewiel Mobiel is sometimes used for more than one destination per ride. Such activities are typical activities to maintain daily life. This suggests that Skewiel Mobiel is especially applied in situations to continue daily life.

3.5 USER INSIGHTS

The previous section has reported on quantitative travel data. Such data provides an objective impression of the Skewiel Mobiel PSS, but it does not provide insights in reasons why people visit these locations, and why they use Skewiel Mobiel for it. In order to do so, qualitative research is necessary, providing user insights that support understanding PSS acceptance. This section will report on a qualitative analysis of Skewiel Mobiel. This will be done by reporting on observations and stakeholder interviews with users, drivers, and representatives from the organization. Firstly, a sample ride will be presented. During this ride, the researcher travelled along with two users and a driver. This ride was conducted to obtain an understanding of the working principles of the PSS in practice.

Figure 17: Visual representation of the geographical lay-out of the Skewiel Mobiel service area. Circles represent visited villages in the area. I.e. “OEN” represents Oentsjerk, “GYT” represents Gytsjerk. Arrows represent trips from one village to another. Arrow thickness corresponds with trip frequency. Looped arrows represent trips within village borders. See Appendix A for a numerical overview.

Figure 18: Visual representation of the purpose of Skewiel Mobiel rides. Arrow thickness corresponds with the frequency of the rides. See Appendix A for a numerical overview.

Second, semi-structured interviews and ad hoc interviews were conducted. Semi-structured interviews will be reported individually, and the results of ad hoc interviews will be used for further explanation or interpretation of data. Lastly, drivers were interviewed during a variety of encounters.

The following paragraphs will first report on the sample ride, followed by user interviews and driver interviews. Finally, the results will be discussed and combined with findings from informal conversations and the quantitative data. This will result in an insight in the values Skewiel Mobiel could offer to users.

3.5.1 SAMPLE RIDE

In order to obtain an understanding of the working principles of the PSS in practice, early in the research period, a number of rides were observed by driving along as a passenger. This section illustrates a typical ride with Skewiel Mobiel.

Figure 19 presents the conducted sample ride. The ride took one hour, and four different locations were visited. All locations were located in Oentsjerk and Gytsjerk, the neighbouring village. The total distance travelled was less than 5 kilometres.

Initially, the ride was booked by one user, for one user. However, when the driver arrived at the intended user, another user appeared. The users were relatives from each other, and there were no issues in taking this second user on the ride. Both users lived in Oentsjerk and stayed together until the end of the ride.

During the ride, the driver alternately joined one user during an activity, or waited in the vehicle, together with the other user. The researcher remained in the back of the vehicle, and either accompanied the users or driver during their activities, or waited in the vehicle and interviewed the waiting user about her experience with the PSS.

The user who booked the ride (User 1) used Skewiel Mobiel on a weekly basis for all kinds of activities. She was a relative of the unannounced user (User 2), who used Skewiel Mobiel only when it rains, as an alternative for her bicycle. Because both User 1 and the driver had a fixed travel day, it happened that they became well acquainted with each other. As a result, User 1 considered the driver as her favourite driver, because he knew User 1's weekly shopping list, and he knew when she needed support in anything. This was highly appreciated by User 1.

Figure 19: Overview of the tasks, visited locations, and service provided by the driver

Locations were visited alternately for User 1 and User 2, and the driver supported when required, and to the required extent. For example, he walked User 1 to the supermarket, let her do the shopping independently, and waited at the cashier desk to help her pack her bag and to carry the bag to the vehicle.

During the ride, several locations were visited, for either User 1 or User 2, but both users did not have shared destinations. The ride, including the driver activities are presented in Figure 19.

FINDINGS

Covering 5 kilometres in one hour shows a sheer ratio between driving and doing an activity. Driving from one place to the next activity took far less time than the activity itself. Ride duration was generally very short and varied from a few seconds to a couple of minutes, while the activities took much longer, due to lengthy ingress and egress, the actual execution of the activity, and additional time for social encounters. Here, two interesting remarks can be made. First, visiting more shops in a row per user is possible with Skewiel Mobiel, even when another user wants to visit another shop. Moreover, neither user had to wait to be picked up, because the driver was always there when the activity was ending.

Second, the service seemed to provide much time for activities and social encounters, and little time for being on route, despite being a mobility service. Remarkably, conversations could take longer than the actual activity, even when another user was waiting in the vehicle. At one moment, the driver had a long conversation with a shop owner, while the user had already finished her activity. Nonetheless, she did not seem to bother and waited until the driver finished his conversation.

Based on these two findings, remarks should be made about the value a PSS could offer a user. Chapter 2 showed that many PSS design methods and tools are aimed at carefully defining a PSS, the expected use scenarios and its intended use. However, a scenario in which a driver takes more time during an activity than the customer would not have been formulated. Additionally, it would have been hard to define exactly when a customer needs help and when not, and it would be unlikely that a driver was instructed to learn the shopping list of one particular client. Although such particular situations would probably not have been designed, the design of Skewiel Mobiel allows for such situations. Consequently, this suggests that PSS values are not necessarily always designed in the design phase. Instead, value can appear when the PSS is provided flexibly enough.

3.5.2 USER INTERVIEWS

Semi-structured interviews were conducted in order to study Skewiel Mobiel users more elaborately. Both frequent users and new users were interviewed, and the objective of these interviews was to gain insight in the needs and values related to activities, mobility, and Skewiel Mobiel usage.

The interviews consisted of two parts: a structured questionnaire, and an open interview. The questionnaire contained 49 multiple-choice items, regarding mobility use, the appreciation of the vehicle, and the overall service appreciation. The open interview focused on the activities the respondent could, could not, and would like to do, and the role of Skewiel Mobiel in his or her life. Both groups were presented a few additional, but different questions that aimed more specifically on their experience as either a frequent user, or a new user. See Appendix B for the questionnaires.

All interviews were recorded by a voice recorder for analysing purposes. Answers were immediately written down near the corresponding questions. After the interviews, the answers were checked by transcriptions of the audio recordings. Each session took approximately 2 hours, and all but one interview were conducted in the respondent's homes. The latter interview was conducted in the Skewiel main building.

PARTICIPANTS

Invitations were sent to 13 frequent users of the service. The users were selected, based on historical data. Frequent users were selected, based on use frequencies of at least once a month. New users were selected if they had used the service more than once during the past month. Frequent users were invited due to their experience with the PSS. New users were invited to gain insight in their reasons to start using the service.

The invitation included a letter to explain the goal and procedure of the interviews, and a questionnaire that could already be completed. Furthermore, the letter announced a phone call to make an appointment for conducting the interview and finishing the questionnaire.

The 13 invitations resulted in nine respondents (8 female, 1 male. Age: 65 to 93, average: 81). Eight respondents were visited personally for the interview, and one respondent only completed the questionnaire, as a personal interview could not be arranged due to planning issues. Unfortunately, male participants were underrepresented in this study. This is most expectedly due to the large share of Skewiel Mobiel users being female.

RESULTS

The results from the questionnaire were analysed, based on the mean score of the given answers. The results of the interviews were analysed and interpreted manually, and were merely aimed at gaining a general insight in the service experience. Consecutively, the outcomes of both analyses were combined in order to interpret the findings.

USER CHARACTERIZATION

8 of the 9 respondents lived alone. 5 were widowed, 1 divorced, and 1 was single. 1 respondent was married and lived together with her husband. None of our respondents possessed a driver's license. Furthermore, 7 respondents used domestic help, 5 used home care, and 1 did not answer this question.

Regarding mobility means, 8 of 9 respondents used a wheeled walker, 8 of 9 used supported, individual transport (WMO transport), 5 of 9 had a bicycle, although most did not use it regularly. Only one respondent used a mobility scooter.

ACTIVITIES

8 of 9 respondents were able to perform most daily activities independently, and all respondents mentioned that they were unable to continue some of the activities they used to do. For example, respondents had to stop taking part in associational activities, such as gaming, singing, or handcrafting, mainly due to reduced mobility.

In spite of some respondents taking part in activities organized in the main office, most have become homebound and performed activities at home, such as handcrafts or reading, or they invited family and friends at home. Six respondents executed activities around the house. One respondent was an active gardener, while others made small walks around the block once or twice a week.

Although most respondents reported to have become unable to do certain activities, the larger part indicated not to really miss these activities. Thereby, the influence of Skewiel Mobiel on activity patterns was reported to be slightly positive in some cases, but absent in most cases.

SKEWIEL MOBIEL USAGE

Generally, respondents have been introduced to Skewiel Mobiel via others, such as family, friends, or employees from the care organization. Their use could be triggered by either necessity, or convenience. For example, a number of respondents started using Skewiel Mobiel due to physical decline, such as not being able to cycle anymore, or becoming wheezy, and others started out of convenience, such as needing transport when it rains.

In addition, respondents indicated that they had limited access to other types of transportation. Most respondents had to give up cycling and all used a wheeled walker outdoors, from which two additionally used it indoors. One visually impaired respondent mentioned not being able to leave her house at all and used Skewiel Mobiel to cover a 100m distance to the Skewiel main building. Another respondent used Skewiel Mobiel only to visit the physiotherapist, whilst other respondents had difficulties with walking longer distances, and used Skewiel Mobiel to overcome the distance to the supermarket and other shops.

BOOKING PROCESS

In several interviews, the booking process of Skewiel Mobiel was explicitly appreciated. It was regarded as very easy and respondents appreciated that a ride could be booked at the last moment. Respondents also indicated that they appreciated the receptionist, especially because he knew most users by name and was up-to-date with the area. In addition, he seemed to know the frequent rides of most users.

SKEWIEL MOBIEL COMPARED TO OTHER MOBILITY MEANS

In order to compare people's evaluations of Skewiel Mobiel with other mobility means in the area, respondents were asked how they compared Skewiel Mobiel to other mobility means, such as car, bicycle, and other transport services, such as WMO transport. WMO transport is a subsidized taxi service that people can use who are unable to use individual transport (De Klerk, Gilsing, & Timmermans, 2010). Generally, one taxi provider was appointed to provide WMO transport in a predefined area, and people needed to have a permit to use this transport in a subsidized way.

The interviews indicated that users did not prefer Skewiel Mobiel to a private car or a bicycle, and none of the respondents was able to use either of these modalities anymore. Instead, they preferred Skewiel Mobiel to using a taxi or WMO transport because of a number of reasons. One respondent did not see any advantages over mobility alternatives, but agreed that the service could be helpful to others for running errands. Other respondents reported the availability of Skewiel Mobiel as a benefit, compared to other mobility services. Especially the fact that a mobility option is closely available, even if it is not needed yet, seemed to deliver a feeling of support and security for most respondents.

Compared to other mobility services, respondents reported to be generally satisfied with the local WMO transport provider, but they were not satisfied with the time interval in which the WMO taxi arrives. Usually, this service arrives within a time-span of 30 minutes around the reserved time. As a result, people have to wait for a long time, before the taxi arrives. In

contrast, they appreciated that Skewiel Mobiel arrived on the agreed time. One respondent illustrated this feature as “you make a phone call and they arrive.”

Another benefit of Skewiel Mobiel was the high manoeuvrability of the vehicle, and its ability to stop literally in front of the door, even in small alleys. This seemed to be an important aspect, because some users had a very limited walking range and walking shorter distances to the vehicle resulted in the ability to cover longer distances during the activity.

Ultimately, it was found that most users had individually preferred days in the week to use Skewiel Mobiel. The fact that drivers work on fixed days added to this, and most respondents reported a good and friendly relationship with their regular driver. Reported benefits of having a fixed driver were that drivers knew when to wait or help during an activity, or knew for some users what they normally had written on their shopping list. As a result, drivers were able to remind the user when he or she forgets to pick a product in the supermarket.

DEPENDENCE ON SKEWIEL MOBIEL

Respondents were also asked how they expected to be affected if Skewiel Mobiel should disappear. This question was asked to estimate the perceived impact of the service on everyday life. In general, respondents mentioned that they would use alternatives, such as WMO taxi, or that they would reduce their outgoing rides. Delivery services were also mentioned for doing groceries or lending books from the library, and two respondents explicitly mentioned that they would like to see a product before buying or borrowing it, and losing Skewiel Mobiel would make this impossible.

3.5.3 THE DRIVER’S PERSPECTIVE

Drivers were considered experts in the service. They interact with many different users during a ride, which provides them a good frame of reference to judge the value of the PSS for users. Additionally, drivers can be considered PSS user themselves, because the PSS provides value to the drivers too.

In order to analyse the value of Skewiel Mobiel, observing drivers, and conducting driver interviews was expected to yield insights into how drivers experience the service, and about what they consider important values of the service.

In this paragraph, the findings of this analysis will be reported.

METHOD

Around 8 different drivers were interviewed in an informal way, at several moments during the living lab study. Some drivers were interviewed more than once, others were interviewed only once. These informal interviews took place during and after rides they have made with their user, or during company meetings, organized by the care organization. The interviews were not scripted, and had an ad hoc character, they were considered useful to obtain situational insights and to analyse the social interactions between drivers and users. The interviews concerned the driver's opinion about the vehicle, the booking procedure, visited locations, and their experience with the service.

FINDINGS

Generally, five to ten drivers were available for driving. Every driver worked on a predefined day of the week, or part of the day. All drivers were volunteer, most were male, and they normally lived in the same area as the people using Skewiel Mobiel. Most drivers were retired and over 60 years old, but some of the drivers were younger, or unemployed for a different reason. Most drivers mentioned that they were looking for a day activity and they considered Skewiel Mobiel as an ideal opportunity to be of use for the local society.

Because most users use Skewiel Mobiel on predefined days, drivers and users often met each other on a regular basis. As a result, drivers knew the locations users often visit, and they knew what support is required by a user. This familiarity between drivers and users enabled the drivers to provide users just the right amount of service and made the service experience highly customizable. Users appreciated that drivers were up-to-date with their requirements, and at the same time, drivers pointed out to enjoy providing the service, because they received social value from the service in return.

As such, supporting others and having social interactions with users and other inhabitants of the area seemed to prevail over efficiency. This resulted in many drivers to feel highly useful and appreciated, and at the same time, the service enabled drivers to meet others and talk to local people during a ride, or during waiting times. This indicated that the service did not only offer social value to users, but also to drivers, who can therefore be considered a specific user of the result the service offers.

3.5.4 INTERMEDIATE DISCUSSION AND CONCLUSION

This section reported on three qualitative studies on Skewiel Mobiel. In addition, less formal studies were conducted by means of ad hoc interviews with users, drivers, and the care organization. In this paragraph, these findings will be discussed, and a conclusion will be drawn.

Firstly, according to the driver and the users in the sample ride, the ride was exemplary for most Skewiel Mobiel rides. This implies that it is normal to the PSS to visit more locations during one ride, to have social encounters, and to cover short distances. Moreover, the small size of the vehicle showed to be very practical, because it could park in an alley, or right in front of the door of the supermarket, limiting the walking distance for the users. Vehicle speed and comfort seemed not important, due to the short distances.

Secondly, observing Skewiel Mobiel from a driver perspective, and conducting unscripted interviews with drivers yielded valuable insights on the manner how both users and drivers experience the Skewiel Mobiel PSS, and what makes the PSS valuable for them. It was remarkable that the relationship between drivers and users was generally good, and both parties seemed to know each other very well. Oftentimes, the driver accompanied the passenger during activities and acted more as a buddy, rather than as a servant. In addition, with the help of the driver, passengers were able to perform activities they could not do alone. This resulted in increased social connectedness, and increased independency, which seemed to be two key values for the PSS.

The social value of Skewiel Mobiel for the drivers became clear when they mentioned to be unsatisfied with the low frequency of the rides they make on a day. Sometimes, a low number of rides per day were booked and the drivers did not like this at all. As compensation, the care provider made an agreement with a local mental healthcare provider, It Aventoer, to offer contracted rides between housing and activity centres. By doing so, the care provider has increased the ride frequency, but from a social perspective and not from an economical perspective.

Lastly, next to the practical whereabouts of Skewiel Mobiel, the user interviews indicated that Skewiel Mobiel is especially used for conducting daily activities, in a very common way. Daily activities are shopping, visiting a doctor, or doing groceries. Such activities are habitual activities for most people, and the interviews confirmed that for Skewiel Mobiel users, such activities have become very difficult, because of physical decline.

The interviews also showed that users had a general appreciation for specific characteristics of Skewiel Mobiel, such as the possibility to cover short distances and the high reliability or arrival and departure times. In addition, the interviews indicated that Skewiel Mobiel offers a very personal service experience, which was highly appreciated.

These points illustrate an important difference with regular demand based transport, such as WMO transport. Skewiel Mobiel seems to fit very well with daily life, while WMO

transport requires people to change their behaviour by letting people wait for an unknown time, or by offering only mobility, and not support during an activity.

On a more general level, these studies suggested that people liked the idea of having a mobility option closely available when they need it, even if they do not need it continuously. Hence, being a back-up option can be considered a very high social value of the service.

This implies that Skewiel Mobiel should not only be considered a pure mobility PSS, but that it radiates a strong impact on secondary tasks, related to the offered mobility. Thereby, Skewiel Mobiel seems to connect seamlessly with people's past behaviour in such a way that they seem to be less affected by their deteriorated mobility. Especially in comparison with other demand based transport offerings, the absence of waiting time, reservation issues and insecurity about when the taxi arrives, shows that Skewiel Mobiel suits better with people's lost daily patterns.

Hence, according to users and drivers, and based on observed rides, Skewiel Mobiel can be considered valuable for its social impact, and for the way it supports users in conducting activities they could not do anymore. Thereby, it suits past behaviour and daily patterns.

3.6 THE IMPACT OF INTERVENTIONS: PROGRAM EVALUATION

During the living lab period, the care organization had decided on applying a number of interventions to the PSS. On one hand, these interventions were intended to increase the ride frequency, on the other hand, these interventions were a good opportunity to test which aspects of the PSS could be modified to increase use numbers. This was done by upgrading Skewiel Mobiel as a PSS, and by aiming to renew the attention for Skewiel Mobiel.

The impact of these interventions on use numbers were measured using the travel data gathered from the booking information. This section will zoom in on conducted program evaluation research that aimed on establishing the relation between user progression figures and the employed interventions.

3.6.1 METHOD

For this study, travel data was analysed over the period from November 2012 until July 2015. 70 users have been registered during this period, and 1714 rides were conducted. Unfortunately, data from January 2014 until May 2014 has been registered falsely, so this time interval was left out of the analysis.

During the monitoring period, four different interventions have been employed. The interventions were:

1) Introduction of a new vehicle

Skewiel Mobiel was operated by an electric GEM e4, which was an upgraded golf cart. Although users did not complain about the vehicle, the care organization had the impression that the Spartan character of the vehicle withheld potential users from using Skewiel Mobiel. Additionally, the rather low top speed and limited range of the GEM made it respectively hazardous to drive on the regional road and difficult to reach more distant locations. In order to cope with these issues, the care provider searched for a replacement vehicle. After an elaborate selection process, a new vehicle was found and introduced in May 2013. Along with this introduction, the service area was expanded, enabling users to visit locations that are further away, and that used to be out of reach.

2) A promotional campaign

In order to increase attention for the Skewiel Mobiel PSS and the new vehicle, four promotional activities were consecutively employed in the period after the introduction of the new vehicle. During four weeks, every week one campaign was performed. The promotional activities consisted of discount vouchers in four participating shops: two supermarkets, a fishmonger, and a bakery. These activities included one fish for free, or discount on bread. A special discount voucher was developed that users could show in the participating shop. All users were allowed to take part in these activities.

3) Approaching an additional user group

Paragraph 3.5.3 reported that Skewiel Mobiel drivers were unsatisfied about the number of rides they could make. In order to satisfy the drivers, the care organization searched for an additional user group to increase the ride frequency. Finally, they found It Aventoer as a partner for which they could conduct short rides.

It Aventoer is a day activity organization for mentally and physically disabled people. Every day, clients moved between their home and a day activity, and the care provider agreed with It Aventoer to take over a number of rides. Although the primary reason was to satisfy drivers, another reason was that a new user

group fitted with the organization's ambition to offer an open-access mobility service to all types of users in the area.

4) A Christmas present

At the end of 2014, every client of the care organization was handed a Christmas present. Part of this present was a free ride with Skewiel Mobiel. Goal of this free ride was to offer a low-level introduction to Skewiel Mobiel and to make more people aware of the benefits of Skewiel Mobiel. Ultimately, this was expected to increase the use frequency among a wider audience.

Figure 20: Replacement vehicle for the Skewiel Mobiel PSS

Figure 21: Trip frequency made by Skewiel Mobiel in the period November 2012 until July 2015. Figures are both including and excluding clients from It Aventoor. No data was available in the period January 2014 until May 2014.

3.6.2 RESULTS

Figure 21 displays the number of rides made with Skewiel Mobiel during the analysed period, including and excluding the registered rides made by clients from It Aventoor. The influence of each intervention will be elaborated upon next.

1) The introduction of new vehicle (May 2013)

Prior to selection of a new vehicle, an elaborate selection process was conducted. Selection criteria included easy ingress and egress, size, manoeuvrability and interior space. The selection process was executed together with users, drivers, and the care organization. Finally, one vehicle was selected, and this was the Mia, as was presented in Figure 20. After installation, the ride development was

monitored. According to the data, a slightly increased use frequency is noticed. This increase might be partially due to the new vehicle, but other factors might also have contributed to an increase. Therefore, it can be concluded that the vehicle might have had an impact on use frequency.

2) A promotional campaign (May/June 2013)

During the promotional weeks, 8 times a participating shop was visited. According to the user interviews, 6 out of 9 respondents were aware of the campaign, but they indicated that they did not visit a participating shop, especially because of the promotional campaign. If they did, this was in line with their weekly routine. As such, no increased ride frequency was observed, and it was concluded that the promotional activities did not have a significant impact on use frequency.

3) Approaching an additional user group (November 2013)

From the moment clients from It Aventoer were invited to use Skewiel Mobiel, the ride number increased substantially and the increase remained stable throughout the monitoring period. On average, a surplus of 35 rides per month was registered, which means an average increase of 42%. Likewise, 10 users were registered as being a client from It Aventoer. This implies that extending the service provision to It Aventoer did have an impact on the use frequency of Skewiel Mobiel. Hence, offering access to clients from It Aventoer might be considered a successful intervention.

4) Christmas present (December 2014)

The effect of offering a Christmas present seems to be temporary. December 2014 and January 2015 show a significant peak in ride numbers, and according to representatives of the care organization, many people indeed used the free card for a ride, such as travelling to the Christmas banquet that was organized in the Skewiel Main Building. Despite this, the number of rides decreases after January, which suggests that the effect of this travel card might have been only temporary. Insight in the long-term effect of the Christmas present requires more profound analysis that was out of scope of this research.

3.6.3 INTERMEDIATE DISCUSSION AND CONCLUSION

Four interventions were applied to the Skewiel Mobiel PSS. Objective of these interventions was to increase the user base and the use frequency of Skewiel Mobiel. The effects of the interventions were measured by analysing travel data, but more importantly, the researcher conducted ad hoc conversations with the care organization, users, and drivers to get an impression of the effectiveness of these interventions.

During the monitoring period, a slow increase in use frequency could be found. This might be due to the interventions, but it might also have been caused by additional effects. First, the interventions will be briefly discussed, followed by a discussion on possible additional effects.

Among interventions, especially the additional user group had a clear effect on an increasing use frequency. Because these users required mobility a few times a week, this was a promising intervention, that shows that offering a PSS in line with existing behaviour can be well accepted.

The new vehicle might have caused an increase in use frequency, but this cannot be validated. The new vehicle offered more comfort and the possibility to visit more distant locations. The increased comfort could hardly be validated by data, although the slight increase of users might be an indication. The possibility to reach more distant locations was justified by the travel data. This data indeed showed that longer distance rides were made, but the biggest part of the rides remained within the range of the former vehicle.

The promotional campaigns did not have a noticeable effect on PSS use. According to the data, the participating shops were not visited more often, compared to regular weeks. The Christmas present might have had an effect. Informal talks with stakeholders resulted in additional findings on the impact of these interventions. For example, according to stakeholders, the introduction of a new vehicle did have an effect on attention. In the first place, the care provider seemed to renew their attention for the PSS. For example, care employees started to use the PSS for rides with clients, and more people noticed the vehicle and knew what its purpose was.

Moreover, this renewed attention might have radiated to other people living in the environment, and thus resulted in increased PSS use. Hence, although Skewiel Mobiel users did not consider the vehicle in itself an important factor for PSS acceptance, it might have played a role in attracting attention for the PSS. Thereby, changing vehicle element is considered a facilitating element in PSS acceptance.

3.7 A CONSTRUCT OF LOST HABITS

Based on the findings reported in the previous sections, Skewiel Mobiel seemed to be well accepted because of how it is able to support its users in doing normal, day-to-day activities. Such activities were mostly shopping-related, but also related to rides to medical facilities, or conveniences as the hairdresser. These activities can be considered daily and repeating activities, and fit very well with (past) behaviour that is typical of the user group.

Past behaviour is often referred to as habit, or habitual behaviour (Limayem et al., 2007), which implies that Skewiel Mobiel is often used to conduct habitual behaviour. However, on top of that, Skewiel Mobiel did not only support people in conducting these normal day-to-day activities, but also in conducting these day-to-day activities in a very common way.

This point can be well illustrated by comparing Skewiel Mobiel with WMO taxi services. WMO taxi is quite well able to support people in doing day-to-day activities, too. In both situations, people are picked up at their desired location and taken to their required destination, where they can conduct their day-to-day activity. When people are finished, they are taken back home, where the journey ends.

Differences between Skewiel Mobiel and WMO taxi arise when zoomed in on the processes that are needed to conduct the day-to-day activity. Using WMO taxi requires a cumbersome process of early booking, insecurity about arrival times, picking up other passengers, and long waiting times. Moreover, the role of the driver is tightly defined as a person who drives the taxi, and interaction between user and driver is kept to a minimum. This process is much more complex, formal and less flexible, compared to Skewiel Mobiel. For Skewiel Mobiel, booking a ride with Skewiel Mobiel involves much informal contact, shorter waiting time, and a very agile driver who offers just the amount of support needed. The service provision is thereby adapted to the user, such that a demanding user receives more support than a quite independent user. Other differences are the unplanned use scenarios that are solved in an ad-hoc and humane manner. Examples are the possibility to visit more locations during one ride, user choices for driving a certain route, and drivers that happen to remember user's shopping lists.

As such, Skewiel Mobiel can be considered a tool that lets people conduct daily activities in a comparable fashion as they used to do. Thereby, it adapts on the user by supporting just enough to compensate certain lost capabilities. This is a very important value, because losing small capabilities (writing a shopping list, walking 100 metres, carrying groceries) can act as a barrier to conduct other activities. As a result, a person that loses a small

capability, can suddenly be forced to cease certain activities, and consequently cease habitual behaviour. Hence, he or she loses important habits.

This implies that Skewiel Mobiel was able to compensate for these lost habits. By doing so, it enabled people to come outside, talk with others, and hear about the latest news. Thereby, it seems that not only recovering the ability to conduct physical activities is an important aspect of the PSS, but also the more social and emotional aspects of these activities, such as maintaining social contacts, or the positive feeling that activities can be conducted in an independent way.

Sufficiently compensating lost capabilities, and thereby recovering daily activities and addressing important values, might be at the core of why Skewiel Mobiel is so well accepted. Based on these findings, a construct of lost habits was formulated as main contributor to the acceptance of Skewiel Mobiel. A construct is an idea based on observation and inference of data, and constructs should be tested on robustness and adjusted by further observations and studies (Graziano & Raulin, 2004).

Based on the findings from this living lab study, the construct of lost habits was developed, and this construct entailed that *providing access to valuable activities, that people have lost, might have a positive impact on PSS acceptance*. In order to test this construct, a systematic approach was developed, and more and more constraints were introduced to test the robustness of this construct. This will be reported upon in this chapter and following chapters.

Firstly two case studies were executed. These case studies were intended to evaluate whether the construct of Lost Habits could be found in another context. In order to do so, the Skewiel Mobiel PSS was copied as precisely as possible to two different contexts. A case study is a method to observe participants' responses in a "moderately limiting environment," by slightly intervening (Graziano & Raulin, 2004). Case studies are a very useful way to generalize research findings (Graziano & Raulin), and case study research is an often applied method in PSS research (see i.e. Clayton, Backhouse, & Dani, 2012; Komoto, 2009; Simonse & Badke-Schaub, 2015; Vezzoli et al., 2015). The following section will report on these case studies.

3.8 INFLUENCE OF THE CONTEXT ON ACCEPTANCE OF THE PSS

In this section, two case studies will be introduced: Aevus PSS and Belbus PSS. Both PSS copied the general Skewiel Mobiel blueprint. The goal of these case studies was to evaluate the construct of lost habits, and thereby to study whether similar principles are true for the acceptance of Aevus PSS and Belbus PSS. In order to do so, the Skewiel Mobiel PSS was copied as precisely as possible to two different contexts: one urban environment, and one rural environment, but in a different area than where Skewiel Mobiel operated. Being a copy means that the same service blueprint was used and that the same PSS elements were used.

The following paragraphs will report on both case studies. Finally, the section will conclude with the lessons learned.

3.8.1 AEVUS PSS CASE STUDY

The Aevus case study was conducted in October 2012, and in collaboration with researchers from different research institutes. For this case study (see Figure 22 for an impression), Skewiel Mobiel was copied to an urban area in a different part of the country, which was the city of Eindhoven. The case study took two days, and two research questions needed to be answered:

- 1) Does a different context indeed result in similar findings concerning the construct of lost habits?
- 2) How does a different context affect the PSS itself, regarding the PSS elements, and the organization of the PSS?

While it was expected that research question 1 could be answered positively, research question 2 was expected to provide new insights, based on differences between a rural and an urban area. It was expected that i.e. congestion, increased distances and travel times, inherent to a city, would follow into decreasing vehicle availability. This caused uncertainties about whether the vehicle could arrive on time, and whether a driver could help another user during the waiting time for the served user. In addition, increasing travel times would result in drivers being more on-route, driving for users, and therefore lacking the opportunity to return to the starting point after every ride. On one hand, this meant that more vehicles might be required. On the other hand, more dependency on the communication device was foreseen, so that drivers could be called during a ride to pick up the next user.

METHOD

The city of Eindhoven was selected for this case study. Eindhoven is an urban area in the southern part of the Netherlands. This area is different from the area where Skewiel Mobiel is operated in many ways in terms of culture, demographics, and facilities. By selecting a completely different area, the effect of the context on the PSS would be clearly visible. Moreover, if the findings of this study would show similar principles that result in the construct of lost habits, the context could be considered to have an insignificant impact on the PSS, thereby being a rather independent variable.

MATERIALS

The Aevus PSS was based on the Skewiel Mobiel service blueprint, and the case study was conducted in collaboration with a local care provider to offer mobility to its clients. Although the Skewiel Mobiel service blueprint was used, minor modifications were applied: the number of vehicles was increased and the communication device played a larger role, as was explained before. Another modification concerned the booking process; In order to have a guaranteed user availability, and thus be able to test the PSS correctly, bookings were made several weeks in advance. Despite this, it was still possible for people to book a ride during the case study. This is slightly different from the ad hoc character by which users booked Skewiel Mobiel.

Figure 22: Impression of the two-day Aevus case study. Clockwise: online planning system, semi-real time map with all vehicle whereabouts and planned destinations, gCar, Mia Electric, 2x Driver with a user. (Images taken by: Maartje van Gestel)

Apart from the early planning, the booking process was similar to Skewiel Mobiel: the requested departure time, departure location, destination, and expected activity duration were registered. Based on this, an estimation of the travel time was made, and added to the booking. See Table 5 for the implementation, in comparison with Skewiel Mobiel. Due to the experimental character, the bookings were made available online to all researchers involved, so that everybody could be up-to-date on any moment.

Table 5: Comparison between PSS implementation of Skewiel Mobiel and Aevus. All PSS elements were copied, but adjusted to the expected situation.

<i>PSS element</i>	<i>Skewiel Mobiel</i>	<i>Aevus</i>
<i>Vehicle</i>	1 vehicle (GEM e4), later: Mia	3 vehicles (2 Mia, 1 gCar)
<i>Driver</i>	Volunteers	Volunteers for Mia Professional for gCar
<i>Receptionist</i>	1 man, who is also responsible for the registration system	Prior acquisition went via care employees. During the case study, researchers and care employees conducted receptionist tasks
<i>Communication device</i>	Not used, personal contact at reception desk	Mobile phone during ride
<i>Registration system</i>	Paper planner, entries a few days to one hour before the ride	Online spreadsheet, entries several week before the case study
<i>User base</i>	Clients from Tellens	Clients from Zuidzorg
<i>Care provider</i>	Zorggroep Tellens	Zuidzorg

Three vehicles were used during the case study: two Mias and one gCar. Each vehicle was electrically powered, and needed to be charged after around 100 kilometres. Charging took a few hours. The gCar was similar to the GEM, which at that time was used in Skewiel Mobiel, in terms of top speed, spaciousness, and comfort. The Mia was selected as the successor of the GEM, but it had not yet been operationalized for Skewiel Mobiel. As such, Aevus provided a first use-experience with the vehicle. Using both vehicle types was useful, because both represented a familiar situation for Skewiel Mobiel, and the effect of the vehicle on the service could be observed. Voluntary drivers were appointed to drive the Mias, and professional drivers to drive the gCar. Reason for the latter was that the gCar was part of a commercial party who could provide already hired drivers.

During the case study, the involved researchers and care organization employees were installed in an operator room to conduct receptionist tasks. From this operator room, located in the main building of the care organization, new rides were planned, an overview

was kept on the activities of each vehicle, and communication between and among the drivers was facilitated.

Regarding rides, each user was called by a member of the operator room, hereafter operator, 30 minutes before the agreed pick-up time. This way, the user was given enough time to prepare. When the user was picked-up, he or she was driven to his or her desired destination and depending on the user, the driver supported during the activity, supported in carrying luggage or groceries, or went to another appointment when required. When the driver had to leave for another ride, driver and user made a pick-up appointment (location, time) and the user could start his or her activity. When necessary, the pick-up appointment was shared with the operator, so another driver could be informed to pick up this user in the case the original driver moved another user.

APPROACH

The case study was monitored and findings were shared plenary among researchers, drivers, and the care organization on various moments during the two days. Furthermore, informal interviews with users were conducted during their ride. After the case study, two evaluation sessions were organized with relevant stakeholders. The first session involved the care organization and researchers, and focused on their experiences with conducting the case study, the perceived added value of the service, and the preparation process towards the case study.

The second session involved the drivers, and focused on their experience with the service and the vehicle, on their opinion about the organization process, and on the service appreciation.

RESULTS

During the case study, 12 people used the service (5 male, 7 female). Visited locations were spread over different neighbourhoods, and rides often went from one side of the city to the other, and had different purposes. Visited destinations included a bookshop, a department store, a restaurant, and a supermarket. The distance travelled was on average 5 to 6 km.

Higher traffic density and further distances, compared to Skewiel Mobiel, did not seem to have a negative effect on arrival times. The margins of arrival time were intentionally kept wide, and as a result, every destination could be reached on time. This also caused that drivers did not perceive any time pressure.

Users were interviewed during the ride, and according to these interviews, users liked the service for being able to get out, and they thought that it was nice to be alone in the vehicle,

and not having to share it with strangers. As such, travelling individually was declared to feel very independent, and users were able to travel where they liked to go, using the route they preferred. Likewise, respondents appreciated that they did not have to call a friend or relative for providing mobility. Next to the independency, users appreciated the shorter waiting times, and being on time was thereby confirmed to be a very important value for Aevus.

Other valuable aspects were the support of the driver, such as carrying groceries. This enabled people to carry more things, or heavier things they were not able to carry themselves. For example, one user went to a supermarket and let the driver carry a beer crate. This was something he was not able to do independently.

More added value was revealed in comparison with other modalities, such as the regular bus. Respondents told that using the regular bus required walking to a nearby bus stop, and this could be very exhaustive for some people, resulting in lack of energy to execute the actual activity. The door-to-door policy of Aevus had a positive effect on the physical effort that was left for an activity, and users experienced this as valuable for Aevus.

During the evaluation sessions with the organization and the drivers, it appeared that drivers were content about their job, and the care organization was interested to include the PSS in their care program. Regarding the preparation phase, prior to the case study, the recruitment process could be improved. Care teams were instructed to recruit users, but it appeared that the response was dependent on the enthusiasm of the recruiter. Moreover, reaching potential users was difficult due to the short time span for recruitment, and due to the indirect approach of instructing care teams.

For drivers, the most difficult part was to cope with the vehicle battery. They found difficulties in interpreting the drive range, and sometimes decided to return to the charging point, although they were intended to pick up a passenger. This process appeared to be somewhat stressful, but all rides could be made, because the number of available vehicles was high enough and a backup vehicle was available during battery recharge.

DISCUSSION AND CONCLUSION

Goal of this case study was twofold. Firstly, the construct of lost habits was studied and validated for the PSS in this particular context. Secondly, the impact of the context on the PSS elements, and the organization of the PSS were assessed.

Regarding the first question, it was found that a number of users indeed used Aevus for activities they were not able to do anymore, or for visiting locations where people were not

able to go independently anymore. As such, Aevus was able to fit with people's lost daily patterns, and the construct indeed appeared in this context. However, some remarks have to be made about the actual use of the PSS, compared to the use of Skewiel Mobiel.

Users appreciated the mixture of independence and support, and were fond of getting support when needed, for example by carrying things. Next to this, people felt independent, as they felt like the vehicle and driver were intended for them only, at that moment. Regarding time, users appreciated that Aevus arrived on agreed time, and that the driver had enough time to accompany them during activities. These aspects are similar to the findings of the Skewiel Mobiel PSS.

Differences arise when considering the purpose of the rides. Skewiel Mobiel users appeared to use the PSS for visiting daily locations, whereas the Aevus users had more recreational purposes, and visited special locations, such as the bookshop, a shopping mall, a restaurant, or a theatre. This could be due to the lack of such facilities in the Skewiel Mobiel service area, and thereby no observed need to visit such locations. Another reason might be the setup of the case study. Users were recruited a few weeks before the study took place, and they could have considered the case study as an opportunity to do a "bonus" ride, complementary to their normal, habitual rides, for which already other transportation options are used. Extended research with more emphasis on the possibility of making ad hoc bookings should provide insights into the day-to-day use of the PSS.

With regard to the impact of the context on the PSS elements, the context indeed affected some service elements. The booking procedure has started earlier in the process, and parallel bookings, expected uncertainty about traffic density and longer distances have resulted in the requirement for more vehicles. In addition, more communication was expected, which would result in a higher demand for a communication device.

These adjustments have not resulted in a different service provision for the user. As such, the Aevus PSS seemed to offer users a similar service experience, compared to the Skewiel Mobiel PSS. This means that a vehicle was used to bring users to desired destinations for activities, and that users could be supported when needed during activities. Next to this, drivers were familiar with the environment, and the PSS was provided in collaboration with a care provider. Therefore, considered from a user perspective, the service experience was identical to the Skewiel Mobiel service experience. However, from an organizational perspective, the context did affect the PSS largely. Examples are the larger team that was assembled to occupy the operator room, the communication device that played a larger role, and more vehicles that were needed.

Hence, although the context was different, it did not have a direct effect on the service quality, but it did have an effect on the service organization. Moreover, the construct of lost habits was also found in this case study.

LIMITATIONS

Although Skewiel Mobiel was copied as precisely as possible to another context, and indicated similar use patterns, a number of remarks must be made. Firstly, prior to the experiment, it was decided that Aevus should offer the same result to the user as Skewiel Mobiel. Using an exact copy of the Skewiel Mobiel PSS would have meant that only one vehicle was available, that a communication device was not used, and that solely ad-hoc bookings could be made. Such a setup would most probably have resulted in organizational issues that distracted from the original research question. Therefore, the small modifications to the service elements were considered appropriate.

Another limitation of this study was the low amount of users. Although the limited amount of users has resulted in an adequate amount of qualitative data, it was impossible to extract significant quantitative data from this case study. The limited number could be explained due to the short time for recruitment, and scepticism about the service among potential participants. For a future study, incubation time should be considered, and downplaying scepticism is required, especially since scepticism decreased during the case study, and the service has gained a lot of positive attention from bystanders.

Regardless of these limitations, it was found that the core principles that made Skewiel Mobiel well accepted, were also present in the Aevus PSS. Among others, these principles were the mixture of independency and support, the social interactions, the freedom people had to go wherever they liked to go, the short waiting times, not having to ask others to travel along, and the freedom to be picked up and dropped off wherever they wanted.

Such principles fit very well with the construct of lost habits, especially since these are peripheral to the actual conducted activities. Therefore, the construct that made Skewiel Mobiel well accepted, could also be found for Aevus. As a result, also the Aevus PSS seemed to be able to address lost habits.

3.8.2 BELBUS PSS CASE STUDIES

Two years after the Aevus case study, the Belbus case studies were rolled out. In these case studies, Skewiel Mobiel was copied to three areas in a rural environment, similar to the area where Skewiel Mobiel is operated. Goal of these studies was to introduce more constraints

to the context, compared to Aevus, and to the organization, as Belbus would be operated by the same care organization that provides the Skewiel Mobiel PSS.

The care organization took the initiative for the introduction of new Belbus PSS, and their aim was to extend Skewiel Mobiel in different service areas. Consecutively, three Skewiel Mobiel copies were introduced and adapted to each respective new area, and the care organization provided the opportunity to monitor this process. As such, one general, long-term study was introduced, including three different case studies. This study provided the possibility to study the introduction of the PSS in a new area, and to validate the construct of lost habits. Moreover, the phased introduction of these Belbus PSS allowed for in-between evaluations and an iterative approach.

Each Belbus PSS was introduced during a staged process in a period of 1.5 years. The first PSS, Belbus Weidum, was introduced on 30 October 2013. The second, Belbus Wommels, was introduced on 15 March 2014 and the third, Belbus Blauwhuis, was introduced on 2 October 2014. Weidum and Wommels are located in the municipality of Littenseradiel, while Blauwhuis is located the municipality of Súdwest Fryslân, which is located adjacent to Littenseradiel. See Figure 23 for a map of the area, including the service area compared to Tytsjerksteradiel, and Table 6 for an overview of the demographics of each village.

Table 6: Characteristics of Littenseradiel at the start of the new Belbus PSS in 2014

Municipality of Littenseradiel. Source: CBS (2014)	
	132,64 km2
	~11000 inhabitants (CBS, 2014)
	29 villages (largest: 2060 inhabitants, smallest: 26 inhabitants)
	Wommels: 2060
	Weidum: 520
	Blauwhuis: 595 (Municipality of Súdwest Fryslân)

Figure 23: Left: Map of the municipalities of Litteraseradiel, Súdwest-Fryslân, and Tytsjerksteradiel. Right: Detailed map of the geographical locations of Wommels, Weidum, and Blauwhuis.

Weidum and Blauwhuis are small hamlets with respectively 520 and 595 inhabitants. Both hamlets are strongly dependent on facilities in surrounding villages. Blauwhuis is dependent on villages that are located further away, compared to Weidum.

Wommels is the largest village of the area, and counts 2060 inhabitants. The village is well comparable with Oentsjerk and Gytsjerk, both in terms of size and regional function. As such, Wommels is the central village of the area, and contains facilities such as a supermarket, a pharmacy, and a convenience store. Weidum and Blauwhuis are different and have a very limited offer in facilities. Weidum is strongly dependent on facilities in the village of Mantgum, while Blauwhuis is more remote and requires longer rides to reach everyday facilities.

For implementation of each Belbus PSS, two alterations were made to the PSS elements, in comparison with Skewiel Mobiel:

- 1) All Belbus PSS were introduced to a digital, online system in which the rides were registered, as replacement for the paper planner used for Skewiel Mobiel. The functionality of this system was essentially not different from the paper planner used for Skewiel Mobiel, but it provided more ease of use. Thereby, the system could be accessed online, so that the registration process for each Belbus could ultimately be done by one central receptionist. Later, also Skewiel Mobiel would be introduced to this new registration system.
- 2) Belbus Weidum and Belbus Wommels used the Mia, but for Belbus Blauwhuis the vehicle was altered. Blauwhuis is a desolate location and the vehicle was expected to travel longer distances. For that reason, an electric vehicle was considered insufficient due to its limited driving range, and a natural gas powered vehicle was selected. The impact of this alteration on the service experience was expected to be limited, because prior research indicated that the vehicle element did not have a significant effect on the number of rides, number of users, or the service experience.

See also Table 7 for an overview of the differences and similarities in implementation at the three locations, compared with Skewiel Mobiel.

As part of the conducted research, the developments of each Belbus were observed and users were interviewed. Additionally, travel data was registered, providing the opportunity to do archival research to the user progression of every Belbus PSS, and to compare these findings with Skewiel Mobiel. Every study will be reported in the following section. First, a

user study on potential Belbus users will be reported, followed by the archival recordings. Finally, general remarks will be made about the implementation process.

Table 7: overview of implementation of every PSS element. Belbus PSS use an online planner that was later also introduced to Skewiel Mobiel. Belbus Blauwhuis uses a different, natural gas powered, vehicle, due to desolate location and longer ride distances.

PSS element	Skewiel Mobiel	Belbus Weidum	Belbus Wommels	Belbus Blauwhuis
Vehicle	1 vehicle (Mia) + backup vehicle (GEM)	1 vehicle (Mia)	1 vehicle (Mia)	1 vehicle (Fiat 500L)
Driver	Volunteers	Volunteers	Volunteers	Volunteers
Receptionist	1 dedicated planner, who is also responsible for entries in the registration system	Location receptionist on duty, who is also responsible for entries in the registration system	Location receptionist on duty, who is also responsible for entries in the registration system	Location receptionist on duty, who is also responsible for entries in the registration system
Communication device	Not used, personal contact at reception desk	Not used, personal contact at reception desk	Not used, personal contact at reception desk	Not used, personal contact at reception desk
Registration system	Paper planner. Rides were registered between a few days and hour before the ride	Digital, online planner. Rides were registered between a few days and hour before the ride	Digital, online planner. Rides were registered between a few days and hour before the ride	Digital, online planner. Rides were registered between a few days and hour before the ride
User base	Inhabitants of Tytsjerksteradiel	Inhabitants of greater Weidum	Inhabitants of greater Wommels	Inhabitants of greater Blauwhuis
Care provider	Zorggroep Tellens	Zorggroep Tellens	Zorggroep Tellens	Zorggroep Tellens

3.8.3 USER STUDY

A user study was rolled out to establish the potential user group for Belbus Wommels. This user study was conducted to obtain insight in the degree of mobility from clients of the care location in Wommels. This paragraph will report on this study.

APPROACH

A questionnaire was conducted among clients from the Wommels location. Objective of this questionnaire was to identify their degree of mobility, and to establish whether characterizations of Skewiel Mobiel users could also be applicable to potential Belbus users.

Based on this, predictions were made about how many clients were potential users for the Belbus service.

Analysis of Skewiel Mobiel illustrated that the PSS was used by people who lived alone, but were unable to move independently by car or bicycle. Next to that, Skewiel Mobiel seemed to be used for daily activities. These criteria were used as a frame of reference for potential Belbus users, just as criteria such as being able to visit the supermarket, or the use of delivery services. Based on these characteristics, the questionnaire consisted of items about the use of mobility means, execution of outgoing activities and the use of delivery services, which are a mobile supermarket, and pharmaceutical delivery services.

See Appendix C for an overview of the questionnaire.

SELECTION

The questionnaire was sent to 161 clients of the Wommels care location, from which each client lived in or around Wommels. Clients lived in the village, as well as in and around the main building. Each questionnaire was accompanied by an explanation letter, signed by the location manager of the Wommels location. The latter was done to assure the authenticity of the letter. Respondents were asked to fill in the questionnaire and hand it in at the reception desk of the main building. 75 responses were completed successfully, 4 were sent back incomplete, and 1 was returned due to a wrong address. The average age of the respondents was 82.92 (SD: 10.12). The youngest respondent was aged 36. The oldest was aged 95.

RESULTS

First, respondents were asked about their living situation and use of modalities. 57 respondents (71%) lived alone, while 25% of the respondents lived not alone. 4% did not answer this question.

Respondents considered car and bicycle as main mobility means. 21% of the respondents had access to a car, 39% had access to a bicycle. 43 respondents (55%) did not have access to either a car or a bicycle. Respondents with access to a bicycle used it for short distances in the village, while longer distances were covered by car as a driver or as passenger. Respondents without access to a car, nor a bicycle, walked to nearby locations, or did not visit nearby locations at all. For longer distances, most respondents indicated to drive as a passenger to family or locations outside the village borders.

With regard to going out, 30% of all respondents indicated that they were not able to visit a supermarket anymore, and 11% did not visit family anymore. Among the group who had no

access to a car, nor a bicycle, 19 respondents (49% of this group) indicated that they did not visit the supermarket anymore.

Shopping was done in the following manner: Among the total group of respondents, 11% used a grocery delivery service, such as the mobile supermarket, or the supermarket delivery service, 35% asked relatives to bring groceries, and 59% ran errands themselves. Among the bicycle users, 86% ran errands independently, and 10% either used the delivery service or asked relatives. Oppositely, among the group who did not use a bicycle, nor a car, 60% asked relatives, against 28% who did it independently and 12% who used the delivery service.

Compared to the way respondents did their groceries, the way in which respondents received their medicines showed different characteristics. 50% of the respondents used the delivery service, while 12% asked relatives and 39% collected them by themselves. Among bicycle-only users, 94% collect medicines by themselves, while 6% use the delivery service. Among the non-bicycle/non-car users, 13% used the delivery service, against 67% who asked relatives and 30% who did it by themselves.

Among the group of users with no access to a car or a bicycle, approximately 64% bicycle were unable to reach one or more destinations, such as a supermarket, medical facilities, or friends and family, against 30% of the respondents with access to either a bicycle or a car.

CONCLUSION

The objectives from this study were to obtain insight in the degree of mobility of clients from the Wommels care location, and to predict the amount of clients who could become a Belbus user, based on criteria derived from the Skewiel Mobiel testbed. Selection criteria were:

- ❖ Being unable to use a car or a bicycle
- ❖ Live alone

Additional criteria were being unable to visit locations for daily activities, or using delivery services. Next to that, the secondary goal of this study was to obtain an overall impression of the mobility abilities of the clients of this care location.

The findings of this study show that more than half of the respondents did not have access to either a bicycle or a car. Moreover, from this group, 43 respondents lived alone. As a result, this group becomes very dependent on others, and Belbus is expected to offer support to this group of people.

Belbus Wommels was intended for clients of the care location in Wommels, and around 50% of the entire client population has completed the questionnaire. When this amount is considered representative for the entire client population, Belbus is expected to be useful for around 86 clients. When the inability to walk to the supermarket is added as a constraint (37%), the total user group is expected drop to around 32 users. The next paragraph will reflect on this prediction.

3.8.4 TRIP DEVELOPMENT

Each Belbus PSS was an actual copy of Skewiel Mobiel, updated with most recent insights. In order to obtain insight in the ride developments of each Belbus PSS, travel data was monitored and analysed. This paragraph will report on this travel data, and will compare the results with the travel data from Skewiel Mobiel. By comparing travel data, it can be established whether each PSS is characterized with a similar acceptance process.

METHOD

Trip data from Belbus Weidum, Wommels, and Blauwhuis were analysed and compared to travel data of Skewiel Mobiel over the same period. The data was selected over the period from the introduction of the first Belbus PSS, Belbus Weidum (November 2013) until July 2015.

Data was acquired from the digital registration system of each respective Belbus; travel data from Skewiel Mobiel was taken over from the analogue registration system. This data excluded data from users that belonged to It Aventoer. Reason for exclusion was to be able to compare the natural development of each PSS, without interventions such as agreements with other parties.

RESULTS

The ride development is presented graphically in Figure 24. User data over this period is displayed in Figure 25. See Appendix D for a numerical representation. In this section, first the findings per Belbus PSS will be reported. Later, these will be compared with data acquired from Skewiel Mobiel. The section will conclude with a discussion to interpret these findings.

Figure 24: Trip development of al Belbus PSS, compared with Skewiel Mobiel.

Figure 25: Visual representation of the trip frequency per user, per PSS. Every block in a ring represents a user, and users are ordered hierarchically, per PSS. The largest blocks per ring show users with the highest use numbers per PSS, followed by less frequent users.

BELBUS WEIDUM

Belbus Weidum was introduced on 30 October 2013. Between the start and 30 July 2015, 21 users have used the PSS, and 752 rides were made. 75% of the rides were made by 4 users (20%). This means that a small group of people can be considered main user of the service. Trip development started rather slowly, but positive, and during 2015, rides per month remained more than 40.

According to the care organization, often visited destinations were shops, the physiotherapist, the dentist and the train station.

BELBUS WOMMELS

Belbus Wommels was introduced after Belbus Weidum on 15 March 2014. Based on the questionnaire, reported in paragraph 3.8.3, 32 users would at least use the PSS, when the inability to visit the supermarket is used as a constraint. According to the travel data, between its introduction and 30 July 2015, 54 users have used the PSS, and 1122 rides were made. This is more than predicted, although 75% of the rides are made by 12 users (22%). This is far less than predicted, and similar to the share of Belbus Weidum users.

The ride progression was initially very steep and peaked to 120 rides in March 2015. After that date, the numbers dropped to values between 60 and 90 rides per month, but the number of users remained rather high, compared to the other PSS. According to the care organization, often visited destinations were the supermarket, the gym, the hairdresser and the dentist.

BELBUS BLAUWHUIS

Belbus Blauwhuis was introduced on 2 October 2014. Between its introduction and 30 July 2015, a total of 89 users have used the PSS for 381 rides. 75% of the rides were made by 27 users (30%), which is a larger group compared to the other two Belbus PSS.

Typical of the ride development in Blauwhuis was a rather steep increase after its introduction. The number of monthly rides is roughly between 20 and 40, and comparable with the numbers of Skewiel Mobiel and Belbus Weidum. Unfortunately, no data was provided about often visited locations.

DISCUSSION AND CONCLUSION

This case study has provided interesting insights regarding PSS development. One core team was used for the introduction of each Belbus PSS in three different areas, and this team was educated by experienced people, who have been involved in the development of the Skewiel Mobiel PSS. During this process, both parties closely collaborated and shared

their insights. As an effect, insights that were obtained from operating Skewiel Mobiel were used as input for the operation of each Belbus PSS, and vice versa. In this paragraph, these insights will be briefly discussed.

Every PSS has shown a steadily increasing ride frequency, and Belbus Weidum and Blauwhuis seemed to develop towards the ride frequency of Skewiel Mobiel, while Belbus Wommels exceeded this frequency. In terms of user demand, Belbus Weidum and Wommels were initially not often used, and familiarity with the service took a couple of months. On the other hand, Belbus Blauwhuis was the last Belbus PSS to be introduced, but was characterized by a higher user demand from the beginning.

In order to study these differences in ride frequency and user demand, a number of meetings and updates were organized. These meetings and updates took place between researcher, the Skewiel Mobiel project leader, and the different teams that introduced each respective PSS. Based on these interactions, an elaborate insight was obtained in the growth characteristics of each Belbus PSS. These insights will be elaborated upon next.

Belbus Weidum and Belbus Wommels were characterized by initial lack of growth. According to the care organization, this was caused by a number of reasons. One reason was a hesitating potential user group. This group required a few months to become acquainted with the PSS. Another reason was a number of organizational issues that were reported during the introduction of these PSS. On one hand, these issues could be caused by members of the care organization who were appointed to support and implement the PSS, but who were not convinced about the value of the PSS. This might have resulted in a lack of cooperation. On the other hand, technical issues regarding the electric driving range of the vehicle seemed to have had a negative effect on initial adoption of the PSS.

Especially for Belbus Wommels, the vehicle appeared to be unpredictable about the electric driving range, and the battery died in some cases during a ride. Therefore, users did not trust the PSS, and drivers had to become familiar with the fluctuating range, depending on how the vehicle is driven. This issue was not identified with Skewiel Mobiel, because the average travel distance of Belbus Wommels exceeded the travel distance of Skewiel Mobiel. Moreover, the driving range of the GEM, which was originally used for Skewiel Mobiel, did have a range that was significantly lower than the range of the Mia. For this reason, Skewiel Mobiel drivers might have become familiar with the limited driving range, and have therefore not used the full range of a Mia.

Compared to Belbus Wommels and Weidum, ride frequency from Belbus Blauwhuis did develop quite fast, and no issues with commitment and range were found. This rather fluent

introduction might be due to learning effects. Prior to the introduction of the first Belbus, Belbus Weidum, a core team was formed to initiate the deployment of Belbus PSS for every location. Initially, this team worked together, and later, more employees from the respective locations were involved. The core team was required to collaborate, and needed to form a good and shared understanding of the goal of the Belbus PSS. This was an evolutionary process, and after the introduction of every next Belbus PSS, the team has gained a better understanding of the steps that must be taken, and what issues could arise. Consequently, the team anticipated on the larger distances that the vehicle must cover, and therefore the natural gas powered vehicle was chosen.

These findings presented an iterative development process that ultimately resulted in three well-accepted Belbus PSS. For PSS development, this illustrates that design for PSS acceptance can very well be done in iterative steps, by “learning by doing,” and by reflecting on users and other stakeholders. Thereby, a clear vision on the functional result that the PSS should deliver seemed directive for the development process. As such, this made it possible to anticipate on the required PSS configurations, to anticipate on expected issues, and to decide on altering elements, if required by the context.

3.9 DISCUSSION AND CONCLUSION

This chapter reported on a longitudinal living lab study to explore the factors that have an effect on the acceptance of Skewiel Mobiel, which is a PSS in the mobility domain.

The objective of this living lab was to study PSS acceptance, and one of the most essential findings that came out of the living lab, was that lost habits were identified as an important, and previously underexposed construct that can have an effect on PSS acceptance. Thereby, not only was the PSS able to let people conduct activities they were not able to do anymore, it was also able to compensate for smaller habits that are needed to conduct that specific activity. For the field of PSS acceptance research, this stresses the importance of studying the wider impact a PSS can have on people’s behaviour.

Next to this, the living lab yielded other insights, which will be elaborated upon next.

Firstly, it was observed that Skewiel Mobiel enabled users to deploy the PSS in configurations they personally liked. By doing so, every PSS element could find its role and new use situations were explored. Consequently, one user might only need the PSS for transport, while another user appreciated integral support during an activity. As such, the PSS could be interpreted as a palette of products and services, which the user can configure depending on his or her own needs. Thereby, the PSS was able to accommodate different

and even unexpected configurations that were not taken into account during the PSS design process.

In addition, it was observed that users did not only require functional demands from the PSS, such as transport or someone who carries groceries, but also appreciated the emotional benefits, such as social connectedness and independency. At the same time, it was observed that drivers, who were initially meant to provide the service that users require, also appreciated these emotional benefits. As a result, this made them users of the PSS too, which illustrates one of the complexities and unexpected configurations of the PSS.

These examples illustrate that unexpected interactions can be very valuable for users. The implications for PSS design are therefore to design a PSS flexible enough in order to facilitate for such unexpected interactions. This also means that a PSS can and should not be designed for all kinds of use scenarios, before it is introduced to the market. Instead, monitoring PSS use provides insight in the user value of the PSS.

Next to design implications, the topic of Living Lab research can be reflected on. Many of the findings in this chapter are found by observations and informal conversations with users and drivers. The living lab setting supported this type of research very well. As such, these findings are considered the result of the practical nature of a living lab, and the corresponding opportunity to follow the evolution of the PSS.

Similarly, immersion of the researcher in the living lab has possibly resulted in a better understanding of the principles that are key to the PSS. Thereby, observing how users and drivers interact, immersing in the local context, or having conversations with others involved, has provided a profound understanding of the roles the PSS plays in a user's daily life and in the local context. This has resulted in an understanding of the functional result Skewiel Mobiel offers to its users at a deeper level: As a result-oriented PSS, Skewiel Mobiel delivers independency and social connectedness by supported mobility, and this result has consequently been found to be offered by Aevus and the Belbus PSS as well.

Because the functional result is rather similar across Skewiel Mobiel, Aevus and Belbus PSS, the main characteristic of a result-oriented PSS, as defined by Tukker & Tischner (2006), is disclosed. The original Skewiel Mobiel PSS was built from a number of tangible and intangible elements, and the living lab showed that these elements did not play an important role by themselves. For example, replacing the vehicle, or leaving out the communication device did not seem to affect the service experience, although replacing the vehicle did seem to act as a catalyst for renewed attention for the PSS.

This finding might also show one of the main benefits of studying a PSS in a long-term living lab setting. The service elements of a PSS can evolve under the influence of its context, but the functional result the PSS delivers is constant and leading in the development process. Therefore, in different contexts, the same functional result can be delivered by a different set of products and services. Thereby, it can be concluded that the way by which each PSS enabled people to recover doing activities they liked to do, but were not able to do anymore, was an essential aspect for acceptance. Furthermore, as long as this result addresses people's lost habits, at least for the various PSS reported in this chapter, a result-oriented PSS could become well accepted.

4

This chapter is based on:

Schotman, H., & Ludden, G. D. S. (2015). A Model of lost habits. Towards a Strategy to Improve the Acceptance of Product-Service Systems. In *Proceedings of the 20th International Conference on Engineering Design (ICED 15), Vol. 1: Design for Life*. Milan, Italy, 27.-30.07.2015.

4. A CONCEPTUAL MODEL TO PREDICT THE ACCEPTANCE OF PRODUCT SERVICE SYSTEMS

The previous chapter has introduced the construct of lost habits, which was derived from analysing the acceptance of mobility PSS for elderly. This study was conducted in a living lab setting, which involved low-constraint, in-the-field research. In this chapter, more constraints will be introduced to develop the construct of lost habits further. Firstly, the construct will be embedded in theory on habits, and subsequently, analysis will aim on understanding how the construct can be generalized to other situations, irrespective to the topic of elderly and mobility.

This chapter is organized as follows. Section 4.2 will briefly reflect on the issue of PSS acceptance, and the need for a solution. Section 4.3 will provide a brief overview on theory of habits and behaviour change. Section 4.4 will introduce a model of lost habits, based on the construct of lost habits. Section 4.5 will report on the evaluation of this model by means of two clinical studies, and in Section 4.6, a general conclusion and discussion will be given, including recommendations for further research.

4.1 THE ISSUE OF PSS ACCEPTANCE

Product-service systems (PSS) replace traditional economic principles, such as purchasing and owning, for more contemporary economic principles, such as sharing and using. Various types of PSS are a good development from an efficiency and/or sustainability perspective (i.e. Herodes & Skinner 2005; Mont 2002; Tukker 2004; Baines et al. 2007; Goedkoop et al. 1999), and for some people, PSS are indeed an interesting proposition. Despite that, for the vast majority, PSS that claim to be less expensive or more efficient, are not necessarily favoured above the more expensive or less efficient products and services already in use.

Potential benefits for the environment, society, and businesses make PSS acceptance an important issue, but increasing PSS acceptance is a difficult issue at the same time. In order to use a PSS, many people are required to change their habits and behaviour. However, people tend to hold on to their old habits and familiar behaviour, which acts as a core barrier for gaining user acceptance (Ceschin, 2013; Vezzoli et al., 2012). Hence, apparently, the implicit benefits of PSS cannot be matched with the practice of everyday life.

The construct of lost habits implies that a PSS that is designed for behaviour, that was valuable, but involuntarily lost, could become well accepted. This means that PSS designers

should look for situations in which people have already changed, because in such situations, people's habits have become discontinued.

This chapter will aim on elaborating the construct of lost habits, by further analysing it in a higher constraint setting. As such, a model will be created that builds on this construct and that establishes what factors contribute to the acceptance of innovations.

4.2 THEORETICAL BACKGROUND: HABITS

Driving the same route, every day, using the stairs instead of the elevator or commuting by bicycle as alternative for the car are all situations in which habits seem to be strong and can hardly be changed, even if someone is motivated to change. This principle was touched upon in chapter 2, using Landis, Triandis, & Adamopoulos (1978), and the Theory of Interpersonal Behaviour. According to this theory, past behaviour is a predictor for future behaviour. As such, an intention to behave differently is overshadowed by the existence of habits, which refrains people from changing behaviour.

Hence, habits act as a barrier for behaviour change. Unfortunately, eliminating habits is difficult, as will be explained based on two main reasons. The first reason is related to the fact that people create stimulus-response (s-r) actions (Aarts, 2009) that cause them to overlook alternatives. When people act, they make decisions to receive a satisfactory reward. When in similar situations, the same decisions are made, people start to create s-r actions. This means that a given stimulus automatically results in a, generally, satisfactory reward. The more a satisfactory reward is given, the stronger s-r association becomes, and finally habits are formed. Interestingly, rewards lose impact when habits become stronger. This causes people to stop making conscious decisions (Gardner, 2009; Verplanken, Aarts, & Van Knippenberg, 1997; Verplanken & Orbell, 2003). When conscious decision making moves to the background, it becomes difficult to motivate or convince people to change their behaviour, e.g. in order to accept a certain product proposition, based on the premise of providing rational benefits.

The second reason is that the perceived value people add to activities they do or objects they have in their possession increases, the longer people do it, or have it in their possession. This perceived value exceeds the actual value of the activity or object, which makes it difficult for alternatives to compete on value. This principle is explained by Gourville (2005), who elaborated on the "endowment effect"; an effect described by Thaler (1980) and Kahneman et al. (1991). The endowment effect entails that people value products they own much more than products they can obtain, and this effect could explain why something new may objectively be better, but will not be accepted. The effect is

amplified by a principle called "loss aversion", which claims that losses have a far greater impact on people than similarly sized gains (Kahneman & Tversky, 1984). Both principles result in a product or activity with a highly perceived value, which will have a very great impact on someone, when lost.

As such, both s-r relations, and the endowment effect could explain why behaviour change is difficult, and offering similar, alternative products may not be successful.

4.2.1 CHANGE BEHAVIOUR... OR NOT?

Gourville (2006) studied what a new product should be like, in order to trigger behaviour change. Therefore, he elaborated on the endowment effect and loss aversion, and he used present behaviour as a starting point. He focused on the amount of behaviour change that is required, based on two variables: the degree of product change and the degree of behaviour change. Based on this, he advocated two approaches for product developers to work around user resistance to change:

- 1) Accepting resistance i.e. by waiting for a long time;
- 2) Minimizing resistance, i.e. by developing behaviourally compatible products.

Gourville proposed the model as shown in Figure 26, where he sketched the relation between required behaviour change and degree of product change.

He showed that a product might sell very well, as long as required behaviour change is minimized. Consequently, whether the product will be a great success, depends on the degree of product change.

This model is very insightful for designers, as they have an inherent influence on the degree of product change. Thereby, according to this model, they should consider to what extent they require people to change their behaviour in order to use a product.

The omission of this model is that it does not include situations in which people have already changed, but against their will. In such situations, present behaviour has been discontinued and behaviour change has consequently already taken place. Such circumstances can be found in so-called life-changing events, as proposed by i.e. Schäfer, Jaeger-Erben, & Bamberg (2011) or Wood, Witt, & Tam (2005). Life changing events can be a new job offer, migration, or bodily changes such as physical decline that forced someone to discontinue old habits. In such situations people have to adapt to a new context, and often have to break their old habits at least temporarily (Aarts, 2009).

Figure 26: Model adapted from Gourville (2006)

Such situations are very interesting for acceptance issues and the construct of lost habits is in line with these principles. Gourville’s model will be used as a starting point, and will be used to study how PSS acceptance is influenced when behaviour is already changing, or has already changed.

4.3 A MODEL OF LOST HABITS

The previous sections pointed out that PSS acceptance is an important and difficult issue, because behaviour change is often required. Moreover, it showed that habits have a very strong effect on behaviour. To increase the acceptance of new PSS, one strategy is to develop PSS that require as little behaviour change as possible (Gourville, 2006), or to embrace the strong effect of habits in the development process. In this section, the variables that are expected to have a significant effect on the construct of lost habits will be analysed, and translated into a model.

Central to the construct of lost habits was that acceptance might be increased when a PSS addresses valuable activities that were involuntarily lost. This PSS could be introduced during or after the process of behavioural change due to undesirable circumstances, as was explained in chapter 3. These situations may offer opportunities for the introduction of PSS, first because a habit has disappeared and people will be sensitive for alternative offerings. Secondly, because people may be willing to continue their lost habit if a PSS allows them to do so. Therefore, it is hypothesized that a positive relation exists between a PSS that addresses lost habits and acceptance of this PSS.

Three independent variables are hypothesised to affect this relation: Importance of habit, Voluntariness, and Time gap, which will be briefly explained after the important variables in the model are introduced: Change, lost habits, and Acceptance.

CHANGE AND LOST HABITS

Lost habits are defined as habits that people have discontinued. Discontinuation implies a transition process from one situation to another, where the latter situation is often a degraded version of the previous situation. In such situations, it is assumed that people are motivated to supersede the change and to recover the old situation. The magnitude of change is expected to have a positive effect on the magnitude of the lost habit and acceptance. This also means that the presence of change is conditional for the model to work.

ACCEPTANCE

Acceptance and adoption are dependent variables in this model. Renaud and Biljon (2008) describe acceptance as an attitude, while they define adoption as a process. They consider a product to be accepted if the user has purchased a product. Adoption is considered as embracing the technology by making it part of one's life.

As a PSS cannot be purchased, in this thesis PSS acceptance is both considered a positive attitude towards using the PSS, and having paid a fee for using the PSS. Adoption will consequently take place if the user has embraced the PSS in his or her life. Here, a habit is formed around using the PSS. Within this thesis, PSS acceptance is studied. Therefore, the model of lost habits aims on acceptance in the first place, because that is considered an important milestone towards final adoption. Adoption, on the other hand, will not be included in this thesis.

4.3.1 INDEPENDENT VARIABLES OF THE MODEL

This paragraph will elaborate on each of the three independent variables that are included in the model of lost habits.

IMPORTANCE OF HABIT

Habits are important for people. Habits reduce the cognitive effort needed to perform a task (Jager, 2003), and offer rewards, such as a good feeling. Conversely, rewards become less important when habits become stronger. Accordingly, in line with Gourville (2006), a habit may gain value in time and losing the habit is assumed to be a high value loss. It is therefore hypothesized that an important habit is valued higher than a less important habit

and the effect of a lost habit on acceptance will therefore be positively related to importance of the habit.

VOLUNTARINESS

In his model, Gourville (2006) argued that products could be successful if there is a limited amount of behaviour change required. Products that require a high amount of behaviour change, can therefore be less successful. This suggests an inversely proportional relation between required behavioural change and acceptance. Next to that, two basic assumptions are derived from this model:

- 1) A person must adapt his or her present behaviour to the required behaviour to use the product;
- 2) A person is not likely to accept a product, if it is similar to what he or she is used to.

Based on these assumptions, the question arises what would happen if people change involuntarily, and the required behaviour to use the product is adapted to a person's past behaviour. In this situation, people did not decide to change, which may trigger dissatisfaction and consequently the will to recover. Involuntariness is the magnitude that pushes someone away from his or her desired behaviour, irrespective of his or her personal choice. As such, involuntariness is hypothesized to have a positive effect on the relation between lost habits and acceptance, but for a better understanding, the term Voluntariness will be used. Accordingly, Voluntariness will be hypothesized to have a negative effect on the relation between lost habits and acceptance.

TIME GAP

Time gap is the time between the moment a habit is lost and the moment a PSS is presented. For people, it is expected to be undesirable to lose a habit, and people may be willing to restore this habit as soon as possible. However, after a while, people are expected to reconcile with the situation, and other habits will be formed. Therefore, Time gap is hypothesized to have a negative effect on the relation between lost habits and Acceptance.

4.3.2 THE MODEL

The conceptual model of lost habits requires change as a boundary condition, because change in this case results in lost habits. Additionally, it is hypothesized that addressing lost habits in the design of a PSS influences acceptance positively, because people are motivated to continue their original behaviour. As such, a PSS that enables people to continue their original behaviour, is hypothesized to influence acceptance positively. Importance of the

lost habit, the lack of voluntariness, and the time gap between the moment the habit is lost and the alternative is offered are hypothesized to influence this relation. This has resulted in the model as presented in Figure 27.

The relations between the different variables in this model are summarized in the following four hypotheses:

- ❖ Hypothesis 1 (H1): Lost habits moderate acceptance, such that the degree in which a PSS enables continuation of lost habits will increase the likeliness of acceptance.
- ❖ Hypothesis 2 (H2): The degree of importance of the lost habit has a positive effect on acceptance, such that the effect will be stronger when the importance increases.
- ❖ Hypothesis 3 (H3): The degree of voluntariness of losing a habit has a negative effect on acceptance, such that the effect will be stronger when the voluntariness decreases.
- ❖ Hypothesis 4 (H4): The length of the time span between losing the habit and the introduction of a PSS has a negative effect on acceptance, such that the effect will be weaker when the timespan increases.

Figure 27: Conceptual model of lost habits. Relations are displayed by arrows. The direction of the arrow illustrates what variable influences another variable or relation. The magnitude of influence is either positive, illustrated by "+" or negative, illustrated by "-"

4.4 EVALUATING THE MODEL OF LOST HABITS

These hypotheses were tested by developing scenarios and PSS propositions, and by analysing how people would predict the acceptance of each PSS, in relation to the scenarios. Every scenario was based on the variables in the model and acceptance was established by measuring the impact of each variable on each PSS.

The following section will introduce the used materials, report on the pre-test to evaluate the manipulations and developed PSS, and report on the method and materials used. Finally, the results of this evaluation study will be presented and discussed.

4.4.1 EXPERIMENTAL MATERIALS

SCENARIOS AND PSS

The factors Importance, Voluntariness, and Time Gap were used and translated in three pairs of scenario parts; for each factor a strongly influential Lost Habit part (LH), and a weakly influential Non lost habits part (NLH) was created. Consequently, the scenarios were created according to the following modular structure: Scenario = Introduction (general) + Importance (LH or NLH) + Voluntariness (LH or NLH) + Time gap (LH or NLH). Because each factor was represented by one pair of scenario parts, the study had a 2x2x2 design. This resulted in 8 scenario variations. All scenarios were written in Dutch, and each part is written out in Appendix E.

The scenarios were accompanied by a collage, representing the main character and his or her activities. Two collage varieties were developed: One LH collage, and one NLH collage. These collages were respectively based on the LH-part and NLH-part of the factor Importance. This factor was used, as it was visually considered the most distinctive factor.

The goal of each collage was to stimulate the respondents' empathy for the main characters in the scenarios, and to be able to imagine the situation easily. The collages consisted of photographs that could have been made during the activity that was described in the scenario.

The study was conducted, using two different themes – holiday and cooking. This was done to verify whether findings would be consistent across the themes. The holiday and cooking themes were chosen because these were expected to be recognizable for respondents. Moreover, the themes were considered general enough to describe realistic and recognizable, theme-related habits that made it easy for the respondent to imagine the consequences of losing the habit. The holiday scenario described a couple who wanted to visit a camping, and the cooking scenario described a woman who wanted to prepare food

for a group of friends. A description of each scenario part is presented in Table 8, and an overview of the collages in Figure 28.

Next to the scenarios, per theme, three PSS were designed. Each PSS was designed to be a solution to the lost habit that was described in the scenarios, in such a way that one PSS enabled continuation of the lost habit by a similar procedure, while the other two PSS offered people the functional result, but achieved by a different procedure. The PSS were presented as advertisements, including a name for the service, pictures of the service and a textual description, written in a promotional way. Each advertisement followed the same structure, both in terms of graphical design and information presentation, in order to control for external influences.

In line with the developed scenarios, each PSS was designed to be well imaginable. Therefore, the PSS were conservative and resembled services that could already exist. The PSS that were offered for the holiday scenarios were a caravan transport service that could bring a caravan to each desired location, a rental caravan on a different camping and a bed and breakfast abroad. The PSS that were offered for the cooking scenarios were a rental kitchen that was intended to represent a domestic feeling, a cooking workshop at which everybody was intended to cook, and a restaurant that promised a private dining experience.

The caravan transport service and the rental kitchen were designed to address the lost habit of the main characters in a way that is similar to what the main character was used to. The other two PSS could also be useful, but were a solution to the problem in a more functional way. For example, the outcome of the caravan transport service was a holiday with a private caravan on the desired camping, while the other two PSS provided a similar functional outcome, but on a different location or with a different accommodation. Thereby, the first did not require behaviour change, while the latter did. Figure 29 and Figure 30 present the developed advertisements.

Table 8: Summary of the scenario text parts

Scenario parts →	Holiday LH	Holiday NLH	Cooking LH	Cooking NLH
Factors ↓				
Importance	Spending holiday at the same camping each year	Spending holiday at various places	Prepares food for the same group each month	Member of a cooking group. Each prepares food in turn
Voluntariness	Medical issue	Self-responsible	Reconstruction work	Decided to move
Time gap	One week before holiday	Two months before holiday	Two days before cooking turn	Two months before cooking turn

Figure 28: Four collages, from left to right: Holiday LH, Holiday NLH, Cooking LH, and Cooking NLH

Figure 29: PSS advertisements for the holiday-themed PSS. The left advertisement presents the LH PSS

4.4.2 MATERIAL VALIDATION

The scenario manipulations have been evaluated in a pre-study (Schotman & Ludden, 2015). According to this pre-study, the means of the factors Voluntariness and Time gap scored significantly lower in the LH scenarios, than the NLH scenarios. This implies that the factors were successfully manipulated. The means for factor Importance scored significantly higher in the Holiday LH scenario, than the Holiday NLH scenario, which also meant a successful manipulation. Conversely, only the factor Importance in the Food scenarios was not significantly different. This manipulation has therefore not been successful, and was adjusted prior to the main study. See Appendix F for an overview of the pre-study.

4.4.3 PARTICIPANTS AND PROCEDURE

An online questionnaire was developed on Limesurvey.org. 133 people participated in this study (84 Male, 49 Female, average age =37). Respondents were recruited by e-mail, sent within the researcher's network. In addition, respondents were recruited via face to face invitation.

The questionnaire presented each participant one scenario from each theme. Consecutively, three PSS were presented in random order, and participants had to score the PSS in relation to the presented theme. All questions were mandatory and responses were treated anonymously.

4.4.4 MEASURES

The main objective of this study was to test the interaction effects from the manipulated scenarios on acceptance of PSS. For this, items originating from the UTAUT2 model

Figure 30: PSS advertisements for the cooking-themed PSS. The left advertisement presents the LH PSS

(Venkatesh, Thong, Xu, 2012) were used, that provided guidelines to estimate actual system use.

The used items belonged to the UTAUT2 factors Intention to use, Perceived usefulness, Performance expectancy, and Effort expectancy. These items were intended to study actual users, but this was incompatible with the nature of this study. Therefore, the items were adjusted to let respondents judge about fictive personas.

All questions were asked on a 9-point scale with end points 'Certainly not (1)' and 'Definitely (9)'.

Three scales for Acceptance were constructed: satisfaction, objection, and effort. The scale Satisfaction was measured by three items (Cronbach's Alpha = .926) ('Do you think they will use this service'; 'Do you think they plan on using this service?'; 'Do you think they can complete their activity satisfactory'). The scales Objection and Effort were based on one item (Respectively 'Do you think they have objections for using this service?' and 'Do you think they need much effort for using this service?').

4.4.5 RESULTS

The main objective of this study was to test the interaction effects of the factors manipulated in the scenarios on PSS acceptance, by validating the four hypotheses that were presented in paragraph 4.3.2. In this section, we will discuss each hypothesis, followed by discussing the results per theme.

HYPOTHESIS 1

Hypothesis 1 was: Lost habits moderate acceptance, such that the degree in which a PSS enables continuation of lost habits will increase the likeliness of acceptance. This means that acceptance would increase if the PSS were better able to address lost habits.

With regards to this study, this means that the average score for the LH PSS would be significantly higher for the variable Satisfaction and significantly lower for variables Objection and Effort compared to NLH PSS 1 and 2. A repeated measures ANOVA was carried out to analyse the mean scores for each variable.

For the holiday theme, the LH PSS scored significantly higher on effort than NLH PSS 2 ($p < .05$). This was in line with the expectations, but no significant differences were found in the other scores, as is presented in Table 9.

For the cooking theme, significant differences were found between LH PSS and both NLH PSS 1 and 2 on the mean score of all variables. The mean score for LH PSS scored

significantly higher on satisfaction and significantly lower on Objection compared to NLH PSS 1 and 2 (both $p < .005$). Equally, LH PSS scored significantly higher on Effort, compared to NLH PSS 1 and 2 ($p < .05$), as is presented in Table 10.

*Table 9: Means for all PSS in Holiday theme, including main effects comparison, using Bonferroni correction. Diagonal axis shows means and SD per PSS, per item. P-values are shown in the cross sections. (p-value: * $<.005$; ** $<.05$)*

N=71	Satisfaction			Objection			Effort		
	LH PSS	NLH PSS 1	NLH PSS 2	LH PSS	NLH PSS 1	NLH PSS 2	LH PSS	NLH PSS 1	NLH PSS 2
LH	M=5.78 SD=1.96	..	..	M=4.89 SD=2.15	..	..	M=4.90 SD=2.27	..	..
NLH 1	.308	M=5.10 SD=2.08	..	.881	M=5.45 SD=2.30	..	1.000	M=4.70 SD=2.23	..
NLH 2	.713	.000*	M=5.92 SD=1.87	.203	.005*	M=4.37 SD=2.23	.007*	.017**	M=3.75 SD=2.10

*Table 10: Means for all PSS in the Cooking theme, including main effects comparison, using Bonferroni correction. Diagonal axis shows means and SD per PSS, per item. P-values are shown in the cross sections. (P-value: * $<.005$; ** $<.05$)*

N=62	Satisfaction			Objection			Effort		
	LH PSS	NLH PSS 1	NLH PSS 2	LH PSS	NLH PSS 1	NLH PSS 2	LH PSS	NLH PSS 1	NLH PSS 2
LH PSS	M=7.26 SD=1.45	..	..	M=3.81 SD=2.23	..	..	M=4.16 SD=2.33	..	..
NLH PSS 1	.000*	M=4.46 SD=1.89	..	.000*	M=6.05 SD=2.04	..	.006**	M=3.26 SD=1.77	..
NLH PSS 2	.000*	.000*	M=2.82 SD=1.59	.000*	.402	M=6.60 SD=1.96	.001*	.872	M=2.89 SD=1.84

REMAINING HYPOTHESIS

The remaining hypotheses were:

- Hypothesis 2 (H2): The degree of importance of the lost habit has a positive effect on acceptance, such that the effect will be stronger when the importance increases.
- Hypothesis 3 (H3): The degree of voluntariness of losing a habit has a negative effect on acceptance, such that the effect will be stronger when the voluntariness decreases.

- Hypothesis 4 (H4): The length of the time span between losing the habit and the introduction of a PSS has a negative effect on acceptance, such that the effect will be weaker when the timespan increases.

With regards to this study, this means that the presence of each factor of the model would have a significant effect on the dependent variables. Hypotheses 2 – 4 were validated by conducting a repeated measures ANOVA and analysing the main effects and interaction effects of the factors on the dependent variables. In the following paragraphs, first the results of the Holiday theme will be discussed, after which the results of the Cooking theme will be discussed.

HYPOTHESES 2 – 4: HOLIDAY SCENARIOS

For the holiday scenarios, main effects were found from Importance on Satisfaction ($p < .005$) and Objection ($p < .05$), and from Voluntariness on Effort ($p < .05$). This was in line with the expectations. Furthermore, interaction effects were found between Importance and Time Gap on Satisfaction ($p < .005$), thereby confirming hypothesis 4, but in interaction with importance. An overview is given in Table 11.

*Table 11: Influence of factors on the scales of acceptance for the Holiday theme. ^a $p < 0.001$; ^b $p < 0.005$; ^c $p < 0.05$; * Huynh-Feldt correction*

	Satisfaction*	Objection	Effort
Importance	$F(1.781 \ 98.86) = 16.84^a$	$F(2 \ 126) = 3.67^c$	$F(2 \ 126) = 0.07$
Voluntariness	$F(1.781 \ 98.86) = 6.244^b$	$F(2 \ 126) = .929$	$F(2 \ 126) = 1.37$
Time gap	$F(1.781 \ 98.86) = .228$	$F(2 \ 126) = .186$	$F(2 \ 126) = .227$
Importance and voluntariness	$F(1.781 \ 98.86) = 1.079$	$F(2 \ 126) = 1.37$	$F(2 \ 126) = 3.20^c$
Importance and time gap	$F(1.781 \ 98.86) = 5.954^b$	$F(2 \ 126) = 1.44$	$F(2 \ 126) = 1.62$

These outcomes presented the influence of each factor on the average score of each item. Unfortunately, information is omitted about whether the value of each acceptance item is influenced by a strong factor, or a weak factor. In order to establish the strength of each effect, an independent samples t-test was conducted, and the vector of each significant relation was studied. According to the results, Importance had a positive effect on satisfaction of LH PSS, and a negative effect on satisfaction of both NLH PSS, which is in line with H2. Furthermore, importance was found to have a positive effect on both NLH PSS, and no effect on LH PSS, which is slightly in line with H2.

For voluntariness, a negative effect was found on satisfaction of LH PSS, and a positive effect on both NLH PSS. This is contrary to H3. A graphical representation of these results is displayed in Appendix G.

HYPOTHESES 2 – 4: COOKING SCENARIOS

The results from validating the hypotheses on the cooking scenarios were not in line with the expectations. No direct effects were found from each factor on the PSS acceptance items. Only an interaction effect was found from Importance and Voluntariness on effort ($F(2\ 108) = 3.91, p < .05$). Thereby, only hypotheses 2 and 3 could be partly confirmed. An overview is given in Table 12.

Table 12: Influence of factors on the scales of acceptance for the Cooking theme. ^a $p < 0.05$

	Satisfaction	Objection	Effort
Importance	$F(2\ 108) = .794$	$F(2\ 108) = .059$	$F(2\ 108) = 2.614$
Voluntariness	$F(2\ 108) = .173$	$F(2\ 108) = .018$	$F(2\ 108) = 1.312$
Time gap	$F(2\ 108) = .549$	$F(2\ 108) = .098$	$F(2\ 108) = .550$
Importance and voluntariness	$F(2\ 108) = 1.138$	$F(2\ 108) = .367$	$F(2\ 108) = 3.912^a$

Although no significant effects were from each factor on the average score of each acceptance item, an independent samples t-test showed significant differences in acceptance scores between each PSS irrespective of the factor, as displayed in Appendix G.

4.4.6 CONCLUSION

For the holiday theme, main and interaction effects were found from the factors on all acceptance items, but no differences on the scales of acceptance. This means that the factors of the model seem to have an influence, but not necessarily the expected influence. As such, both the LH PSS, as NLH PSS 1 and 2 might be a solution to the problem sketched in the scenario on its own.

For the cooking theme, the LH PSS was found to be significantly more satisfactory and less objecting, while costing the most effort, compared to NLH PSS 1 and 2. On the other hand, only interaction effects were found from Importance and Voluntariness on acceptance item Satisfaction. These results presented that the LH PSS scored structurally higher than both NLH PSS, while not being influenced by the factors of the model. This means that the LH PSS might be a better solution to the problem sketched in the scenario, compared to both NLH PSS at all times.

Hence, based on these findings, no hypothesis could be unconditionally confirmed, nor rejected, and it has not been established whether addressing lost habits might be useful to increase PSS acceptance. Nevertheless, the results do point out that the variables of the model in some situations might indeed lead to increased PSS acceptance. Therefore, this study should be repeated in more domains in order to generate more general conclusions.

4.5 DISCUSSION AND CONCLUSION

The present study has presented that in some cases, addressing people's lost habits in PSS design can increase acceptance. As such, the construct of lost habits could further be validated, but not regardless of all situations. Reason for this is that the results of the main study were rather dualistic, and both themes presented opposite characteristics. This requires further interpretation.

One of the explanations could be that the factor importance, as was found in the holiday scenarios, is very dominant. The scenario tests showed that the factor importance scored high in both manipulations for the cooking theme. This may have resulted in overall high acceptance scores for the LHPSS in that theme. If this would be the case, Hypothesis 2 could be confirmed for the cooking theme. Conversely, the influence of the factor Voluntariness, although significant, should correspondingly have resulted in high acceptance scores for the LH PSS in the holiday theme, but it did not.

A second explanation may be underpinned in the design of each PSS and unforeseen factors or interaction effects with the scenarios. Respondents may have scored the PSS based on other factors than anticipated, and these factors might not be derived from the model, not consciously incorporated in the PSS design or the scenarios, or may originate from the bias a respondent obtained from interpreting the scenario. Hence, for future studies, these are two important points to take into consideration.

Apart from these points, the study design had particular benefits and drawbacks that require further discussion. Specific for this study was the use of fictive scenarios and fictive personas. This has been a conscious decision, despite the fact that theoretical studies are typical of not representing real-life situations, and therefore potentially leading to results that are not necessarily easily translated to real world scenarios. For this decision, particular benefits and drawbacks can be identified, as will be elaborated upon next.

One of the main drawbacks was that letting respondents score situations for fictive personas, might have triggered towards a decisive role of the personal bias of respondents. This could have resulted in personal answers instead of answers for the fictive personas. It

can be hard for respondents to empathize with fictive personas for reasons such as values, needs, or family situations that differ from the persona's situation described in the scenario. In addition, it can be hard to imagine the sketched scenarios, because situations can be very different from what respondents like, or respondents might intent to solve a situation in a different way. Hence, for future research it is recommended to use more, very well-imaginable scenarios and PSS samples.

A second drawback is the use of modified UTAUT2 items. Although these items are originally intended to establish the intention to use, in this study the items were used to establish expected, actual use. The items might therefore have not been fully usable to establish expected use, and it would have been more validating to test the actual use of the PSS, in such a way that real-life acceptance could be measured. However, it would have been very hard to find comparable situations in real-life, to design specific PSS, and consequently to offer people the same type of PSS, compatible with that situation. This would have resulted in many uncontrollable variables that would have affected the interpretability of the outcomes largely.

This controllability was considered the most important benefit of the theoretical setup of this study, because it enabled testing the relationships within the model. This was especially necessary in order to add more constraints after the rather low constraint Living Lab research that was reported in chapter 3. By adding constraints, such as the highly controllable scenarios and personas, all PSS could be tailored to the situation and every respondent was presented elements from the same group of scenarios.

Lastly, the use of two themes has proved to be useful, because analysing both themes resulted in nuanced outcomes. Both themes showed a different perspective on the working principles of the model and significant results were found in both themes. In addition, although this study did not show the expected coherent findings across both themes, the isolated results from both themes suggest that there might indeed be a relation between lost habits and acceptance. As such, these dualistic outcomes emphasize the importance of studying more types of situation, both in laboratory settings, and in practice. This way, it would be possible to verify the exact influence of the factors.

5. DEVELOPMENT OF A DESIGN TOOL TO ADDRESS LOST HABITS

5.1 INTRODUCTION

Chapter 4 described the theoretical backgrounds of why designing for lost habits could increase the acceptance of a PSS. This indicated that Importance and Voluntariness, which are two factors from the model of lost habits, contributed to acceptance. This chapter concluded that there is a relation between PSS acceptance and recovering the impact of an involuntary change on an important habit.

In the following chapter, the theoretical underpinnings will be translated into a practical useable design tool that supports people involved in PSS design. This tool aims to enable designers to apply the principles of lost habits in design practice and to develop PSS that have a better chance of becoming well accepted. The design tool is developed in two iterative steps, with input from prospective users, and then evaluated in an explorative way. The first iteration of the design tool was developed and evaluated during a workshop with students. Based on this, the second iteration was developed and evaluated. Next to development and evaluation of the design tool, this chapter discusses the rationale for a new design tool. Finally, it provides recommendations for the further development of the tool.

5.2 RATIONALE FOR A NEW DESIGN TOOL

Chapter 2 described that PSS design is a relatively new discipline, and that PSS are generally designed by using product and service design methods, instead of specific PSS design methods. Consequently, PSS are often designed as a package in which products and services are not designed simultaneously. This neglects the value that an integrated PSS design process can elicit (Müller & Blessing, 2007).

Next to this, PSS design is not only conducted by traditional designers, such as product designers and service designers. Instead, it is also conducted by people who have no background in design, or do not consider themselves designers. Joore & Brezet (2015) consider that designers have become entangled with other actors, such as non-designers, organizations, and companies. This has made the task of design rather complex and in some cases has changed the role of the designer towards a facilitator of a design process. Similarly, Henze, Mulder, Stappers, & Rezaei (2012) found that the act of PSS design is generally not conducted by one person, but by a multi-disciplinary team of people who are jointly concerned with PSS design activities (Henze et al., 2012).

Next to the diversity of people involved in PSS design, PSS design itself can be very diverse. This requires designers with different types of expertise, depending on the particular PSS that is designed (Joore & Brezet, 2015). Thereby, designers generally use customized sets of tools and methods during their design process. Because of all of the above, there might be as many PSS design methods as there are design projects.

The large variety of designers and corresponding design tools and methods triggers the question whether more design methods and tools are needed, and if so, at whom the tool or method should be aimed. Providing another design tool may therefore not be necessary. Nevertheless, the reason why another design tool is presented here is that addressing lost habits considers a very specific set of user values in the design process, which has not yet been captured by other design tools. Additionally, in spite of many existing design tools and methods, the number of design tools that focus on PSS design, let alone PSS that are aimed at integrating user values, such as lost habits, is limited.

Because addressing lost habits is a promising approach to increase PSS acceptance, it is important to make the translation from theoretical work to design practice. This leads to a major challenge to develop a design tool that will be useful to all design teams, for two reasons. The first reason is that PSS design is generally a multi-stakeholder activity. This includes a wide variety of people that have not necessarily experience with (PSS) design. As such, it is challenging to develop a PSS design tool that is understandable for unexperienced designers, and flexible enough for experienced designers. The second reason is that already a large variety of design toolboxes are available and in use. The risk of adding another tool is that it will not be used when it does not comply with the design habits of design practitioners, or when it cannot be integrated with commonly used methods. Therefore, primarily, the design tool should be simple to use and understand, and should give a clear image of the type of situations in which the tool can be used. Moreover, it is essential to guide the designer to work in a user-centred manner, such that his or her values and behaviour can be addressed. Finally, it is important to consider what type of PSS design tool should add value to the field of PSS design.

In the following paragraphs, the iterative development process of the design tool will be reported, including the sessions during which the usefulness of this tool was tested and evaluated.

5.2.1 REQUIREMENTS OF THE TOOL

Chapter 2 and the previous sections have suggested that practically oriented design approaches are required (Glauco et al., 2015; Vasantha, Roy, Lelah, & Brissaud, 2012),

while the complexity of PSS design dictates a rather flexible design approach when it comes to design processes (Morelli, 2006). Moreover, a PSS design tool must be able to facilitate discussion among the multi-stakeholder design team (Bocken et al., 2013). As such, it was pointed out what a PSS design tool should be like. It should be flexible (Morelli, 2006) and not prescriptive, while being more a reference guide for designers, rather than a strict methodology (IDEO, 2014; Mager, 2004). On top of that, the tool should be useful for members in multi-stakeholder design teams, and most importantly, the user must be considered in the entire design process i.e. Lloyd et al. (2006) and Schmidt, Malaschewski, Fluhr, et al. (2015) .

Consequently, the following points are central in the development of the design tool:

- 1) The tool must be understandable; such that inexperienced designers are able to use the tool.
- 2) The tool must provide a structured approach that provides guidelines which designers could follow towards useful PSS designs, based on lost habits.
- 3) The tool must provide a good balance between being prescriptive and being general. Methods that are too prescriptive result in limited creativity of the designer, whereas methods that are too open make it unclear when design decisions must be made (Eger et al., 2013).

A design method that is in line with these points, and that seems to share similar background principles as lost habits, is the Modes of Transition design framework, as developed by Ozenc (2014). This framework (see Figure 31) includes both the purpose of analysing the user (represented by the Understanding phase), and synthesising user needs into a design proposal (represented by the Conceiving and Refining phase) in an iterative way (represented by the Assessing phase, in which a designer tests prototypes with users).

Similar to lost habits, the framework is based on the perception that people in transition have functional needs and experiential needs, and that changing situations challenge people's routines. Insight in these needs and routines may support a designer to understand the impact a PSS might have on a person's life. According to Ozenc, insight in these needs can make a designer more aware of the real problem of change, and the framework guides designers to design concepts that address the impact of change.

Figure 31: Overview of the Modes of Transitions design framework (adopted from: Ozenc, 2014)

5.2.2 BUILDING BLOCKS

The model of lost habits described the relation between addressing lost habits and Acceptance. Chapter 4 presented that this relation was moderated by the importance of a habit, and by the voluntariness of change. In order to transform this model into a workable design tool, the variables and relations in the model are translated into building blocks. These building blocks are used to create a user centred design tool to support the design process of a PSS, based on important values that are related to lost habits. Every building block will be elaborated upon next. See Figure 32 for a schematic overview of the building block.

HABIT

Habitual processes can hardly be disrupted, for to two main reasons. First, habits are valuable for people, and an alternative is often perceived to be less valuable. Second, habits are often performed unconsciously, and people may not be aware of alternatives.

Designing for lost habits is based on addressing the values that an original habit represented. To effectively design for lost habits, a PSS designer must consider how important the habit was for the person, and in what manner it was valuable. Focusing on the user's habit will then define a clear problem space, and the designer can become aware of the role this habit had in a person's life.

Figure 32: Building blocks that form the design tool

PERSON

Habits are performed by people. As the PSS design process is user centred, and based on values, it is necessary to have a profound understanding of the person behind the habit. Understanding this person will provide clarity about the reasons why he or she performs a particular habit. As such, this will define the relevant characteristics of the target user of the PSS. In design and research, the term “persona” is often used as a personal profile that represents an archetype for a particular group of people. The use of personas is an approach to estimate how a person would react on certain manifestations (Cooper, 1999), and according to Van Dijk, Mulder, & Van der Lugt (2013), “Personas are created to enable designers to maintain a rich view of the user while making design decisions.” As such, a persona will become a target user in the design process.

CHANGE

When considering lost habits, behaviour change must have taken place involuntarily, as was described in chapter 4. This means that the target user did not initiate discontinuation of the habit. Instead, an external influence has forced him or her to discontinue the habit.

LOST HABIT

The design tool will be developed in order to make the rather abstract term “lost habits” usable for designers. In order to design a PSS that recovers the important values the user received from the lost habit, the tool aims to support the designer in identifying what results the user expects from that PSS.

IMPORTANT VALUES

Lost habits are caused by undesirable behaviour change. In order to explore the impact of change, lost habits must be further specified. This can be done by establishing what made the habit so valuable for a user. Based on these important values, the designer can formulate design guidelines to design a PSS. This will help framing, and guiding the design process of the PSS.

Southerton, McMeekin, & Evans (2011) have established three contexts on which behaviour change can have an effect. These contexts are: individual, social and material. The individual context implies an effect on people’s attitudes, the social context on the quality of interactions between people, and the material context on infrastructures, technologies, and objects that people can use to behave in a certain way. While the first two contexts are rather straightforward, and can be related to a user, the latter cannot. Therefore, in this chapter, the material context will be interpreted as the functionality of an object for a person. Based the theory from Southerton et al. (2011), the following three value categories will be used:

- ❖ Individual values
- ❖ Social values
- ❖ Functional values

SOLUTION

Based on the named building blocks, the designer can start to think of solutions that address one or more of the important values, and design a PSS that addresses the user’s lost habit. While doing so, the designer must be aware that the result this PSS provides to the user is leading in this process. Especially since this process involves the design of result oriented PSS, the exact role of products and services is subordinate to the result. Likewise, anticipating on solitary products and services will strongly restrict the solution space for a designer, and will presumably not result in an optimal solution. Instead, PSS must be considered holistic compositions of product, service, and system aspects.

5.3 DESIGN TOOL VERSION 1

Based on the formulated building blocks, a first version of a design tool was developed. This version of the tool was divided in two parts: an analysis part, in which a persona, his or her habits, behaviour change, and the impact of change should be analysed, and the synthesis part, in which the PSS itself should be designed. See Figure 33 and Figure 34 for a visual presentation of both parts.

5.3.1 DESIGN TOOL: ANALYSIS PART

The analysis part of the design tool represented the following building blocks, which were separated over sections:

- ❖ Habit
- ❖ Persona
- ❖ Change
- ❖ Lost Habit
- ❖ Important values

The tool described a consecutive process. The order of the building blocks started with an empty space for a persona (section 1). This empty space was considered sufficiently sized to stimulate the design team to allocate attributes to the persona. Next to the persona, empty space was provided for a characterization of the habit (section 2a). Here, the design team could point out both the habit, and the frequency by which the habit is performed. The persona and habit element are positioned next to each other, and both share the top part of the design tool.

Designers should start with these building blocks, in order to stimulate empathy for the persona. Increased empathy was considered to make it easier to analyse the impact of change on the persona, hence simplifying the design process.

After this step, the values of the initial habit should be analysed and defined in section 2b, following the three categories for important values (Social, Personal, and Functional). After this, the impact of change on these values should be established (section 3). These value categories were intended to provide the designer guidelines to study the impact of change on the initial habit. Based on this impact, the lost habit can be formulated.

The design tool template is divided into four numbered sections:

- Section 1:** Persona definition, featuring a placeholder for a person's image.
- Section 2a:** Habit definition, with the heading **HABIT WHAT?** and the label **2a**.
- Section 2b:** Value definition, with the heading **THE HABIT IS IMPORTANT, BECAUSE:** and sub-headings **SOCIAL**, **PERSONAL**, and **FUNCTIONAL**. The label **2b** is centered in this section.
- Section 3:** Impact of the intervention, with the label **3** centered in this section.
- Section 4:** Space for placing the synthesis part, indicated by a large number **4** at the bottom.

Figure 33: Analysis part, divided in 4 sections: 1: Persona definition, 2a: Habit definition, 2b: value definition, 3: impact of the intervention, 4: space for placing the synthesis part

Figure 34: Synthesis part, divided in four quadrants, and one central element: clockwise: 'What is it?'; "How can your persona use it?"; "How does it connect to the persona's lost habits?"; "What can your persona do with it?". The central element considers the vehicle type.

Next, the designer could decide which values must be addressed by the PSS. This will result in lost habits-based design guidelines. These guidelines can be used to define how the PSS will address the lost habits, and thus the values that are important to the user. For example, the social impact from deteriorating mobility would be that the person could become lonely. This impact is consequently translated into design guidelines that state that the PSS must be able to counter loneliness and provide support in maintaining social connections.

5.3.2 DESIGN TOOL: SYNTHESIS PART

The synthesis part of the tool aims on defining the PSS to be designed. Therefore, it should be used after the analysis part.

The synthesis part was separated in five sections: a centralized PSS section that presented a visual representation of the PSS, and four surrounding sections to verify how the PSS complies with the designer's vision on the persona, habit, and values. The surrounding sections were intended to be discussion topics for the design team, supporting the decision process towards a PSS that indeed addresses lost habits. The topics are:

- 1) What is the PSS?
- 2) How can the persona use the PSS?
- 3) What can the persona do with the PSS?
- 4) How does the PSS address lost habits?

The synthesis part aimed to describe a meta-level PSS concept that describes what functional result the PSS should offer. It is explicitly not necessary to narrow the solution down to the definition of specific products and services. As such, the phase supports designers to develop a shared vision on the result the PSS solution should provide, and to create a narrative of the PSS, voluntarily completed with drawings, images or other visualizations about (parts of) the PSS. In addition, this phase should support the design team to consider the relation between the PSS and the persona's values and concerns, and to address the persona's lost habits implicitly. The end-point of this process can be considered the starting point of the PSS design process, in which the designer or design team can start to define and design the required products, services, interfaces, and interactions.

5.4 TESTING THE DESIGN TOOL IN PRACTICE

For the further development of the design tool, an evaluative workshop was organized, in which the tool was tested in practice. These practical insights could consequently be used as input for the next iteration of the design tool. The tool was tested by observing how participants used and appreciated the tool, and where difficulties were found. Importantly, although the final PSS designs were discussed, the goal of this workshop was not to study how feasible or how good the developed PSS were.

5.4.1 PARTICIPANTS

This workshop involved 14 participants. 12 were 4th year students (age around 22 years, 10 male, 2 female) from a vocational university, that were following an educational programme in transportation engineering. These students took part in the course Smart Mobility from the study Spatial Development and Mobility. 2 participants were teachers (male) who taught this course. The students had no particular experience with product, service, or PSS design, but were educated in some human behaviour subjects. This was a good qualification for testing how the method would be used by unexperienced PSS designers, and was expected to provide good, unbiased insights in how well the elements in the method communicated their intention.

5.4.2 PROCEDURE

The workshop took place in the morning, in a room in the education building of the university. The workshop took approximately 2 hours. The script of the workshop is presented in Table 13.

The workshop consisted of five steps, and each step was preceded by a short, oral explanation of 3 to 4 minutes. In step 1, theoretical backgrounds of the tool were explained, the findings of the Skewiel Mobiel study were briefly reported, and the case study was introduced on which the students would work during the workshop. The case study was based on a fictive neighbourhood, described in the presentation, and used six personas, including name and age. See Figure 35 and Figure 36 for an impression of respectively the neighbourhood and the personas.

Table 13: Workshop script

Activity	Materials	Duration
Introduction	PowerPoint	30 minutes
Definition of persona, including habits	Persona picture, post-its	20 minutes (including flexible break time)
Analysing the impact on habits	Analysis form, section 1, 2a, 2b	10 minutes
PSS design	Analysis form section 3	15 minutes
Discussion and evaluation	Synthesis form	15 minutes
	Plenary

Figure 35: Context. White area represents the living area of the personas

Figure 36: Personas used during the workshop, including a given name and age. Personas were fictive and unknown to all involved.

Step 3 introduced a situation of change that caused every persona to resign the formulated habit. In this case, the living area of the personas was selected for transformation into a pedestrian zone. The participants were asked to describe the impact of this change on the formulated habit. After this, in step 4, participants were asked to use the synthesis form and imagine a PSS that can compensate for this impact. Finally, in step 5, every group presented their ideas, and a plenary session was organized to establish a discussion among all groups, and the researcher.

Throughout the workshop, the groups were observed and questions from the students were answered by the researcher. Goal of this interaction was supporting every group to perform the entire process, and to guarantee that the formulated change would have an effect on the habits that participants have defined for their persona.

5.4.3 RESULTS

To evaluate the workshop, 3 methods were used: Observations were made during the workshop, the feedback of participants was collected and analysed, and the completed workshop materials were analysed.

According to the observations, participants strongly empathized with the persona of choice, and many ideas and opinions were shared within the groups. This caused an interactive process between the participants, and resulted in a shared understanding of the user. Moreover, habits were easily formulated, but it appeared difficult to relate the habits to value categories. Although the categories were intended to provide a frame of reference, interpretation of the categories seemed difficult and much overlap was found between the personal and functional category.

A feedback session with all participants showed that participants found difficulties with assessing the habit, based on the values and with defining the exact impact of change on these values. This seemed to make it difficult to start the PSS creation process, but apart from that, participants indicated that they started to like their persona, enjoyed it to characterize the persona and to imagine habits, and they believed this persona would use the PSS.

Lastly, analysis of the materials pointed out that the impact of change was clear to all participants, but it appeared to be difficult to specify how the intervention would impact every category exactly. Some participants made an explicit link between values and the impact, but others used a more narrative method and described in short sentences what the impact was. Despite the used method, most participants described the impact rather general, which resulted in weakly defined lost habits, and expectedly not so innovative PSS proposals. See also Figure 37 for the materials produced by the participants.

5.4.4 DISCUSSION AND CONCLUSION

Despite the participants' lack of PSS design expertise and the short time intervals to define, analyse, and design, it was remarkable that every group has developed a PSS concept, based on lost habits, within a 2-hour time span. Furthermore, participants interacted actively, were enthusiastic about the workshop, and appreciated it to design for fictive

persons. Despite a number of difficulties, this workshop demonstrated that the building blocks are adequate to generate PSS concepts, although the designed concepts cannot be considered innovative. One of the reasons for this lack of innovation, might be that the case represented a rather familiar issue of not using a car for mobility.

Consequently, participants might have used their own knowledge of mobility services to solve the issue. In this respect, the results of this evaluation show similarities with findings of Lockton, Harrison, & Stanton (2010), who studied how their Design with Intent Method could be applied on design issues. They found that most designed solutions were engineered to fit with existing ideas about the design subject.

The goals of the design tool were to be understandable, to offer a structured process, to facilitate discussions, and to offer a balance between being prescriptive and general. When the outcome of this workshop is compared with the goals of the design tool, it seems that the design tool only partially achieved these goals. Reasons for not achieving these goals will be discussed next.

A number of issues were found that had to do with the analysis form. On the positive side, participants seemed able to understand most elements, and the tool seemed to provide enough support to define the target user, and to establish what habits this persona might have. However, it appeared to be difficult to use the value categories in establishing the impact of change.

Figure 37: Completed workshop materials

One of the reasons might be that the categories are both prescriptive and vague at the same time. On the one hand, analysing the impact of change, based on these categories, might not have been conducted in a structured enough manner, and resulted in rather random impact descriptions. On the other hand, participants seemed to be determined to follow the categories as precisely as possible, while they did not fully understand the meaning of these categories.

Because this resulted in a weak impact definition, participants seemed unable to define clear design guidelines to address these values, and the imagination of participants might have been blocked. For the synthesis form, other issues were found. Based on observations and discussions with the participants, this form seemed to provide no clear working method on how to design and define the PSS. This might have caused a mismatch between analysis and synthesis, which resulted in a quite random design process and possible restrictions to let participants use the full potential of the design tool.

RECOMMENDATIONS FOR THE NEXT ITERATION

In order to stimulate creativity during the design process, it is important that the designer's flow be not obstructed by difficulties in interpreting the values correctly. Furthermore, the analysis and synthesis process should be better integrated, in order to stimulate an iterative process. Therefore, the next iteration of the tool should better facilitate the designers to analyse the impact of change, and more support is needed during the process to translate habit categories to lost habits. Lastly, the next iteration of the tool should incorporate a more precise description of how to define the PSS.

5.5 DESIGN TOOL VERSION 2

After evaluation of the workshop, the design tool (DT1) has been transformed into design tool 2 (DT2). This step was an iterative step, and as such, the basic approach of the tool remained intact. Nevertheless, some focal points were changed and the structure of the tool was redesigned. Modifications related to naming and implementation of the building blocks, to integration of the analysis and synthesis form, and to visual appearance. The following section will discuss all modifications, and will report on a second test session that was performed to evaluate the iterated tool.

5.5.1 MODIFICATIONS TO THE DESIGN TOOL

Evaluation of the workshop results has yielded three important items to be improved. Regarding the analysis form:

- 1) It was unclear to the participants whether and how the value categories could be used for analysing the impact of the intervention;
- 2) It appeared difficult for the participants to use lost habits and work towards a PSS design.

Regarding the synthesis form:

- 3) It was found that participants required more guidance on how the form must be filled in.

The first two items are strongly related and seemed to originate from the explicit use of the value categories to define the importance of the habit. For the iteration, it was decided to make the value categories integral part of the analysis and synthesis process, which was also expected to solve the third issue. Thereby, DT2 (see Figure 38) was aimed to provide stronger guidelines to categorize the value of the habit and to consider the impact of change. By making the value categories integral part of the synthesis part, the designer should be enabled to analyse the impact of the intervention per category. This is expected to simplify the PSS design process.

Explicitly integrating the value categories in the design process was expected to result in an important benefit: a designer could develop parts of the PSS by following each value category. As such, a designer is forced to consider a value-based approach that addresses the result the PSS must provide to the user, rather than a function-based approach that considers what products or services are required. The latter is expected to limit the solution space for the designer, so definition issues about which part of a PSS is being developed (product, service, system) are postponed and do not restrict the creation process.

Other modifications were based on new insights. While the basic structure of the design tool has remained intact, and a key role was still assigned to the user, DT2 was designed to present a circular process, instead of the linear process of DT1. Reason for this was to emphasize that the PSS design tool is user centred, and can be iterative. Another modification was the addition of so-called situations, separated by intervention lines. The situations are:

- 1) Former situation, containing the old habit, in which former behaviour is described;
- 2) Lost habit situation, containing the lost habit, in which the actual impact of change is described;
- 3) Desired situation, containing the new habit, in which the PSS is used.

Figure 38: Enhanced design tool (DT2)

The former and lost habit situations are separated by an event of change, named “breaking intervention.” The lost habit situation and desired situation are separated by “design intervention.” Furthermore, the value categories are displayed throughout these situations. See Figure 38 for an overview of DT2, and Table 14 for a comparison of the differences between DT1 and DT2. A manual for DT2 is presented in Appendix H.

Table 14: Naming differences between building blocks from DT1 and DT2

<i>Building blocks DT1</i>	<i>Building blocks DT2</i>
Habit	Former situation & values
Person	Person
Change	Breaking intervention
	Design intervention
Lost Habit	Lost habits situation & values
Important values	Important values, integrated in other building blocks
Solution	Desired situation & values

The new tool setup, combined with the inclusion of the value categories throughout the situations, was aimed to stimulate and simplify an iterative PSS design process. Thereby, the tool was intended to support designers to consider only one value category at a time, to think of solutions in that category, and to evaluate them in the same category for every situation. By repeatedly conducting these steps back and forth and by dealing with one value category at a time, the complexity of PSS design could be reduced. This way, an idea of a PSS could be iteratively enhanced, and a high-level PSS concept could be developed.

5.6 EXPLORATIVE EVALUATION OF THE DESIGN TOOL

To test how the design tool would be accepted in practice, an explorative evaluation session was conducted with people who were professionally concerned with the design of products, services, or PSS. As Chapter 2 already reported, design is conducted by a wide variety of people, from highly experienced and specialized designers, to people who are not aware of conducting a design project. In order to obtain an insight in how the design tool would fit the working processes of this variety of people, five different professionals in three groups were selected for this evaluation. Although this set-up will not result in a thorough evaluation and validation of the design tool, it will provide insight into how people from various backgrounds understand the tool, and into how useful they consider the tool to be.

The design tool was tested on two levels: first, the overall idea of the tool was assessed, which was to establish whether each participant considered this specific tool useful and valuable for addressing lost habits in the design process. This part tried to answer the following main research question:

- ❖ Do the participants consider the developed tool useful and valuable to address lost habits in design practice?

Second, this particular design tool was tested on how successful it has translated the theoretical concept of lost habits into practical guidelines for design. This part aimed to answer the following sub-research questions:

- 1) Which elements of the design tool do participants consider valuable and which not?
- 2) How understandable is the design tool for the participants?
- 3) Do participants consider the process described in this tool effective?
- 4) How useful is the design tool for the working field of the participants?
- 5) How applicable is the design tool in the working field of the participants?

5.6.1 SELECTION

For this study, people were selected that were professionally involved in some kind of product-, service or PSS design, and had different levels of expertise concerning the field of design and the field of behaviour. Three interview sessions were conducted:

- 1) Firstly, an interview was conducted with three members of the management board of a home care organization. These participants were involved in service design, but had no particular background in the field of design. They were responsible for the development and implementation of new care services and used a very pragmatic, and practically oriented design approach. The group consisted of the owner of the home care organization (male, 56 years), the director of care service implementation (female, 57 years), and a manager responsible for the development and implementation of new care services (male, 50 years). Because the interview was conducted with three participants at once, this group will be considered one entity, and will be named Participant A.
- 2) Secondly, a service designer and co-owner of a service design agency (male, 49 years) was interviewed. This participant was both practically and theoretically educated in design and as such, he was very knowledgeable about PSS design. Next to that, he took part in various research projects that worked on PSS design

and design for behaviour change. This resulted in an interesting combination of practical and scientific knowledge about behaviour and design. This is Participant B.

- 3) Thirdly, a behavioural scientist was interviewed (male, 42 years). He was knowledgeable about design, and did his research in the field of behaviour change. His research subject focused on changing habits to improve the acceptance of innovations, which shows many similarities with design for lost habits. As a member of a research group, he had developed a design tool to design for behaviour change. His expertise was therefore mainly theoretically informed. This is Participant C.

5.6.2 PROCEDURE

Every interview was conducted on or near the workplace of the respective participant. During the interviews, no visitors were allowed in order to guarantee a stable interview context.

The interviews were planned to take an hour, but were allowed to take longer if the participants agreed. One week before the interview would take place, a background article was sent that explained lost habits and the goal of the interviews. Besides that, each participant was asked to imagine a product or service, or a situation of change. This would be used during the interview to test the design tool.

The nature of this study, and the small sample of participants, required to introduce a number of constraints to reduce outcome uncertainty. This enabled the researcher to compare the answers in a systematic way, and to enhance the interpretability of the answers. For this reason, a general interview guide approach was used. Turner (2010) explained the general interview guide approach as a qualitative and semi-structured interview method that is built around a predefined script, with predefined questions. Despite this, Turner (2010) points out that the researcher is allowed to vary a bit, and to ask follow-up questions. The result is a rather agile interview method that is well suited for the explorative nature of the conducted interviews. Prior to the interviews, a script was created, as presented in Appendix I. This script is separated in four different phases. It furthermore includes open-ended questions. The four phases were:

- 1) Introduction phase, in which the background of the research was explained (15 minutes)
- 2) Explanation phase, in which the design tool was presented and explained (20 minutes)

- 3) Design phase, in which the design tool was used for a design task (15 minutes)
- 4) Feedback phase, in which the participants impression and opinion about the design tool were evaluated (10 minutes)

The phases were followed and questions were initially asked in a fixed order, but the question order was adjusted when probing for further details was needed. Phase 1 was used as a general introduction about PSS and the ability to use habits in the design process.

In phase 2, the design tool was shown, and no explanation was given. Instead, the participant was asked to immerse him or herself in the tool, and try to explain it. This was done to assess how self-explanatory the tool is. After this, the researcher explained the tool, thereby following a fixed explanation structure. First, the persona was explained, followed by the Former situation, the breaking intervention, the Lost habit situation, the design intervention and the Desired situation. This explanation was concluded by an intermediate evaluation in which the participant's understanding of each part was assessed. Next to this, the participant was asked if he or she saw similarities with other design tools and methods.

In phase 3, the tool was used to design an intervention that was proposed by the participant, and that was agreed upon mutually. In this phase, every step in the tool was followed, and the procedure was finalized by creating a narrative PSS concept.

Phase 4 aimed on evaluating the tool, based on pros and cons, missing features, understanding and the perceived use for the participant. Moreover, the participant was asked how he or she would have performed the executed design process otherwise, without using this strategy. During the interviews, audio recordings and written notes were made for analysis purposes. When possible, the notes were directly written down by the questions asked. Right after the interviews, the overall findings were written down and answers were interpreted, partially based on observed behaviour of the participants. After that, the audio recordings were transcribed per interview question, and compared with the notes made during the interview to check for irregularities. Finally, the research questions were answered by comparing, analysing, and interpreting the interview data.

5.6.3 RESULTS

The interviews were conducted in an explorative evaluation setting. The main objective was to obtain an insight in participants' opinions on the value and possible use of DT2. In the following sections, findings will be elaborated per research sub-question, after which the main research question will be answered.

1. How understandable is the design tool for the participants?

All participants were able to understand the processes and elements from the design tool at first sight. Participants A and B could relate parts of the tool to other methods and tools that were familiar to them. Participant C noticed a lack of explicit theoretical foundation, but he admitted that it might not be necessary to mention theory in a design tool explicitly.

2. Which elements of the design tool do participants consider valuable and which not?

The building blocks of this design tool were divided over different sections. These sections were:

- ❖ Persona section
- ❖ Habit section (former situation, lost habit situation, desired situation)
- ❖ PSS section
- ❖ Breaking intervention
- ❖ Design intervention.

All participants indicated to understand each section, and all were able to use most sections. The persona could be easily used by Participant B and Participant A required some encouragement to elaborate the persona. Participant C found it difficult to work with a persona, because he wanted to give the persona a sufficient amount of characteristics, but did not know what level of detail was required.

With regard to the habit section, the interviews revealed that all participants had different opinions about the categorization of habits. Participant B found that this division did not do justice to the richness of behaviour, Participant C found it hard to make a distinction between the Personal and Functional category. In contrast to these participants, Participant A found this division very useful.

The breaking intervention was understood differently by the participants. Participant B did not recognize the breaking intervention from practice. Therefore, he did not agree with the presence of this element in the tool. According to him, in his design practice, a designer actively performs the breaking intervention by design, instead of reacting on already changed behaviour that design for lost habits foresees. On the other hand, in contrast to Participant B, Participant C appreciated the breaking intervention and he thought it was a good idea to make the intervention and its impact explicit.

3. Do participants consider the process described in this tool is effective?

Participant B understood the process, but he found that the process was not representative for reality. According to him, reality considers much more aspects in the design process than those included in the tool, and the design process takes much longer than the time of this interview. Therefore, he was not sure whether the process would eventually lead to a right problem definition to start the design process, and he found the process too analytic and too prescriptive, which restricted his creativity.

This is in contrast to Participant A, who found the process useful, because it forced to focus on the user and not on technology, as they normally do. According to them, the process was especially useful to obtain another mind-set and work from there. Participant C agreed with the process, but found it hard to connect the lost habit with the desired habit, and he was not triggered to become creative to design the PSS for this desired habit.

4. How useful is the design tool for the working field of the participants?

The usefulness of the design tool is defined by the way in which principles, advocated by the model of lost habits and translated to the design tool, are generally useful.

The participants found the tool especially useful for exploring purposes. According to Participant A, it was useful to explore user values, needs, and wants. Participant B found it useful to use the persona and former situation to study target users, and Participant C found it useful to explore to what extent the impact of a breaking intervention must be recovered. On the other hand, Participants A and B considered behaviour change as something that must be actively done to the user, for example by means of design interventions (Participant B), or by rules and regulations (Participant A). This is a fundamental difference between the respondents' perspective and the tool's perspective, and will be further elaborated upon in paragraph 5.6.4.

5. How applicable is the design tool in the working field of the participants?

The applicability of the design tool is defined by the way in which participants thought they could adopt the tool in their own design practice. According to the participants' feedback, the tool was considered not directly applicable in their current design practice. This was caused by a number of reasons. First, Participant A and B did not agree with the tool's perspective on behaviour change, as Participant A and B involved in projects to actively change user behaviour from undesired to desired behaviour. Secondly, Participant A mentioned that the tool was difficult to apply by uninstructed people, due to the abstraction level and high complexity of the tool.

5.6.4 DISCUSSION AND CONCLUSION

The main research question for this explorative evaluation was:

- ❖ Do the participants consider the developed tool useful and valuable to address lost habits in design practice?

This research question focused on the specific approach the design tool proposes to design for lost habits. Furthermore, based on the evaluative sessions, additional insights were gained about the attitude of participants towards addressing lost habits. According to these insights, participants found addressing lost habits in the design process a promising approach, and especially the focus on values and attention to the impact of an intervention on habits were considered important aspects.

With regard to the research question, positive remarks were made about the attention the tool contributes to the user and his or her values. For example, Participant A appreciated that addressing lost habits stimulates a designer to consider people based on their habits, and Participant B found it useful and interesting to emphasise on behaviour and habits during the design process. In addition, Participant A and C were glad to notice that the tool strongly focused on the user, his or her values, and that it categorized habits in different value categories. Furthermore, Participant B appreciated the focus on behaviour, but he found this focus too narrow and indicated that more factors that have an impact on behaviour should have been included.

As such, the main research question should be answered positively, which means that this particular approach was considered useful and valuable to address lost habits in the design process. However, although the intention of the tool was evaluated positively, critical remarks must be made about the differences in interpretation of the tool by participants, and about how useful they considered the tool for their daily practice. The next part will discuss these remarks.

Most critical remarks were related to the design process the tool described. Although the participants generally understood and accepted the elements and process, especially the specific implementation of the elements and process were criticized. The implementation seemed not to match with their current practice, and two participants pointed out that in practice they usually develop interventions to change undesired behaviour into desired behaviour. They indicated that they are rarely in the situation where existing behaviour is forcefully changed, and the design task is to recover this behaviour. Because of this, they feel that their daily work does not quite match with the aim of this tool.

Next to implementation issues, it seemed that the level of expertise this tool required did not completely match that of the participants. The design process this tool prescribed was considered too complex by one participant, and too simple by another. Here, Participant A found the tool too complex and unusable for uninstructed people, while it was considered too general, and lacked concrete directions on how to execute the steps in the tool. Participant B found the tool too simple and directive, and had the impression that the tool restricted his creativity too much. Lastly, Participant C missed the theoretical underpinnings of the tool, although he was not sure whether explicit theory belonged in a design tool.

These remarks imply that, although the aim of this tool was appreciated and found valuable, the way in which it is worked out was not unanimously appreciated. These different responses can largely be contributed to the participants' different points of view and levels of expertise. Participant B, an experienced service designer, recognized all elements, was able to fill in all the fields rather quickly and on his own, and reverse engineered a design project he had already finished. On the other hand, Participant A, the care organization, started with a product they planned to introduce, and evaluated how habits must be changed to make it accepted. Interestingly, they used the tool as a discussion tool, and formulated a shared vision on the challenges concerning implementation of that product. Finally, Participant C used the tool as a mix of a discussion tool and a design tool. He used the conductor of the interview as a sparring partner, and he consequently used the tool to design a general idea of a PSS.

Just as participant C, participant A used the tool to discuss on many design decisions, and this shows that the tool can very well be used to facilitate discussion among a design team. Moreover, when this finding is combined with the remark that the tool is well applicable for exploration purposes, the value of this design tool becomes clear. It shows that the tool is valuable for design teams in very early stages of development, for example to discuss on what kind of PSS must be designed, given the behaviour of the target group. This way, this design tool acts in line with Van der Bijl-Brouwer (2012), who argued that discussion tools are especially useful to support design teams to establish a shared vision on the object to be designed.

Moreover, this short evaluation session illustrated the challenges that arise when one design tool is developed for a wide variety of experts. The differences in use, following from the differences in expertise, have shown how the different levels of design experience affect the use and interpretation of the design tool. For example, the service designer was proficient at considering the user in the design process, but this might have caused him to miss more detailed user aspects. At the same time, the care workers were not experienced with using a

strict user focus and found this an eye opener, although their lack of experience on working with a user focus in design projects could have made the tool too complex for an effortless understanding.

Based on this, it might be very difficult to develop one design tool that can be used by all types of members of multi-disciplinary design teams, unless this tool facilitates that all stakeholders can share their thoughts and expertise on the design problem. A tool can facilitate this process by introducing the discussion topics, and by installing a moderator that keeps track of the discussion. A trained designer would be an appropriate moderator that can add to the discussion, and propose other design tools and methods that can help in developing a PSS.

5.7 DISCUSSION AND CONCLUSION

This chapter has described the iterative development process of a PSS design tool that aims on supporting designers to address lost habits in the design process. During this development process, the tool was tested by a selected group of students, and discussed with a small group of professionals. Goal of the design tool was to provide guidelines to design for lost habits. Thereby, the tool aimed to present a structured procedure to design PSS in a short time, while addressing lost habits.

Both the workshop and the evaluative session indicated that participants agreed with the value of addressing lost habits in the design process. Thereby, the tool seemed to support in making a quick analysis of habits and values, and resulted in a quick formulation of the concept of a PSS. Thereby, although most PSS concepts were not very innovative, it was interesting to see how quickly PSS concepts could be created.

The tool did not show its value as a standalone design tool. One of the main reasons was that the tool did not fully comply with current design practice of every participant, and participants missed specific aspects, or could not comply with the process the tool prescribes. On one hand, this finding might be due to the explorative nature, and the limited selection of participants with different backgrounds. On the other hand, the differences in background have emphasized a fundamental issue with PSS design, which will be elaborated upon next.

However, the design tool seemed promising as a discussion tool for multi-stakeholder design teams. Typical for PSS design are multi-stakeholder design teams. Not all members of such teams are trained designers. Instead, many members are expert in their own field, and all have their own vision on what should be designed. Design tools can support this

process, as is underlined by Van der Bijl (2012), Henze, Mulder, & Stappers (2011), Mulder-Nijkamp & Chueng-Nainby (2015) and Van Dijk et al. (2013). The design tool reported in this chapter should therefore be merely considered a discussion tool that supports to formulate a shared understanding of the design goals, and to agree on a shared vision on the issues to design for.

6. DISCUSSION AND CONCLUSION

Research on PSS acceptance has yielded many reasons for the lack of acceptance, and it appeared that the impact of PSS on behaviour and the role of habits have been largely underexposed in prior research. The objective of the research reported in this thesis was therefore to zoom in on the role of user behaviour and habits, and to identify how these factors contribute to PSS acceptance. The construct of lost habits was created as a factor to enhance PSS acceptance. Consequently, this research aimed to disseminate the findings to the discipline of design, and a design tool was proposed that aims to support designers in addressing lost habits in the PSS design process. According to the findings in this research, the following points can be identified.

Primarily, this thesis shows that PSS acceptance can be enhanced when designers address lost habits in the design process. This is conceptualized in the model of lost habits, which represents how lost habits relate to acceptance. The factors importance and voluntariness have an effect on this relation, such that addressing a lost habit that was very important and lost involuntarily will result in high PSS acceptance.

For PSS design, addressing lost habits implicitly means that the designed PSS should be compatible with existing or lost behaviour. As such, designers are stimulated not to focus the design process on behaviour change, but merely on the question how changed behaviour can be restored.

In order to support designers to address lost habits in the design process, a design tool is proposed. This tool is especially useful for multi-stakeholder discussions in the early phases of PSS design. In these early phases, a shared understanding must be created about what PSS should be developed, and for whom it is intended. The tool supports in this process, as it acts as a central guide to establish user requirements, based on lost habits and related values. The guidance and relative simplicity the tool enables both non-designers and designers to structure their thoughts and to share perspectives on the object to be designed. This chapter will discuss the research presented in this thesis and the contributions to design research, design practice, and society. Firstly, a brief summary is presented of the main results of this research, after which the implications of this research will be discussed. Lastly, a conclusion will be drawn, the limitations of this research will be identified, and recommendations for future research will be given.

6.1 SUMMARY

Chapter 1 introduced the main research questions for this thesis, and discussed the concept of PSS and the origin of the lack of acceptance. Furthermore, it reported that PSS acceptance is often studied in theory, but not in practice. This has caused a gap between practice and theory, which was aimed to bridge in the further course of this thesis.

Chapter 2 elaborated on theoretical and practical research on acceptance, and proposed living lab research as an approach to study practice and theory simultaneously. Especially the explorative character and the longevity of living lab research were considered suitable for studying the process of PSS acceptance.

Chapter 3 introduced the Skewiel Mobiel PSS as a living lab and reported on different studies that were conducted to study acceptance. This way, the living lab and conducted studies resulted in a clear idea of the factors that contributed to the acceptance of Skewiel Mobiel. Based on this, the construct of lost habits was identified as an important, but previously underexposed factor that contributed to the acceptance of Skewiel Mobiel.

Chapter 4 transformed the construct of lost habits into a model, and explored three factors that were hypothesized to predict PSS acceptance: Importance, Voluntariness, and Time Gap. These three factors were studied by means of two case studies. According to these case studies, the importance of the lost habit and the amount of involuntary habit loss were influential factors for PSS acceptance. On the other hand, the time between losing a habit and presenting an alternative PSS was found to have a less significant impact.

Chapter 5 reported on the iterative development of a design tool. This tool aimed to support designers and non-designers to address lost habits in the PSS design process. The tool was evaluated in two phases. The evaluations pointed out that it can be useful to address lost habits in the design process, and that the evaluated tool was useful as a discussion tool for design teams. Contrarily, the evaluated tool was less suitable as an independent design tool since it did not rightly match with different levels of design expertise.

6.2 GENERAL DISCUSSION

The research reported in this thesis was explorative, and it combined practical and theoretical studies. In the following paragraphs, the value of this research will be discussed. This discussion will be divided in contributions to the field of design research, design practice, and society.

6.2.1 CONTRIBUTION TO DESIGN RESEARCH

“Design research aims at increasing our understanding of the phenomena of design in all its complexity and at the development and validation of knowledge, methods and tools to improve the observed situation in design” (Blessing, 2002). One of these phenomena is PSS acceptance, and research has focused on finding an answer to how PSS acceptance could be increased. In line with this, the objective of the research reported in this thesis was to identify factors that can be addressed by design and that contribute to PSS acceptance.

Firstly, behavioural frameworks and technology acceptance frameworks were studied. These frameworks generally considered intention to use as an important factor for actual behaviour and acceptance. An important drawback of these frameworks was that they consider people as rational entities that make continuous cost/benefit analyses (Darnton, 2008). Additionally, Moons & De Pelsmacker (2012) showed that emotions do not play a role in these models, although they are very important determinant for usage intention. Next to emotions, Landis et al. (1978) have introduced habits as an important determinant for actual behaviour, which remained a rather underexposed factor for behaviour and acceptance.

Next to these determinants, limited attention was paid to transformative aspects in acceptance issues. Whereas the discussed frameworks can be used to predict certain situations, they do not take the transformative process into account that should lead to that predicted situation. Since PSS acceptance requires change, these models are of limited use to understand how people can be triggered to start the transformative process towards acceptance.

The field of design provided more knowledge on the role of emotions, habits, and transformation in relation to behaviour change. The tools and methods that were studied in this thesis were expected to provide insight in how to design for acceptance. However, although the studied tools and methods provided much insight in how a design process should look like (Kim, Lee, Lee, et al., 2011; Schmidt, Malaschewski, & Mörtl, 2015), and how a PSS could be visualized (Lay et al., 2009), no clear directions were given on how to design PSS for increased acceptance.

After exploring these merely theoretical frameworks, tools and methods, a more practical approach was studied in order to study the relation between habits, behaviour, and PSS acceptance. Therefore a living lab approach was used for analysing a well-accepted PSS, Skewiel Mobiel. Using this approach yielded benefits of living lab research in relation to PSS research and PSS acceptance, as will be further elaborated upon next.

Firstly, this living lab research was deemed useful for conducting explorative research. At the start of the living lab there was a general sense that habits and behaviour change could play an important role in PSS acceptance, but it was unclear what factors exactly contributed to PSS acceptance and in what way. The longitudinal and in-the-field character of living lab research has contributed largely to focusing this explorative research. Thereby, it provided the opportunity to study many aspects of this PSS, its users, and its context simultaneously.

The natural and longitudinal setting enabled the researcher to monitor the gradual transformation process of a PSS as a pilot project into a regular service. As such, the PSS could be studied as a PSS that was “just being operated.” This triggered the opportunity to study factors and constructs that contribute to “real-life” PSS acceptance. Besides that, inherent to living lab research, acceptance could be studied longitudinally, and in an unobtrusive way by using a loosely controlled experimentation environment, with limited control over study objects and the context. Hence, the limited control and extended period have provided the opportunity to observe the people involved in a natural way, including triggers and motivations that lead to PSS use, and their interactions with each other and with the PSS.

In addition, the longitudinal and in-the-field nature of living lab research was considered well-suited for monitoring and analysing the relation between habit creation, use motivations and acceptance of Skewiel Mobiel. Thereby, the formation of habits, which are typically considered barriers for PSS acceptance, could be studied.

From a researcher’s standpoint, actively participating in the living lab and studying particular situations and interactions among all stakeholders has yielded unexpected ancillary findings. For example, it was noted that drivers were unsatisfied with the limited amount of daily rides they made. As it appeared, drivers considered the PSS valuable for their social life, and they decided to become a driver to get more involved in social interactions.

As a response, the care organization arranged with another, local, healthcare organization to present the PSS to their clients. This arrangement resulted in more users, an increased number of rides, and hence happier drivers. As such, this case pointed out that the drivers are user of the PSS too, although they were initially considered service elements. On a more general level, this illustrates the dynamics of living lab research, as well as the flexibility of a PSS. Thereby, it proves that a designed PSS is not necessarily carved in stone, but the development process continues after release, as Müller & Blessing (2007) have also claimed.

Actively participating in the living lab has additionally provided a good opportunity to establish the value of this PSS. Initially, Skewiel Mobiel was developed as a mobility means to conduct local activities. Yet, during the living lab, the functional result has transformed from providing rather practical values – go shopping, visit a friend, towards increasingly social values – be up-to-date with rumours, be involved in the local network. This insight was consequently used for decisions on follow-up developments, such as the introduction of new Belbus PSS, which again shows that PSS design is never finished.

For the field of design research, these points show that living lab research can be a promising approach to study interactions between PSS and user, and to study longitudinal processes, such as PSS acceptance and the habits that can drive or obstruct them. Thereby, the in-the-field character can trigger situations that would probably not be found in laboratory research. In this case, not only insights were yielded about the development of the PSS and the acceptance process, but also about how the PSS could be adapted to the situation at hand. Thereby, a profound insight could be established in the values a PSS can provide to the user. Such insights could be fed back into the design process to enhance the PSS for a user, and this demonstrated the value of living lab research for the discipline of design research once more.

6.2.2 CONTRIBUTION TO DESIGN PRACTICE

Chapter 2 described that PSS design is generally conducted in a multi-stakeholder setting, by designers with different levels of expertise and different backgrounds. Furthermore, it described that some PSS designers may not even be aware that they are involved in a PSS design process. Lastly, chapter 2 described that PSS design is an open-ended process, which continues after the PSS is released. On one hand, the research reported in this thesis has illustrated these points, as will be elaborated upon first. On the other hand, these findings were considered in the development of a design tool, as will be elaborated upon second.

Prove for the multi-stakeholder design process was found in the way Skewiel Mobiel was originally designed. Although a trained designer had led the design process, Skewiel Mobiel was developed by a care organization that was not experienced with PSS design. However, the organization was well-familiar with their clients, and this stimulated them to develop an innovation that could be valuable for their clients. This resulted in the development of a mobility PSS, which was a PSS in a field that was currently unfamiliar to them. As such, this case shows that understanding user needs can let an organization be an innovator in yet unfamiliar fields.

Secondly, the living lab has shown that a PSS can indeed be adjusted and transformed after its release. During the living lab study, the vision of the care organization was translated into a functional result that the PSS should provide, and in a physical representation of the PSS. During the living lab study, the representation and the functional result were mutually adapted, based on insights obtained from presently, and previously introduced PSS variants.

This shows that a clear, and shared vision on the functional result can be a good point of reference for aiming the (PSS) development process, as was also proposed by Van der Bijl-Brouwer (2012). For Skewiel Mobiel, the functional result was to provide independence to its users by offering mobility, and this result appeared to be somewhat independent of the physical representation. For a PSS designer, it is important to be aware of the independency between functional result and physical representation. Because both can evolve independently, PSS design becomes a quite complex activity, in addition to the already complex nature of a PSS (Kim, Lee, & Koh, 2011). As such, it might trouble a design team to understand what exactly they are designing. Because of this, design teams need supportive tools to facilitate discussions about the PSS to be designed, and the design tool presented in this thesis might be a solution to that issue. This will be elaborated upon next.

In order to disseminate the research findings into design practice, this thesis proposed a tool to design PSS, based on lost habits. This design tool aimed to support designers and design teams to address lost habits in the design process, but a number of remarks must be made with respect to the contribution of this tool to design practice. Chapter 3 referred to Morelli (2006), who claimed that no standard PSS design method could exist, and to Tukker (2015), who argued that a sound design method is of minor importance, compared to organizational changes that are needed to integrate a PSS design process in a company's structure, culture, or activities. Furthermore, Clayton, Backhouse, & Dani (2012) and Vasantha, Roy, Lelah, & Brissaud (2012) were cited, who pointed out that too many PSS design methods are developed that are not used in practice. Considering these claims, it is important to stress how and why the design tool presented in this thesis can be a contribution to design practice.

According to the evaluative sessions on the design tool, it appeared that the tool triggered discussion among participants about how the usefulness of their developed PSS for the users. As these decisions should be made early in the design process, the tool seems suitable for early design phases, during which the design team collects design requirements and defines the vision on the designed object. This first phase of PSS design is identified by Tukker (2015) as the analysis phase, or more specifically defined by Kim, Lee, & Koh (2011) as the Requirement Identification and Value Targeting phase.

A focus on the first phase of PSS design, and on facilitating discussion in a multi-stakeholder means that the tool should be improved by focusing more on stressing what addressing lost habits in the design process means, what factors are important, and why this can be useful, and less on the process of addressing lost habits. This way, designers can use this tool as a mapping tool in which they define lost habits carefully and discuss about whether the designed created vision on the PSS fits with user habits and user values. In later design stages, they can use their own preferred design methods develop the PSS towards a final design proposal, based on these points of departure.

6.2.3 CONTRIBUTION TO SOCIETY

The objective of investigating factors that contribute to PSS acceptance is to understand how PSS can become more widely implemented. This is important, because PSS can be beneficial for numerous topics. In this thesis, the living lab touched upon two present-day societal topics: sustainability and ageing. With regard to sustainability, especially use-oriented and result-oriented PSS are considered beneficial for the environment. With regard to ageing, the studied PSS provides mobility to elderly, and thereby it supports elderly in being independent and socially connected. The next part will elaborate on both topics.

In the field of sustainability, much attention is paid to the impact of consumption patterns on the environment. The circular economy is proposed to reduce the environmental impact of consumption patterns, by means of promoting recycling, reducing the required amount of resources, or by creating awareness among citizens about pollution. Part of this objective is the increasing attention to sharing products instead of owning them, which is considered to contribute to a more sustainable world.

Designing for lost habits can be a successful approach to increase acceptance of such sharing initiatives. In this way, knowledge on how to design for lost habits contributes to the body of knowledge that is needed to create a more circular economy. Thereby, recognizing people's values in the current, not necessarily sustainable situation, and translating those values into a new, more sustainable situation, can stimulate the transition towards a more sustainable society.

Similarly, understanding people's values, and iteratively including these into the PSS design process, can be a promising approach to address an ageing society. In the coming three decades, the share of persons aged 60 years or older will double in size from 11.7% in 2013 to 21.1% of the world population in 2050 (United Nations, 2013). Considering that a large part of this group will inevitably be confronted with physical decline, while willing to

continue their behaviour, introduces an interesting frame for offering PSS for elderly by addressing lost habits.

The group of elderly is already in a transitional phase, in which many of their behaviours change and habits are lost. This can be due to physical decline and losing mental and physical capabilities, or because of changes in daily life, such as their housing situation. Such transitions cause habits and existing behaviour, previously mentioned as acceptance barriers, to be present to a lesser extent. The studies presented in this thesis have suggested that people may be willing to conserve their behaviour and related needs and values. Hence, a PSS that addresses these might be prone to become accepted, and therefore addressing lost habits could be a good approach to deal with various issues in an ageing society.

6.3 GENERAL CONCLUSION

This thesis has studied a generally underexposed aspect of research on PSS acceptance: the role of user behaviour and habits in relation to PSS acceptance. Prior research has suggested that existing habits and required behaviour change are barriers to PSS acceptance, especially in the case of use-oriented and result-oriented PSS. Furthermore, researchers have suggested that Living lab research should be used to study PSS acceptance.

This thesis has presented research, which incorporated an elaborate living lab study, on user behaviour and habits in relation to PSS acceptance. As such, this research has revealed knowledge on the development, implementation, and up-scaling of a result-oriented PSS, and on the factors that contribute to PSS acceptance. For the field of PSS research, this shows that living lab research is indeed a promising approach to study PSS acceptance.

Furthermore, this thesis has presented a new perspective on how PSS acceptance can be enhanced. This perspective implies that enabling people to restore valuable behaviour by means of a PSS, is a promising approach to increase PSS acceptance.

This is due to two main reasons:

- 1) Habits trigger automatic behaviour, which frustrates deliberate decision making. When habits are lost, automatic behaviour is discontinued, and deliberate decision making can return;
- 2) Habits are valuable for people, and losing habits might result in value loss. Consequently, restoring lost habits is expected to restore lost values.

These reasons suggest that it is not always necessary to change people's behaviour actively, in order for a PSS to become accepted. In contrast, a PSS that is designed to address lost habits, and, thereby, to allow people to continue past behaviour, may be more successful. Reasons are that addressing lost habits empowers people to restore important values, and people can deliberately decide to use this PSS. This also implies that designers should not only design PSS that stress existing behaviour, but instead to study people's values and habits, and to design PSS that address these values and habits. As such, PSS can support people to continue valuable behaviour.

6.4 FUTURE RESEARCH

Research on PSS is relatively new, and especially research on PSS acceptance has been limited for a long time. However, recently young researchers as (Camacho-Otero, Pettersen, & Boks, 2017; Schmidt, Malaschewski, Fluhr, et al., 2015) seem to intend to studying this particular topic elaborately. This newness of the topic means that there is still much more work to do, until PSS acceptance will be understood to its fullest. This newness also means that the research reported in this thesis had a very explorative character with all kinds of limitations, especially with regard to generalization of the results.

Generalization of the results, based on one extensive living lab study and derived experiments, is a delicate matter. In addition to that, the living lab study was conducted in an uncontrolled, real-life setting that is continuously affected by, sometimes even unknown, external variables. From a scientific perspective, it is very hard to generalize research findings, based on such types of study. Yet, the findings from this study are generalized in a theory of lost habits. While doing so, these limitations were taken into account in two ways.

Firstly, the scientific value of the study was strengthened by supporting the model of lost habits by other, existing theories on behavior, habits and PSS acceptance, and by relating findings from the living lab with theory. Secondly, the developed model was tested in a controlled experiment, which indicated that importance and voluntariness have an effect on the relation between lost habits and acceptance.

On the other hand, thoroughly studying one PSS sample has provided many new and very interesting findings in relation to PSS acceptance. As such, the explorative character had revealed interesting directions for future research, which could be picked up in future studies. These opportunities will be illustrated next. Firstly, recommendations on the design tool will be given, followed by a discussion on business cases. Lastly, this section will conclude with a discussion on the model of lost habits.

6.4.1 DESIGN TOOL

Findings from the living lab were translated into a design tool, which could be used in situations of lost habits. It was evaluated in an explorative manner with students and a small group of prospective users. These evaluative sessions yielded that the tool might not be very useful as a design guideline that supports a designer in designing for Lost Habits. Instead, it was considered more valuable as a discussion tool that helps design teams to create a shared understanding of the PSS that is to be designed.

Future studies should focus on various research goals. One is to evaluate the way in which the tool translates research insights on lost habits into workable guidelines for the design process. Other research goals can be to test the effect of this tool on establishment of an overall design goal, on definition of a persona and lost behaviour, and on the capabilities of the design team to decide which values should be addressed in the design process. This latter is important to understand how this design tool can be optimized to facilitate the role as a discussion tool in the early phases of design.

Lastly, the outcome of a design process in which this tool is used, should be a real-life PSS that could be monitored during the use phase. Based on these findings, it can be established whether this process has indeed resulted in a well-accepted PSS.

6.4.2 BUSINESS CASES

Skewiel Mobiel and the Belbus PSS are small-scale mobility PSS for elderly. Although such types of PSS were rather new when introduced, the concept has been copied several times and in several areas in The Netherlands (“Argos mobiel,” 2017, “Buurt mobiel,” 2017). Many of these PSS, just like Skewiel Mobiel and the Belbus PSS, focus on supporting social connectedness, are funded by subsidies, driven by volunteers, and are well appreciated by users and the local network.

Another commonality is that most of such PSS, just like Skewiel Mobiel and the Belbus PSS, lack a sustainable business case that guarantees financial continuity. This introduces a dilemma. On one hand, the social aspects are considered core values and should be remained. On the other hand, a lack of financial support threatens continuity of the PSS. In order to reduce this dilemma, operating costs are intentionally kept low, for example by using volunteer drivers. Another possibility is to compensate the costs for one PSS with the income from another PSS, but financial sustainability remains an issue to address.

In the Netherlands, WMO transport is offered to elderly who need mobility. The financial sustainability is on one hand covered by governmental subsidies. On the other hand, WMO

transport is much focused on increasing financial efficiency by combining rides, and large time intervals in which the taxi would arrive. Thereby, WMO transport lacks personal attention, short travel times, and support during activities, which are very important for services as Skewiel Mobiel and the like.

Because these latter aspects seem important for users, financial sustainability might be enhanced when the PSS provider asks a premium for these aspects. This can be an alternative for the often applied approach of limiting operating costs, especially since these can have a negative impact on the offered service.

Further research should therefore focus on the development of business models that guarantee that the core values will be maintained, while the costs are covered. Research directions are to study the impact and possibilities of asking premiums for valuable service aspects, and to study how a mobility PSS can be financially integrated in a larger package of related PSS.

6.4.3 MODEL OF LOST HABITS

Studying the Skewiel Mobiel living lab resulted in identification of lost habits as an important construct for acceptance. This construct was translated into a model of lost habits. For this model, three dependent variables were assessed, and Importance and Voluntariness were found to have an important effect on PSS acceptance. In addition to these findings, it can be expected that these variables are only a selection of the variables that add to acceptance, and lost habits might as well be influenced by many other variables.

In order to enhance the model of lost habits, future research could focus on testing the validity of the model, or on extending the model, based on new insights. The validity of the model could be tested by assessing the effects of the variables on PSS acceptance, following a similar approach as reported in Section 4.5.

The model could be extended by studying existing PSS, and analysing whether lost habits and the dependent variables have played a role in relation to acceptance, or whether other acceptance factors can be identified. Such a study could reveal other factors that have an effect on acceptance, while these factors could relate to lost habits, or to completely different principles. With regard to PSS acceptance, this type of research will most probably result in an enhanced insight in PSS acceptance factors.

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A. TRIP DATA SKEWIEL MOBIEL

Skewiel Mobiel travel data was analysed and divided in the number of rides, and the functional purpose of the ride. The results are presented and discussed in Section 3.4. This appendix presents the numerical data that was used as input for the visual representations.

NUMERICAL REPRESENTATION OF THE RIDES

This table shows (in alphabetical order) the number of rides that were made from one place to another, or within one place, in the period from 1st November 2012 until 20th December 2013. The top section represents the ride origins, the left section the destinations.

Table 15: Origins and destinations of Skewiel Mobiel rides

Origin:						
Destination:	Aldtsjerk (ALD)	Gytsjerk (GYT)	Munein (MUN)	Oentsjerk (OEN)	Tytsjerk (TYT)	Unknown (?)
<i>Aldtsjerk (ALD)</i>	0	2	0	13	0	0
<i>Burgum (BUR)</i>	0	0	0	3	0	0
<i>Damwoude (DAM)</i>	0	3	0	4	0	0
<i>Dokkum (DOK)</i>	0	0	0	1	0	0
<i>Gytsjerk (GYT)</i>	22	19	7	82	0	0
<i>Hurdegaryp (HUR)</i>	1	1	0	2	0	1
<i>Leeuwarden (LWD)</i>	0	0	0	1	0	0
<i>Munein (MUN)</i>	0	0	0	4	0	0
<i>Oentsjerk (OEN)</i>	29	52	5	137	1	1
<i>Readtsjerk (REA)</i>	0	0	0	0	0	0
<i>Tytsjerk (TYT)</i>	0	0	0	12	0	0
<i>Unknown (?)</i>	9	2	1	51	0	1

NUMERICAL REPRESENTATION OF TRAVEL PURPOSE

This table shows the purpose of each ride made with Skewiel Mobiel.

Heemstra-Unknown represents visits to Heemstra State. Heemstra State is the main office for Skewiel Mobiel and facilitates services such as a physiotherapist, occupational therapist, a restaurant. In addition, various associational activities are conducted here.

The travel registration system did not structurally make a subdivision in visits to Heemstra State, hence the exact purpose of a number of rides remained unknown.

Similarly, the “Unknown” category is rather large, since the receptionist did not always specifically mention the purpose of a ride. Observations and informal meetings have pointed out that most rides marked as Unknown are rides frequently made with frequent users.

Table 16: Purpose of Skewiel Mobiel rides

<i>Trip purpose</i>	<i>Number of rides</i>
<i>Animal care</i>	5
<i>Health</i>	4
<i>Heemstra-Unknown</i>	70
<i>Leisure</i>	8
<i>Medical</i>	53
<i>Personal care</i>	9
<i>Public</i>	13
<i>Shopping</i>	91
<i>Supermarket</i>	141
<i>Visit</i>	15
<i>Work</i>	5
<i>Unknown</i>	68

B. SKEWIEL MOBIEL USER INTERVIEWS

This appendix presents the questionnaires that were used for the semi-structured interviews, as presented in Paragraph 3.5.2.

Both frequent and new users were interviewed. Both groups were interviewed with a minimal different objective, and the questionnaires slightly differ in order to be line with the research objective.

INTERVIEWS FREQUENT USERS

MULTIPLE CHOICE QUESTIONNAIRE

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Vaste gebruikers PP editie

Proefpersoon nummer:

DEEL I

1. Geslacht	Vrouw		Man			
2. Leeftijd:						
3. Burgerlijke staat:	Gehuwd	Samenwonend	Gescheiden	Weduwe	Alleenstaand	
4. Heeft u een rijbewijs?	Ja		Nee			
5. Gebruikt u meer diensten van Tellens?	Ja, meerdere	Ja, enkele	Ja, één	Nee, enkel Skewiel Mobiel	Weet niet	
6. Welke vervoersmogelijkheden staan u ter beschikking? (meerdere antwoorden mogelijk)	Stok	Rollator	Scootmobiel	(e-)Fiets	Skewiel Mobiel	Auto
	Familie	Buren	Vrienden	Bus	(WMO) taxi	Anders, nl.
7. Voert u activiteiten zelfstandig uit?	Ja, altijd		Ja, soms met hulp		Nee, altijd met hulp	Nee, onmogelijk

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DEEL 2

1. Heeft u gemerkt dat Skewiel Mobiel met een nieuw voertuig wordt uitgevoerd?	Ja		Weet niet		Nee
2. Hoe bevalt het nieuwe voertuig vergeleken met het oude voertuig	Veel beter	Beter	Geen verschil	Slechter	Veel slechter
3. Hoe waardeert u het comfort van het nieuwe voertuig	Zeer goed	Goed	Voldoende	Matig	Zeer matig
4. Hoe waardeert u de ruimte in het voertuig	Zeer goed	Goed	Voldoende	Matig	Zeer matig
5. Hoe waardeert u de in-/uitstap van het voertuig	Zeer goed	Goed	Voldoende	Matig	Zeer matig
6. Wat vindt u van de vormgeving van het nieuwe voertuig	Opvallend	Vrolijk	Milieuvriendelijk	Stoer	Lelijk
8. Zou u Skewiel Mobiel vaker gaan gebruiken als u er meer bestemmingen mee kan bereiken?	Jazeker	Ja, misschien	Nee, waarschijnlijk niet	Nee, zeker niet	Weet niet

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Vaste gebruikers PP editie

9. Heeft u gemerkt dat een nieuw betaalsysteem is ingevoerd?	Ja		Weet niet		Nee
10. Hoe ervaart u het betaalsysteem	Zeer eenvoudig	Eenvoudig	Niet eenvoudig, niet lastig	Lastig	Zeer lastig
11. Wat vindt u van de nieuwe prijzen	Veel beter	Beter	Geen verschil	Slechter	Veel slechter
12. Was u op de hoogte van de kortingsacties	Ja		Nee. U mag vraag 13, 14 en 15 overslaan.		Weet niet
13. Heeft u gebruik gemaakt van de kortingsacties	Ja, allemaal	Ja, enkele	Ja, eenmaal	Nee. U mag vraag 14 en 15 overslaan.	Weet niet
14. Heeft u andere bestemmingen bezocht door de actie	Ja, nieuwe bestemming	Ja, maar ik kom er vaker	Nee, ik kom er altijd met Skewiel Mobiel	Nee, maar ik gebruik normaal gesproken iets anders	Weet niet
15. Heeft u iets anders gekocht dan het kortingsproduct	Ja, alle boodschappen	Ja, enkele noodzakelijke boodschappen	Ja, enkel iets lekkers	Nee, enkel het kortingsproduct	Weet niet
16. Vindt u dat de service is veranderd sinds de invoering van het nieuwe voertuig?	Sterk verbeterd	Iets verbeterd	Geen verschil	Iets verslechterd	Sterk verslechterd

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Vaste gebruikers PP editie

DEEL 3

1. Is Skewiel Mobiel voor u geschikt om de volgende bestemmingen te bereiken? (meerdere antwoorden mogelijk)	Familie	Vrienden	Supermarkt	Speciaalzaak	Huisarts
	Café	Fysiotherapie	Gemeentehuis	Anders	...
2. Indien nee: waarom gebruikt u Skewiel Mobiel niet om deze bestemmingen te bereiken?	De bestemming is te ver	De rit is te duur	Het gebruik is te omslachtig	Alternatief vervoer is beschikbaar	Weet niet
6. Hoe beoordeelt u het boekingsproces	Zeer eenvoudig	Eenvoudig	Geen mening	Lastig	Zeer lastig
7. Wanneer besluit u om een rit te boeken?	Besluit staat vast vanwege vaste ritten	Een dag voor de rit	Enkele dagen voor de rit	Afhankelijk van omstandigheden	Anders, nl.
8. Waar hangt de beslissing van af om een rit te boeken?	Het weer	Beschikbaarheid van alternatief vervoer	Hoeveelheid boodschappen	De bestemming	De chauffeur
9. Hoe beoordeelt u de chauffeurshulp in de winkel?	Overbodig	Prettig	Nuttig	Gewenst	Noodzakelijk

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Vaste gebruikers PP editie

10. Hoe beoordeelt u de chauffeurshulp bij het in- en uitstappen?	Overbodig	Prettig	Nuttig	Gewenst	Noodzakelijk
11. Hoe beoordeelt u de chauffeurshulp bij het inpakken van uw bagage?	Overbodig	Prettig	Nuttig	Gewenst	Noodzakelijk
12. Waarom gebruikt u andere vervoersmiddelen dan Skewiel Mobiel?	Beter comfort	Meer gemak	Uit gewoonte	Locatie niet haalbaar	Anders, nl.
16. Is de kortingsactie aanleiding geweest om Skewiel Mobiel (vaker) te gebruiken?	Ja, volledig	Ja, deels	Nee, maar wel mooi meegenomen	Nee, had er geen behoefte aan	Weet niet
17. Is het nieuwe voertuig aanleiding geweest om Skewiel Mobiel (vaker) te gebruiken?	Ja, volledig	Ja, deels	Nee, maar wel mooi meegenomen	Nee, had er geen behoefte aan	Weet niet
20. Vindt u dat u momenteel actiever bent dan vroeger?	Veel actiever	Iets actiever	Gelijk gebleven	Minder actief	Veel minder actief

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Vaste gebruikers PP editie

22. Slaat u wel eens een rit over vanwege een meereizende cliënt?	Ja, reden om niet te gaan	Ja, tenzij ik weet wie het is	Nee, ik accepteer het	Nee, geen moeite mee	Nee, het is juist leuk
23. Slaat u wel eens een rit over vanwege een chauffeur?	Ja, ik volbreng de rit op een andere manier	Ja, ik verplaats de rit	Nee, maar ik had liever een andere chauffeur	Nee, ik vind alle chauffeurs prima	Weet niet
24. Is het voertuig wel eens aanleiding om niet met Skewiel Mobiel te gaan?	Ja, slecht comfort	Ja, te weinig ruimte	Ja, niet veilig	Nee	Weet niet
25. Spreekt u wel eens met anderen over Skewiel Mobiel?	Ja, vaak	Ja, regelmatig	Ja, een enkele keer	Nee, nooit	Weet niet
26. Heeft u met anderen over het nieuwe voertuig gesproken?	Ja, vaak	Ja, regelmatig	Ja, een enkele keer	Nee, nooit	Weet niet

Einde van deze vragenlijst. Bedankt voor het invullen.

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Vaste gebruikers PP editie

OPEN QUESTIONNAIRE

- Welke 3 belangrijkste buitenshuize activiteiten voert u wekelijks uit?
- Welke 3 belangrijkste buitenshuize activiteiten voert u maandelijks uit?
- Welke buitenshuize activiteiten voert u niet meer uit?
- Mist u deze activiteiten?
- Hoe heeft u voor het eerst kennis gemaakt met Skewiel Mobiel?
- Wanneer heeft u besloten om met Skewiel Mobiel te reizen?
- Waarom gebruikt u Skewiel Mobiel om locatie X te bezoeken?
- Wat waardeert u het meest aan de Skewiel Mobiel service?
- Hoe ging u ergens naartoe, toen u Skewiel Mobiel nog niet gebruikte?
- Vindt u dat uw sociale leven is veranderd sinds u Skewiel Mobiel gebruikt?
- Wat voor gevolgen heeft het voor u als Skewiel Mobiel wegvalt?
- Wat vindt u minder goed aan het nieuwe voertuig?
- Waarom zouden anderen Skewiel Mobiel niet gebruiken?
- Kent u mensen die geschikt zijn voor Skewiel Mobiel?

INTERVIEWS NEW USERS

MULTIPLE CHOICE QUESTIONNAIRE

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Incidentele gebruikers PP editie

Proefpersoonnummer:

DEEL I

1. Geslacht	Vrouw		Man			
2. Leeftijd:						
3. Burgerlijke staat:	Gehuwd	Samenwonend	Gescheiden	Veduwe	Alleenstaand	
4. Heeft u een rijbewijs?	Ja			Nee		
5. Gebruikt u meer diensten van Tellens?	Ja, meerdere	Ja, enkele	Ja, één	Nee, enkel Skewiel Mobiel	Weet niet	
6. Welke vervoersmogelijkheden staan u ter beschikking?	Stok	Rollator	Scootmobiel	(e-)Fiets	Skewiel Mobiel	Auto
	Familie	Buren	Vrienden	Bus	(WMO) taxi	Anders, nl.
7. Voert u activiteiten zelfstandig uit?	Ja, altijd		Ja, soms met hulp	Nee, altijd met hulp		Nee, onmogelijk

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Incidentele/nieuwe gebruikers PP editie

DEEL 2

Inc1. Wat was de hoofreden om Skewiel Mobiel (weer) te gebruiken? (A3)	Het nieuwe voertuig	De kortingsactie	Ik werd erop gewezen door iemand van Tellens	Ik wilde weten Skewiel Mobiel geschikt voor mij is	Een andere reden, namelijk...
Inc2. Hoe was u op uw bestemming gekomen als u Skewiel Mobiel niet had gebruikt?	Lopend met de stok	Lopend met de rollator	Met de scootmobiel	Met de (elektrische) Fiets	Met de (WMO) taxi
	Meereizend met familie	Meereizend met bure	Meereizend met vrienden	Ik had de bestemming niet bereikt	Anders, namelijk:
Inc3. Zou u Skewiel Mobiel opnieuw willen gebruiken om deze bestemming te bereiken?	Ja, zeker	Ja, misschien	Weet niet	Nee, waarschijnlijk niet	Nee, absoluut niet
Inc4. Zou u Skewiel Mobiel willen gebruiken om andere bestemmingen te bereiken?	Ja, zeker	Ja, misschien	Weet niet	Nee, waarschijnlijk niet	Nee, absoluut niet
Inc5. Is Skewiel Mobiel nuttig voor u?	Ja, zeker	Ja, misschien	Weet niet	Nee, waarschijnlijk niet	Nee, absoluut niet

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Incidentele/nieuwe gebruikers PP editie

Inc6. Wat vond u van de rit?	Leuk	Gezellig	Handig	Vervelend	Overbodig
Inc7. Wat is de aanleiding om niet van Skewiel Mobiel gebruik te maken? (u23)	Slecht comfort	Te weinig ruimte	Niet veilig	Niet nodig	Beter alternatief
Inc8. Kent u mensen die geschikt zijn voor Skewiel Mobiel? (u24)	Ja, meerdere		Ja, een enkele		Nee

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Incidentele/nieuwe gebruikers PP editie

DEEL 3

1. Heeft u gemerkt dat Skewiel Mobiel met een nieuw voertuig wordt uitgevoerd?	Ja		Weet niet		Nee
2. Hoe bevalt het nieuwe voertuig vergeleken met het oude voertuig?	Veel beter	Beter	Geen verschil	Slechter	Veel slechter
3. Hoe waardeert u het comfort van het nieuwe voertuig?	Zeer goed	Goed	Voldoende	Matig	Zeer matig
4. Hoe waardeert u de ruimte in het voertuig?	Zeer goed	Goed	Voldoende	Matig	Zeer matig
5. Hoe waardeert u de in- en uitstap van het voertuig?	Zeer goed	Goed	Voldoende	Matig	Zeer matig
6. Wat vindt u van de vormgeving van het nieuwe voertuig?	Opvallend	Vrolijk	Milieuvriendelijk	Stoer	Lelijk
8. Zou u Skewiel Mobiel vaker gaan gebruiken als u er meer bestemmingen mee kan bereiken?	Jazeker	Ja, misschien	Nee, waarschijnlijk niet	Nee, zeker niet	Weet niet

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Incidentele/nieuwe gebruikers PP editie

9. Heeft u gemerkt dat een nieuw betaalsysteem is ingevoerd?	Ja		Weet niet		Nee
10. Hoe ervaart u het betaalsysteem?	Zeer eenvoudig	Eenvoudig	Niet eenvoudig, niet lastig	Lastig	Zeer lastig
11. Wat vindt u van de nieuwe prijzen?	Veel beter	Beter	Geen verschil	Slechter	Veel slechter
12. Was u op de hoogte van de kortingsacties?	Ja		Weet niet		Nee. U mag nu naar vraag 17
13. Heeft u gebruik gemaakt van de kortingsacties?	Ja, allemaal	Ja, enkele	Ja, eenmaal	Nee. U mag nu naar vraag 17	Weet niet
14. Heeft u andere bestemmingen bezocht door de actie?	Ja, nieuwe bestemming	Ja, maar ik kom er vaker	Nee, ik kom er altijd met Skewiel Mobiel	Nee, maar ik gebruik normaal gesproken iets anders	Weet niet
15. Heeft u iets anders gekocht dan het kortingsproduct?	Ja, alle boodschappen	Ja, enkele noodzakelijke boodschappen	Ja, enkel iets lekkers	Nee, enkel het kortingsproduct	Weet niet

20130725 Vragenlijst kwalitatief onderzoek Skewiel Mobiel – Incidentele/nieuwe gebruikers PP editie

16. Vindt u dat de service is veranderd sinds de invoering van het nieuwe voertuig?	Sterk verbeterd	Iets verbeterd	Geen verschil	Iets verslechterd	Sterk verslechterd
17. Hoe vond u de dienstverlening? (SV14)	Overbodig	Prettig	Nuttig	Gewenst	Noodzakelijk

Einde van de vragenlijst. Bedankt voor het invullen.

OPEN QUESTIONNAIRE

1. Welke 3 belangrijkste buitenshuize activiteiten voert u wekelijks uit?
2. Welke 3 belangrijkste buitenshuize activiteiten voert u maandelijks uit?
3. Welke buitenshuize activiteiten voert u niet meer uit?
4. Mist u deze activiteiten?
5. Hoe heeft u voor het eerst kennis gemaakt met Skewiel Mobiel?
6. Wanneer heeft u besloten om met Skewiel Mobiel te reizen?
7. Wat waardeert u het meest aan de Skewiel Mobiel service?
8. Wat vindt u minder goed aan het nieuwe voertuig?
9. Waarom zouden anderen Skewiel Mobiel niet gebruiken?
10. Kent u mensen die geschikt zijn voor Skewiel Mobiel?

C. USER STUDY POTENTIAL USERS BELBUS WOMMELS

This appendix presents the questionnaire that was reported in Section 3.8. First, the announcement letter is presented. This letter was sent to all clients from care location Wommels. A few days later, the questionnaires were sent.

Aan de inwoners van Wommels en omgeving die zorg
en/of diensten van Nij Stapert ontvangen

Betreft: Onderzoek naar vervoersbehoefte

Wommels, 17 februari 2014

Geachte heer/mevrouw,

"Wommels is een mooi dorp waar u de meeste voorzieningen kunt vinden!" Er zijn echter ongetwijfeld momenten waarop u het dorp uit wilt om bijvoorbeeld een speciale winkel, vrienden of familie te bezoeken. Vanuit Nij Stapert onderzoeken we hoe de inwoners van Wommels hun "deipaad" invullen. We zijn benieuwd welke vervoersopties u gebruikt om naar buiten te gaan en wat u dan bezoekt. Loopt u nog hele stukken, neemt u liever de fiets of de taxi of rijdt u misschien graag mee met bekenden? En waar gaat u dan naartoe? Is dat bijvoorbeeld het wekelijkse bezoek aan de supermarkt, of gaat u vaak naar vrienden, familie of een vereniging?

Behalve wat u doet, willen we u ook vragen wat u graag zou willen doen. Mist u bijvoorbeeld vervoersopties die uw "deipaad" nog beter kunnen invullen? Misschien laat u de boodschappen wel door uw kinderen brengen, terwijl u dat zelf wilt doen, maar niet kunt. Onze stagiair Rick Schotman zou graag uw verhaal en uw mening willen horen. Hij heeft daarvoor een vragenlijst opgesteld met enkele vragen die u niet meer dan 10 minuten kost. We zouden het fijn vinden als u deel wilt nemen aan dit onderzoek. Met dit onderzoek kan Nij Stapert in de toekomst mogelijk de dienstverlening verder verbeteren. Deelnemen aan het onderzoek is vrijwillig!

Als u hulp nodig heeft bij het invullen of u wilt er graag verder over praten dan kunt u dat aangeven bij de medewerker van de receptie. Rick Schotman komt dan bij u langs. U kunt de vragenlijst in de bijgevoegde envelop versturen. Mocht u vragen of opmerkingen hebben van deze brief of anderszins dan kunt u contact opnemen met mij. Namens de medewerkers van Nij Stapert bij voorbaat hartelijk dank voor uw medewerking.

Met vriendelijke groet,

Annagreet Krommendijk

Locatiemanager Nij Stapert
Zorggroep Tellens

Figure 39: Letter to clients from the Wommels care location

Geachte heer/mevrouw,

Hieronder vindt u een aantal vragen. Alle vragen gaan over uw eigen situatie. Zou u per vraag aan willen geven wat voor uw situatie van toepassing is? Uw antwoorden zullen anoniem verwerkt worden. Als u moeite heeft met invullen, kunt u contact opnemen met de receptie van Nij Stapert. Zij zullen u dan verder helpen.

Vraag 1. Hoe bezoekt u de volgende locaties?

a. Supermarkt Koolstra (u mag meerdere manieren aankruisen)

- ☐ Ik ga niet naar de supermarkt Koolstra
- ☐ Ik ga lopend, eventueel met rollator
- ☐ Ik ga met de fiets
- ☐ Ik ga met de scootmobiel
- ☐ Ik rijd zelf met de auto
- ☐ Ik rij mee met iemand
- ☐ Ik ga met het openbaar vervoer
- ☐ Ik gebruik de WMO taxi

b. De bakkerij in het dorp (u mag meerdere manieren aankruisen)

- ☐ Ik ga niet naar de bakkerij in het dorp
- ☐ Ik ga lopend, eventueel met rollator
- ☐ Ik ga met de fiets
- ☐ Ik ga met de scootmobiel
- ☐ Ik rijd zelf met de auto
- ☐ Ik rij mee met iemand
- ☐ Ik ga met het openbaar vervoer
- ☐ Ik gebruik de WMO taxi

c. Apotheekhoudende huisarts (u mag meerdere manieren aankruisen)

- ☐ Ik ga niet naar de apotheek (houdende huisarts)
- ☐ Ik ga lopend, eventueel met rollator
- ☐ Ik ga met de fiets
- ☐ Ik ga met de scootmobiel
- ☐ Ik rijd zelf met de auto
- ☐ Ik rij mee met iemand
- ☐ Ik ga met het openbaar vervoer
- ☐ Ik gebruik de WMO taxi

d. Winkels buiten het dorp (u mag meerdere manieren aankruisen)

- ☐ Ik ga niet naar winkels buiten het dorp
- ☐ Ik ga lopend, eventueel met rollator
- ☐ Ik ga met de fiets
- ☐ Ik ga met de scootmobiel
- ☐ Ik rijd zelf met de auto
- ☐ Ik rij mee met iemand
- ☐ Ik ga met het openbaar vervoer
- ☐ Ik gebruik de WMO taxi

e. Familie / vrienden in de omgeving (u mag meerdere manieren aankruisen)

- ☐ Ik ga niet naar familie in de omgeving
- ☐ Ik ga lopend, eventueel met rollator
- ☐ Ik ga met de fiets
- ☐ Ik ga met de scootmobiel
- ☐ Ik rijd zelf met de auto
- ☐ Ik rij mee met iemand
- ☐ Ik ga met het openbaar vervoer
- ☐ Ik gebruik de WMO taxi

Vraag 2. Worden uw boodschappen wel eens aan huis gebracht? (u mag één antwoord aankruisen)

- ☐ Ja, ik krijg mijn boodschappen meestal via een bezorgdienst
- ☐ Ja, bekenden nemen meestal boodschappen voor me mee
- ☐ Nee, ik haal mijn boodschappen meestal zelf op

Vraag 3. Worden uw medicijnen wel eens aan huis gebracht? (u mag één antwoord aankruisen)

- ☐ Ja, ik krijg mijn medicijnen meestal via een bezorgdienst
- ☐ Ja, bekenden halen meestal medicijnen voor me op
- ☐ Nee, ik haal mijn medicijnen meestal zelf op

Vraag 4. Zijn er bestemmingen die u vroeger bezocht, maar die u nu niet meer kunt bereiken? (u mag meerdere antwoorden aankruisen)

- ☐ Supermarkt
- ☐ Apotheek
- ☐ Huisarts
- ☐ Vrienden
- ☐ Familie
- ☐ Vereniging
- ☐ Het café
- ☐ De kapper

Deze vragen gingen over uw mobiliteit. De volgende vragen zijn algemener. Zou u misschien deze vragen ook willen invullen?

I. Wanneer bent u geboren?

Dag:

Maand:

Jaar:

II. Gebruikt u een fiets?

- ☐ Ja
- ☐ Nee

III. Kunt u zelfstandig autorijden?

- ☐ Ja
- ☐ Nee

IV. Woont u alleen?

- ☐ Ja
- ☐ Nee

V. Waar woont u?

- ☐ Nij Stapert
- ☐ De Birning
- ☐ De Skeakel
- ☐ Het dorp
- ☐ Buiten het dorp

Hartelijk dank voor het invullen van alle vragen. U kunt de vragenlijst in de bijgesloten envelop doen en via de post of bij receptie van Nij Stapert inleveren. Als u liever wil dat we de vragenlijst bij u ophalen, dan kan dat ook. Zou u in dat geval contact willen opnemen met de receptie van Nij Stapert?

Zou u ervoor willen zorgen dat Nij Stapert deze vragenlijst vóór donderdag 27 februari a.s. ontvangt? Hartelijk dank!

Figure 40: Questionnaire

D. FREQUENT USERS BELBUS AND SKEWIEL MOBIEL

This appendix shows the 20 most frequent users for Skewiel Mobiel and each Belbus. For every user, it presents the number of registered rides per user, and the share of this number, in relation to all registered rides.

Table 17: Frequent users from Skewiel Mobiel and every Belbus

User ID	Weidum #	Weidum %	Wommels #	Wommels %	Blauwhuis #	Blauwhuis %	Skewiel #	Skewiel %
1	279	37%	268	24%	36	9%	201	17%
2	133	18%	120	11%	28	7%	74	6%
3	89	12%	67	6%	22	6%	68	6%
4	60	8%	67	6%	22	6%	63	5%
5	49	7%	50	4%	20	5%	60	5%
6	23	3%	49	4%	17	4%	54	5%
7	20	3%	47	4%	17	4%	52	5%
8	17	2%	44	4%	14	4%	51	4%
9	16	2%	41	4%	8	2%	43	4%
10	15	2%	39	3%	8	2%	43	4%
11	9	1%	39	3%	7	2%	34	3%
12	8	1%	36	3%	7	2%	33	3%
13	7	1%	35	3%	7	2%	29	3%
14	6	1%	21	2%	7	2%	26	2%
15	6	1%	21	2%	6	2%	24	2%
16	4	1%	18	2%	6	2%	24	2%
17	3	0%	14	1%	6	2%	23	2%
18	3	0%	13	1%	6	2%	22	2%
19	2	0%	13	1%	6	2%	19	2%
20	2	0%	13	1%	5	1%	18	2%

E. SCENARIO PARTS

This appendix presents the scenario parts that were used in the evaluation study presented in section 4.5.

The scenarios were assembled according to the following structure: Scenario = Introduction (general) + Importance/"IMP" (LH or NLH) + Voluntariness/"VOL" (LH or NLH) + Time gap/"GAP" (LH or NLH)

Because two themes were used, this structure resulted in 16 different scenarios. See Table 18: Scenario configurations for an overview of every all scenario configurations. The following pages show the narratives that were used for every scenario part.

Table 18: Scenario configurations

<i>Holiday</i>	<i>IMP</i>	<i>VOL</i>	<i>GAP</i>		<i>Cooking</i>	<i>IMP</i>	<i>VOL</i>	<i>GAP</i>
1	LH	LH	LH		1	LH	LH	LH
2	LH	LH	NLH		2	LH	LH	NLH
3	LH	NLH	LH		3	LH	NLH	LH
4	LH	NLH	NLH		4	LH	NLH	NLH
5	NLH	LH	LH		5	NLH	LH	LH
6	NLH	LH	NLH		6	NLH	LH	NLH
7	NLH	NLH	LH		7	NLH	NLH	LH
8	NLH	NLH	NLH		8	NLH	NLH	NLH

HOLIDAY SCENARIOS

<i>General situation</i>	<i>VAR</i>	<i>Importance (IMP)</i>	<i>Voluntariness (VOL)</i>	<i>Time gap (GAP)</i>
<p>Piet en Bep gaan ieder jaar met z'n tweeën op vakantie. Hun kinderen zijn de deur uit, maar ze zijn nog niet met pensioen. Van hun werkgever mogen ze ze ieder jaar 4 weken vakantie opnemen. Deze 4 weken worden al in het begin van het jaar vastgelegd.</p>	LH	<p>Tijdens hun vier weken vakantie gaan ze al 15 jaar met hun caravan naar Camping De Berárd in Zuid-Frankrijk. Omdat Bep geen rijbewijs heeft, rijdt Piet altijd. Op de camping ontmoeten ze ieder jaar dezelfde groep internationale kampeers. De groep bestaat uit Italianen, Fransen, Duitsers, Denen en een stel Engelsen. Er wordt zelfs een speciaal veld voor ze ingericht waar ze gezellig bij elkaar staan. Samen voeren ze activiteiten uit, zoals BBQ's waar de leukste anekdotes boven tafel komen, ze doen kanotochten en maken uitjes binnen de omgeving.</p>	<p>Bij een oogcontrole wordt een oogafwijking bij Piet geconstateerd. Tot zijn grote schrik mag Piet per direct niet meer autorijden.</p>	<p>Dit gebeurt 2 maanden voordat ze op vakantie willen gaan.</p>
	NLH	<p>De vier weken die ze aan vakantie te besteden hebben, delen ze op om verschillende vakanties te vieren. Ze bezoeken vaak leuke campings in Zuid Europa. Zo zijn ze vorig jaar met hun caravan naar Italië en dit jaar hebben ze gepland om naar camping La Vache in Frankrijk te gaan. Ze hebben de camping niet gereserveerd, omdat de ervaring leert dat ze altijd wel een plek kunnen vinden. Omdat Bep geen rijbewijs heeft, rijdt Piet altijd. Ze gaan echter ook wel eens vliegen en zoeken dan een gezellige bed-and-breakfast op.</p> <p>Op vakantie hebben ze altijd snel aansluiting met andere gasten met wie ze eten of activiteiten ondernemen.</p>	<p>Tijdens een rit naar zijn werk heeft Piet de snelheid ruimschoots overtreden. Hij is door de politie aangehouden en moet zijn rijbewijs voor minimaal een half jaar inleveren.</p>	<p>Dit gebeurt een week vóórdat ze op vakantie willen gaan.</p>

COOKING SCENARIOS

<i>General situation</i>	<i>VAR</i>	<i>Importance</i>	<i>Voluntariness</i>	<i>Time gap</i>
<p>Mina houdt ontzettend van lekker eten. Ondanks haar hoge leeftijd mag ze nog steeds erg graag koken en ze vindt het erg gezellig om met anderen te genieten van de meest fantasievolle meergangenmaaltijden.</p>	LH	<p>Elke drie maanden tovert ze haar huis om in “Mina’s Restaurant”. Ze kookt dan voor haar 8 vrienden op leeftijd. Ze spreken altijd de eerste van de maand af en iedereen houdt deze datum vrij. Mina heeft haar huis helemaal afgestemd op koken, want haar keuken is bijna nog groter dan haar woonkamer. De keuken is dan ook van alle gemakken voorzien, zodat ze de meest creatieve maaltijden in elkaar draait. Haar vrienden wonen een stuk kleiner en ze vinden het dan ook geweldig om bij Mina uit eten te gaan.</p>	<p>Toen Mina klaar was met het bereiden van een maaltijd voor haarzelf, is ze vergeten het vuur onder een pan uit te doen. Tijdens het eten ziet ze ineens rook uit de keuken komen. De vlam is in de pan geslagen en het vuur is overgegaan op de rest van de keuken. Haar keuken en een deel van de woonkamer brandt af en is voorlopig niet te gebruiken.</p>	<p>Dit gebeurt twee maanden voordat de vrienden bij haar zouden komen eten</p>
	NLH	<p>Elke drie maanden eet ze met 8 vrienden, met wie ze een kookgroep vormt. Ze koken om de beurt en eten afwisselend bij elkaar. Iedereen doet erg de best om de meest creatieve maaltijden in elkaar te draaien. Ze wonen allemaal in dezelfde stad</p>	<p>Mina wordt alweer een jaartje ouder. Ze vindt het erg spannend worden om haar hele huis schoon te houden en ze besluit kleiner te gaan wonen. Deze nieuwe woning heeft een kleine keuken en er is net genoeg ruimte om met 2 mensen aan tafel te zitten. De groep kan dus niet meer bij haar eten.</p>	<p>Dit gebeurt een week voordat de vrienden bij haar zouden komen eten.</p>

F. SCENARIO VALIDATION

This appendix describes the material validation of the scenario parts. Objective was to study whether the scenario parts were distinctive enough to be used in the main study that is presented in Section 4.5. For this study, 4 scenarios were used: scenario 1 and 8 from both the Holiday theme and the Cooking theme. See Appendix D for the used fragments.

This validation study has also been presented in Schotman & Ludden (2015).

METHOD

As part of a larger study, we conducted a validation study towards scenario creation. Our aim was to develop distinctive scenarios, based on the factors presented in the model of lost habits. Following, we present the results of this validation study towards scenario creation.

PARTICIPANTS

The study was conducted via a survey, among a group of 42 respondents. All respondents were free to stop the survey at any moment, although questions could not be skipped. 10 respondents did not finish the survey. It is unclear at which part the survey was abandoned, although colleagues told that some questions were ambiguous or difficult to answer.

2 entries have been ignored, as these respondents gave an unreal age. Therefore, the answer reliability cannot be verified. This resulted in a group of 30 respondents, of which 9 were women between the ages of 23 and 63 years, and 21 were men between the ages of 26 years and 67 years. The average age of all respondents was 42 years old.

Invitations were sent to half of the colleagues working at the department of Design, Production, and Management, and respondents were asked to spread the survey among acquaintances. Additionally, a selected group of acquaintances from the researcher have been asked.

It has not been monitored which respondents were colleague, or acquaintance, as the responds were taken anonymously.

MATERIALS

An online survey was created on limesurvey.org. Two themes were developed (Holiday & Food), each containing 2 scenarios (Lost Habit (LH) and Not Lost Habit (NLH)). The independent factors in the model have been manipulated. In scenario Holiday LH and Food LH the factors were manipulated to enhance the relation between lost habits and acceptance, in scenario Holiday NLH and Food NLH, the factors were manipulated to decrease the relation.

The scenarios were built according to the following modular structure:

Scenario = Introduction (general) + Importance (positive or negative) + Voluntariness (positive or negative) + Time gap (negative or positive)

The scenarios were written in Dutch. The introduction was identical for both scenarios within the theme. Thereafter, the scenarios were tailored towards a Lost Habit scenario (LH) and a general, control scenario (NLH).

All scenarios were created in a modular way, following a specified course of events. The LH scenarios introduced one or two main characters who enjoyed a recurring activity. Then, this activity has to be discontinued due to an external event. This happens short before the habitual activity would be performed. The NLH scenarios introduced the same one or two characters as used in the LH scenarios, but the characters enjoyed various similar and recurring activities. Their ability to perform some of these activities is discontinued by their own choice. This choice is made long before a recurring activity will be performed.

Each scenario was accompanied by a collage, representing the main character(s) and their activities.

PROCEDURE

Each respondent was assigned to one random scenario from each theme, so two scenarios were presented (Holiday LH or Holiday NLH and Food LH or Food NLH). For each presented scenario, respondents were asked to read the scenario and to check the collage. After a scenario has been presented, the respondent evaluated the magnitude of each moderator on a 9-point Likert scale with end points "Very little (1)" to "Very much (9)". After two scenarios, the gender and age of the respondent was asked. In this way, the magnitude of each factor was evaluated twice, resulting in 4 different values for each factor. All questions and answers were given in Dutch and all questions were mandatory.

RESULTS

For the evaluation of the scenario parts, a one-way ANOVA has been carried out on the different factors. The sample size for scenario's were: Holiday LH: N=12, Holiday NLH: N=18, Food LH: N=19 and Food NLH: N=13. The results are presented in Table 1 and Table 2.

Table 19: Scenario A

Factor	df	Holiday LH Mean	Holiday NLH Mean	F	p
Between subjects					
Importance	1	8.17	5.33	22.582	.000
Voluntariness	1	2.42	8.17	120.278	.000
Time gap	1	2.75	5.22	7.931	.009

Table 20: Scenario B

Factor	df	Food LH Mean	Food NLH Mean	F	p
Between subjects					
Importance	1	6.59	6.77	.058	.811
Voluntariness	1	2.12	6.38	45.334	.000
Time gap	1	2.76	5.62	11.470	.002

From the factors Importance, Voluntariness, and Time gap, the means and F-values have been evaluated. A successful manipulation would result in a significantly higher mean score for Importance in the LH scenarios than the NLH scenarios. The means for Voluntariness and Time gap would score significantly lower for the LH scenarios than the NLH scenarios. A high significance would be illustrated by a low p-value, which is usually the case when $p < 0.01$.

In Table 1 and Table 2, we see that the means of the factors Voluntariness and Time gap score significantly lower in the LH scenarios, than the NLH scenarios, which means that the factors are successfully manipulated. The means for factor Importance scores significantly higher in the Holiday LH scenario, than the Holiday NLH scenario, which also means a successful manipulation. Conversely, the factor Importance in the Food scenarios is not significantly different. This manipulation has therefore not been successful.

G. GRAPHICAL REPRESENTATION ANOVA

This appendix presents the graphical representations of the relations found in Section 4.5.

First, the graphs for the Holiday-themed PSS will be presented, followed by the graphs for the Cooking-themed PSS.

HOLIDAY-THEMED PSS

Figure 41: These lines represent the relation between the factor Importance and the magnitude of satisfaction of each holiday-themed PSS.

Figure 42: These lines represent the relation between the factor Importance and the magnitude of Objection of each holiday-themed PSS.

Figure 43: These lines represent the relation between the factor Voluntariness and the magnitude of satisfaction of each holiday-themed PSS.

COOKING-THEMED PSS

Figure 44: These figures represent the relation between each factor and the magnitude of satisfaction for each cooking-themed PSS

Figure 45: These figures represent the relation between each factor and the magnitude of objection for each cooking-themed PSS.

Figure 46: These lines represent the relation between each factor and the magnitude of effort for each cooking-themed PSS.

H. MANUAL DESIGN TOOL 2

This appendix presents the manual for using Design Tool 2 in practice.

I. INTERVIEW GUIDE APPROACH SCRIPT

Design Tool 2 was evaluated with prospective users, as presented in Section 5.6. This appendix presents the questions and the script that were used.

EXPERT INTERVIEWS DESIGN FOR LOST HABITS – AN EMPATHIC DESIGN STRATEGY				
Interview met:				
Van organisatie:				
Datum:				

Fase	Procedure/Uitleg	Vragen	Materialen	Tijdsduur
Voorbereiding	Materialen verzamelen		1. Pen en papier 2. Voicerecorder 3. Pennen 4. Design strategie (geplastificeerd) 5. Invul-strategie 6. Handleiding (geplastificeerd) 7. Voorbeeld (geplastificeerd) 8. Presentje	0.00
Voorstellen	1. Begintijd noteren 2. Voicerecorder starten 3. Vragen stellen	1. Heeft u er bezwaar tegen als uw naam en bedrijfsnaam wordt genoemd? 2. Wat is uw leeftijd? 3. Wat is uw functie binnen deze organisatie? 4. Hoe omschrijft u uw organisatie? 5. Op een schaal van 1 tot 10, hoe bekend bent u met het begrip product-service system (PSS)? 6. Op een schaal van 1 tot 10, hoe ervaren acht u zichzelf met het ontwerpen van PSS'en, producten en/of diensten? 7. Op een schaal van 1 tot 10, hoeveel kennis heeft u van gedrag en gedragsverandering? 8. Welke rol speelt gedrag en gedragsverandering in uw dagelijkse (ontwerp) praktijk? 9. Op een schaal van 1 tot 10, hoe vaak komt u in contact met mensen die uw PSS, producten en/of diensten gebruiken? 10. Waaraan moet volgens u een goede ontwerpmethodologie of ontwerpstrategie voldoen? 11. Was het vooraf opgestuurde document over de achtergrond van mijn onderzoek duidelijk? 12. Heeft u een verandering, product of dienst bedacht?		0.10

Fase	Procedure/Uitleg	Materialen	Tijdsduur
Achtergrond	1. Vertellen: <ul style="list-style-type: none"> - Promotieonderzoek aan UT - Onderzoek naar de acceptatie van PSS - Probleem van PSS: slechte acceptatie door gewoontes en benodigde gedragsverandering - Strategie ontwikkeld om acceptatie te verbeteren - Ik heb de strategie meegenomen en wil deze graag behandelen in het komende uur - Het doel van dit interview is onderzoeken of de ontwikkelde strategie nuttig is en creërend en inspirerend kan werken voor het ontwerpproces 2. De interview procedure aankondigen: <ul style="list-style-type: none"> - ik zal de strategie presenteren - We doen een korte evaluatie - We doen een oefening met de strategie aan de hand van de bedachte verandering, product of dienst - We sluiten af met een enkele vragen ter evaluatie 		0.05

Fase	Procedure/Uitleg	Materialen	Tijdsduur
Strategie presenteren	<ol style="list-style-type: none"> 1. Strategie tonen 2. Uitleggen <ul style="list-style-type: none"> - De strategie kan gebruikt worden om PSS concepten te ontwikkelen - De strategie werkt als ondersteuning om te ontwerpen op basis van zogenaamde verloren gewoonten - De gebruiker speelt een centrale rol binnen de strategie (= user-centred). 3. Strategie kent verschillende startpunten, afhankelijk van het doel. Voorbeelden: <ol style="list-style-type: none"> 1. <i>Persona en old habit</i>. Doel: Ontwerpen om gewoontes te veranderen 2. <i>Breaking intervention</i>. Doel: impact op gewoonte onderzoeken 3. <i>Lost Habits</i>. Doel: Latente behoeftes onderzoeken 4. <i>Design intervention</i>. Doel: productevaluatie 4. Onderdelen per stuk behandelen 	<ol style="list-style-type: none"> 1. Ontwerp strategie (geplastificeerd) 2. Handleiding (geplastificeerd) 3. Voorbeeld (geplastificeerd) 	0.10
Onderdeel <i>Persona</i>	<ul style="list-style-type: none"> - We beginnen bij de persona. Die staat centraal in het ontwerpproces - Persona wordt "aangekleed" met leeftijd, woonsituatie, hobby's, etc. - Kan virtueel of "echt" zijn, of een combinatie van beide 		
Onderdeel <i>Old habit</i>	<ul style="list-style-type: none"> - Functionele beschrijving van een gewoonte - Uitesplitst in categorieën functioneel, persoonlijk en sociaal - Functioneel: pure functievervulling, bijv: eten op tafel of reizen van A naar B - Persoonlijk: Belang voor persona, onzichtbaar van buiten. Bijvoorbeeld geluk, gezondheid, etc. - Sociaal: Belang voor persona in interactie met anderen. Bijvoorbeeld status, onderdeel van de groep, etc. - Categorieën zullen in de praktijk enigszins overlappen 		
Onderdeel <i>Br. intervention</i>	<ul style="list-style-type: none"> - Situatie of verandering die ervoor zorgt dat de gewoonte niet meer doorgezet kan worden. Bijvoorbeeld overheidsinterventie, fysieke achteruitgang, verhuizing 		
Onderdeel <i>Lost habit</i>	<ul style="list-style-type: none"> - De impact van de interventie op de oude gewoontes, aan de hand van 3 categorieën - Gedachte: mensen willen hun gewoontes voortzetten en nemen iets aan dat hierbij helpt - Heeft doorgaans de vorm: "persona kan niet meer [redenen bij oude gewoonte]" 		
Onderdeel <i>D. intervention</i>	<ul style="list-style-type: none"> - Ontwerpoplossing om verloren gewoontes aan te spreken - Start van een iteratief proces, wisselend tussen interventie en oplossingen 		
Onderdeel <i>Solutions</i>	<ul style="list-style-type: none"> - Deeloplossingen voor impact, per categorie. - Hulp om gestructureerd de impact op te lossen - Kruisverbanden tussen deeloplossingen kunnen getrokken worden - Uiteindelijk zullen alle deeloplossingen samen de nieuwe PSS definiëren 		
Onderdeel <i>New habit</i>	<ul style="list-style-type: none"> - Toepassing van de nieuw ontworpen PSS in het leven van de persona - Startpunt voor een ontwikkelproces naar een nieuwe PSS 		

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Fase	Procedure/Uitleg	Vragen	Materialen	Tijdsduur
Tussenevaluatie		<ol style="list-style-type: none"> 1. Begrijpt u de onderdelen 2. Welke onderdelen begrijpt u minder goed 3. Ziet u gelijkenissen met andere ontwerpstrategieën/methoden? 		0.10
Strategie doorwerken	<ol style="list-style-type: none"> 1. Aan de hand van door geïnterviewde aangedragen gebeurtenis/PSS de strategie doorwerken. - In geval van aangedragen product/service: eerst evalueren in hoeverre het past bij de old habit en eventueel op basis van de beschreven old habit een herontwerp voorstellen voor de product/service 2. Afronden met een concept PSS 		<ol style="list-style-type: none"> 1. Invulvel ontwerpstrategie 2. Aangedragen verandering 3. Aangedragen product/service 4. Pennen 	0.15
Evaluatie		<ol style="list-style-type: none"> 1. Vond u het door de door u gekozen verandering of PSS geschikt voor deze methode? 2. Hoe zou u zonder deze strategie met de verandering omgaan/Hoe zou u zonder deze strategie de PSS geëvalueerd hebben? 3. Wat vindt u goed aan de strategie? 4. Wat vindt u slecht/minder goed aan de strategie? 5. Welke toepassingsgebieden ziet u voor deze strategie? 6. Lijkt de strategie u nuttig in uw beroepspraktijk? 7. Zijn er zaken die u mist aan deze strategie? 8. Als u een verbeterpunt mag noemen, welke zou dat zijn? 		0.10
Afscheid	<ol style="list-style-type: none"> 1. Bedanken 2. Eindtijd noteren 3. Presentje overhandigen 4. Geplastificeerde materialen overhandigen 5. Vervolprocedure uitleggen en termijnen vastleggen 		<ol style="list-style-type: none"> 1. Presentje 2. Geplastificeerd materiaal 	0.05
Nazorg	<ol style="list-style-type: none"> 1. Draft verslag opsturen voor commentaar 2. Interviews uitwerken en opsturen als bijlage 3. Geupdate versie van de ontwerpstrategie meesturen 			0.00

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