User acceptance in a changing context: why some product-service systems do not suffer acceptance problems

Hendrikus Schotman* and
Geke Dina Simone Ludden

Faculty of Engineering Technology,
Chair of Product Design,
University of Twente,
P.O. Box 217, 7500 AE Enschede, The Netherlands
E-mail: h.schotman@utwente.nl
E-mail: g.d.s.ludden@utwente.nl
*Corresponding author

Abstract: The Western world is increasingly moving towards a service-oriented economy. The concept of product-service systems (PSSs) can help to deal with this transition. However, users and businesses are generally required to change their normal way of behaving to adhere to a PSS and this often acts as a barrier for successful implementation. This lack of required behavioural change often results in poor user acceptance and many PSS initiatives fail after successful pilot projects. Various measures are put forward to improve acceptance, but not all measures focus on changing user habits. This paper argues that PSSs can be more powerful in gaining user acceptance when they are designed to address lost habits, owing to unwillingly changed behaviour.

Keywords: user acceptance; changing contexts; product-service systems; PSSs; acceptance problems; changing context; behavioural change; user habits; personal influences; design research; intrinsic motivation; extrinsic motivation.

Reference to this paper should be made as follows: Schotman, H. and Ludden, G.D.S. (2014) 'User acceptance in a changing context: why some product-service systems do not suffer acceptance problems', *J. Design Research*, Vol. 12, No. 3, pp.188–203.

Biographical notes: Hendrikus Schotman is a PhD candidate at the Faculty of Engineering Technology at the University of Twente. His research focuses on product-service systems related to elderly and mobility. He studies the role of user habits and asks how habits can be used to improve user acceptance of PSS. His work is part of the grey but mobile research group within CRISP.

Geke Dina Simone Ludden is an Assistant Professor at the Faculty of Engineering Technology at the University of Twente. She studies design for behaviour change and has published in major international journals such as *Design Issues*, *International Journal of Design*, and *The International Journal of Humor Research*.

1 Introduction

1.1 From products and services to product-service systems

Europe and the USA have historically been good at manufacturing products. Mass production grew explosively in the end of the 19th century and during the 20th century, and the focus on improving productivity and quality has persisted for many decades. However, at the beginning of the 1980s a shift became apparent (Gale, 1994) where some manufacturers were confronted with severe economic problems, while others prospered. This trend continued through the end of the 1990s. Wise and Baumgartner (1999) explain the success of these latter businesses by 'going downstream', meaning to focus more on the consumer than they used to. They divide downstream moves into four different business models:

1 embedded services

2 comprehensive services

3 integrated solutions

4 distribution control.

'Distribution control' differs from the other three as it merely focuses on expanding the business by taking over distribution channels. The first three, on the contrary, are significantly focused on the development and improvement of services rather than products alone. As Tukker and Tischner (2006a) claimed: "Selling products used to be the standard way of doing business".

This transition from products towards services is the basis of many PSS theories. PSSs evolved from two research areas. The first area is business management, where the focus is mainly on offering competitive advantage rather than price advantage. European companies cannot compete on price alone with, for example, Asian low-cost countries (Wise and Baumgartner, 1999). Although business management is one of the fundamental research areas for PSS, the emphasis is on the second research area: environmental and social benefits (Baines et al., 2007).

Tan (2010) analysed ten leading definitions of PSS and reports that a distinctive question is "whether PSS solutions should lead to lower environmental impact than existing business models, or not". Some definitions indeed ignore environmental factors, but environmental effects very much remain key to PSSs (Baines et al., 2007; Goedkoop et al., 1999; Manzini and Vezzoli, 2002; Tukker and Tischner, 2006b). According to these authors, the focus is mainly on reducing the use of resources inherently related to the increase of consumption associated with wealth. Dematerialisation of products, which means decreasing use of materials, optimisation of use, and competitive advantages are cited as benefits. However, it must be stressed that PSSs not by definition push consumption in a more sustainable direction. They have the potential to do it (Tukker and Tischner, 2006a).

PSSs are not a clearly defined research area and practical implementation shows challenges that need to be addressed. To start with, a universal definition for PSSs does not yet exist, and there is no consensus about the definition of products or services either. Products used to be tangible objects, while services used to be intangible, but in the past many definitions of products, services, and product-service systems (PSSs) have been

proposed (Tan, 2010; Baines et al., 2007). Products and services have been growing towards each other, and it depends on the definition whether something is regarded as a product, a service, or a combination of products and services.

This paper addresses issues of acceptance of PSSs. Typically, these issues arise in the implementation phase, rather than in the concept phase of PSSs. We will use a wide definition for PSS, because we will not focus on the theoretical foundations of PSS, but rather on the interaction with practice. Goedkoop et al. (1999) formulated a workable definition for PSSs as "a marketable set of products and services capable of jointly fulfilling a user's need". Our research is part of a larger research agenda that focuses on PSSs for elderly and mobility. Therefore, while our focus is on acceptance of PSS, this paper is written in a context of mobility and elderly. We will describe a case where an innovative PSS seems to be very well accepted. From this case, we will derive a possible solution for PSS acceptance issues in general.

1.2 Products, services and PSSs

The character of services lies in the collaboration between stakeholders and users. Services differ from products by relying on the interaction between the user and the provider of the service (Henze et al., 2012). The value of a service is created by the user in the use phase of the service. PSSs therefore provide many opportunities for customisation, more than many traditional products.

This characterisation is in line with the thoughts of Morelli (2002). He summarised Rifkin (2000) by stating: "The element of novelty, from the design perspective, comes from the service component of the PSS." Rifkin added to this that services only exist when they are rendered. This means that a multi-stakeholder collaboration starts, because not only the designer or the service provider gives shape to the service. The user also takes part in the process.

Morelli recognised four developments that accompany the transition from traditional product thinking to PSS thinking. In short, these developments are:

- from possession to access
- from product to service
- from pre-manufacturing to live manufacturing
- from designer-based to co-creation-based.

These transitions agree with the findings from others (i.e., Mont, 2002), although the transition from product to service would probably be reversed by more service-oriented researchers.

The IHIP paradigm was often used to define and recognise services. IHIP is the abbreviation for intangibility, heterogeneity, inseparability, and perishability. Lovelock (2004) described the fuzziness of this paradigm. He explained how these elements could also be true for products. An example of intangible goods is info-based media that are stored electronically and can be reproduced on demand (Hill, 1999). Because the traditional IHIP definition was out-dated, Lovelock proposed a new paradigm. His proposal for a 'rental/access' paradigm is quite similar to that in most PSS theories.

According to Lovelock (2004), user involvement in service creation is not essential. He described numerous examples where inseparability of production and consumption in a service is not apparent. Instead, he claimed, "Increasingly, both consumers and organizations outsource activities they don't want to get involved in". Therefore, he refuted the inseparability aspect of services. However, for the provider or designer of a PSS this meant a new challenge to anticipate and pre-define parts of the PSS. Lovelock claimed that many services could not be stored after production and will perish, but there was the "need to recognize [the] concept of *advance inventory* (pre-production) as well as *post-production inventory*".

Lovelock is typical in arguing from a service perspective. Baines et al. (2007) focused on products but they see the same transition, which they called the 'servitisation' of products and 'productisation' of services.

2 Result oriented PSSs

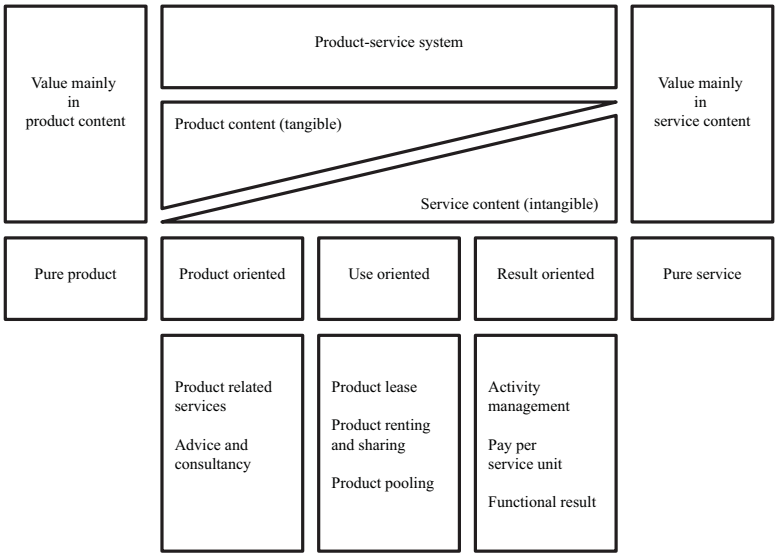
Morelli (2002) defined a blueprint of a service as a schematic representation that "contains indications about material elements of the service (e.g. sequence of spaces, products used) and immaterial attributes, such as time sequences, interaction, actors involved, accessorial operations". Morelli's point was "use cases are aimed at generating scenarios that represent the possible future configurations of what is to be designed". This means that PSSs are designed for use scenarios they could possibly encounter. This is close to what Lovelock defined as the concept of 'advance inventory'.

The transition from possession to access is one of the most important characteristics of PSSs. Manzini and Vezzoli (2002), Morelli (2002) and many others described how the consumer does not demand a product or service as is. The consumer is said to be interested in the outcome – or the result – that these products and/or services can deliver. They are regarded as not being interested in the product's actual use and possession. Theoretically, this is a good starting point, but PSSs are generally not implemented successfully in practice. The success of PSSs largely depends on how well the PSS is designed and embedded, and how well all elements work together (Williams, 2007). Tukker and Tischner (2006b) stressed that many PSSs just "form an envelope around a system filled with products and material" and they propose to categorise PSSs in three types. To understand their categorisation, it is important to point out the relation they described between a *product-service* and a *PSSs*. A product-service is "a value proposition that consists of a mix of tangible products and intangible service[s] designed and combined so that they jointly are capable of fulfilling final customer needs". This is very similar to the definition used in this paper, although tangibility and intangibility of products and services were criticised earlier. Tukker and Tischner distinguished the system aspect from product-service aspects. The system-aspect adds "the network, infrastructure, and governance structure that is needed to 'produce' a product-service". Their categorisation is a way to interpret and understand the working principles of PSSs. The three categories move from being primarily product-based to primarily service-based:

- *Product-oriented services*, where some services are added to products. Examples include maintenance plans or financing schemes.

- *Use-oriented services*, where use is still product-related, but the ownership of the product stays with the provider. Examples include renting or leasing contracts.
- Result-oriented services, where client and provider agree on a 'functional result'. There is no agreement of the product to be used. Instead, the provider can offer a range of not necessarily predefined products that suit the needs of the user. An example is outsourcing to third parties.

Figure 1 Classification of PSS



Source: Tukker and Tischner (2006a)

Result-oriented PSSs are more abstractly defined than the other two types. Here, results are commonly defined in terms of performance indicators or in less tangible outcomes, such as conditions. However, activities that are performed in a result-oriented PSS do not appear to be very different from use-oriented PSSs. This is why result-oriented and use-oriented PSSs can be difficult to distinguish in practice, especially when the user pays for the output of the system, which is referred to as the pay-per-service unit. Nevertheless, specific for use-oriented types is the active involvement of the user in the process towards the result of the PSS, whereas the user is not involved in the process of a result-oriented PSS. In practice, this often implies that for use-oriented PSSs a predefined object will be used for a given situation, while the used object may vary depending on the functional result or performance agreed between user and provider for a result-oriented PSS.

3 The impact of change

As stated earlier, the transition from possession to access is one of the basic elements of PSSs. This transition is less apparent with product-oriented PSSs, but even more with use-oriented and result-oriented PSSs. This transition has bigger implications than one

might expect. A provider who keeps ownership of the products remains responsible. Interaction between provider and consumer by means of offering services is therefore important in order to provide the desired result. However, most of the time a fundamental change is necessary. Williams (2007) suggested that change that comes with PSSs could be divided in five categories:

1 change in ownership structure

2. change in device concept

3 change in infrastructural/institutional context

4 change in stakeholder learning

5 change in product-user interaction.

Williams' focus was on the capabilities of PSSs to change systems, or in other words, to innovate systems. After analysing many different PSSs, using the three categories of PSS, he concluded that the examined product-oriented PSSs do not offer any system innovation at all. However, use-oriented PSSs have more potential and show some of the listed changes. Leasing and renting systems exist, and here ownership structures change thoroughly. However, although sometimes the used products are specifically tailored to the system, an aspect such as the providers' end-of-life responsibility for products is rarely recognised.

While product- and use-oriented PSSs are quite commonly implemented, result-oriented PSSs are seen less often. According to the definition of Tukker and Tischner, outsourcing is quite common, but the reason why 'functional result' delivering PSSs are rare is the more abstractly defined agreement between provider and user about the system performance. This results in users not quite understanding what to expect from the PSS and providers hesitating to offer such types of PSSs, due to the perceived risk (Tukker, 2004). The low implementation rate of result-oriented PSSs is generally seen as a problem, because these types have the highest potential to be both innovative and sustainable.

It is inherent to most result-oriented PSSs that offering a result is not directly linked to a specific product. A better solution offers better results, but it does not automatically imply that users always choose a better solution, especially when they already can achieve the result they desire. Changing human behaviour is difficult, Christiaans (2011) illustrated this by mentioning rather enigmatically that "People are furious pattern makers". To benefit from the results that PSSs can deliver, consumers – and other stakeholders such as manufacturers and providers – are expected to change their normal behaviour in order to implement a PSS and to make it work. However, as user behaviour is difficult to change, it is logical that requiring behavioural change often leads to difficulties in implementation and accordingly to acceptance and adaptation issues.

4 Barriers for implementation

PSSs that require behavioural change can be seen as radical innovations. This character not only results in challenging behaviour, but also in challenging structures and policies (Vezzoli et al., 2012). From a provider perspective, acceptance and implementation of PSSs can consequently be very problematic.

Manzini and Vezzoli (2002) found that businesses use PSSs as a means to cope with competition or to enter new markets. However, they admitted that other businesses hesitate due to perceived risks and lack of knowledge about and experience with PSSs. Vezzoli, et al. (2012) concluded that the use of PSS approaches is very limited and stakeholder acceptance was generally seen as the barrier to the success and expansion of PSSs. Most authors argue that barriers concentrate around a lack of knowledge and uncertainties about PSS implementation.

Ceschin and Vezzoli (2010) saw necessary behavioural change and government policies not being specifically beneficial for PSSs as a barrier. Besch (2005) found low enthusiasm among manufacturers or providers owing to the necessary reorganisations of their traditional business models, which possibly costs a lot of money and may introduce risks that cannot be managed. Williams (2007) found that another barrier could be that providers do not see their offering in the wider context of the entire life cycle. According to him, focus must therefore not only be on the product offering, but also on management through the entire lifecycle of the offering for example upgradability or end-of-life management. He stated, "It seems that a general lack of recognition of the central importance of providing such a total offering may hinder the potential of many so-called PSSs".

However, even when companies are willing to implement PSS strategies, it may be hard to be the only PSS provider in an industry. Ceschin and Vezzoli (2010) described for example high break-even points as a barrier in the automotive industry. The business is traditionally based on car sales, while the main cost of a vehicle comes in the use-phase. Newcomers have the opportunity to adjust their business model on a PSS offering from the beginning. However, the leading high break-even points make it extremely difficult to create competitive offerings.

Tukker and Tischner (2006b) argued that socio-technical context is often a barrier for 'true system innovation'. Changing the company culture alone is not enough, as the socio-technical context also needs to change. Ceschin (2012) agreed and gave three strategies that companies should consider. One of these was that a 'broader system approach' was needed. By this, he meant that businesses should not only look at the PSS solution and its value chain, but they should also look at how to influence the 'social-technical context' to shape conditions for implementation.

The user interacts with this social-technical context and Manzini and Vezzoli (2002) described "the cultural shift necessary for the user to value 'having a need or want met in a sustainable way' as opposed to 'owning a product'" as the main barrier to adopting PSS in developed countries. More specific reasons were given, such as low enthusiasm among users for ownerless consumption (Baines et al., 2007), or the loss of status (Herodes and Skinner, 2005).

A solution to overcome such barriers could be influencing the context. However, the extent to which the context can be influenced may be less than expected. In fact, it is questionable whether focusing on changing the social-technical context is truly the way to achieve wider PSS implementation. PSSs are not new (Ceschin and Vezzoli, 2010). In the automotive industry, vehicle leasing is a PSS model that has been implemented very well. A certain amount of segmentation can already be seen in this category, such as leasing organisations that offer only 'green' vehicles. Leasing is based on ownerless consumption and a clear example of a use-oriented PSS, although Williams (2006) disagreed with how well most car leasing concepts are worked out. On the other hand,

vehicle-sharing encounters less enthusiasm and result-oriented PSSs in this category remain largely unimplemented (Williams, 2007).

Many examples of promising PSS cases exist. Product-, use-, and result-oriented PSS cases are put forward (Manzini and Vezzoli, 2002; Skinner et al., 2004; Tukker and Tischner, 2006b), just as satisfaction delivering PSSs (Manzini and Vezzoli, 2003), which are very well comparable with result-oriented PSSs. However, as Vezzoli et al. (2012) later also reported, most especially use- and result-oriented PSS attempts suffer an unmistakable difficulty with scaling-up from pilot-project or niche to mainstream market.

It can be concluded that many PSSs that seem very promising in theory, work less well in practice. Tukker and Tischner (2006b) stated already in their conclusion after evaluating the state-of-art of PSS theory: "Having and depicting sustainable PSS-dreams in themselves will not save the earth. Understanding what it takes to realise such dreams will, and that is where our community should focus on". They have put forward that sustainable PSS developers focus too much on sustainability issues and not enough on user acceptance or business potential. The commonly seen problem they also address is that the amount of necessary change for PSS adoption in 'real life' stays a high barrier, despite how much knowledge is yielded about theory, methods, and tools related to PSS creation and implementation and about claimed benefits for stakeholders, the environment, and society.

To overcome this barrier numerous measures have been put forward to turn away from the lack of change. Policy-based measures, such as cost motivations for companies or informing users "about environmentally preferable solutions available in the market" (Ceschin and Vezzoli, 2010) are proposed, or design-based suggestions such as incorporating end-users in the design process (Baines et al., 2007). However, acceptance issues still occur, regardless of the solutions proposed so far.

5 Influencing user behaviour

An important characteristic in PSS implementation is the transition from possession to use. What is striking in mobility offering PSSs is that the 'ownerless' lease car has been implemented successfully, while the 'ownerless' shared vehicle has not. One of the differences between these two offerings is that a lease vehicle fits very well in people's daily routines or habits, while users have to alter their habits when adopting a car-sharing programme. This suggests that in this case acceptance is not affected by the conceptual level of the PSS, but by the implications of adopting the PSS in everyday life. Not the type of PSS, but the amount of change that is needed for adoption seems to be the barrier.

This is a very important aspect, which has been largely ignored in research on PSSs. Implementation of more access-based PSSs requires significant behavioural changes from users. Although the PSS may offer the performance the user expects from a mobility means, addressing user habits seems to be at least equally important when considering the use or implementation of a system. We would like to argue that the power of user behaviour is severely underestimated and this viewpoint will be illustrated by using a PSS case that seems to be well implemented and accepted by its users.

In behavioural sciences many studies have been performed that look at how people make choices and how their choices can be influenced (Tiemeijer and Thomas, 2009). Next to this, a lot of work has been done on the power of habits (Aarts et al., 1998; Jager, 2003; Wood et al., 2005). In the process of selecting products and/or services, users will

always find their way to achieve the best-perceived solution for them. Some choices can be influenced, where many factors play a role, for example, attention to selection context, creating implementation intentions or reprioritising unconscious goals (Aarts, 2009). However, strong habits can still prevent people from changing their behaviour. Therefore, the radical behavioural change that many PSSs require may be more of a barrier than one might think. Probably, not only the functional result is at stake, but other demands need to be satisfied as well. As Dell'Era et al. (2010) said: "radical new ideas may work very well, but the focus should be on innovation of meaning". This is a higher level of abstraction than Tukker (2004) proposes by "a person that needs transport from A to B". While selecting products and services that they would want to use, people do not look for functional results, they look for meanings.

The fact that many result-oriented PSSs encounter difficulties in implementation may not necessarily be due to people's unwillingness to change. The problem with many PSSs is that they are designed to offer a familiar result in a way that differs too much from existing use patterns. For the user the added value the service brings is apparently too weak to be willing to break his habits. Hence, the functional result seems to be different from what users really want. Therefore, it is essential to have a profound understanding of the behavioural science perspective on the power of habits in order to understand how PSSs can be designed and implemented more successfully.

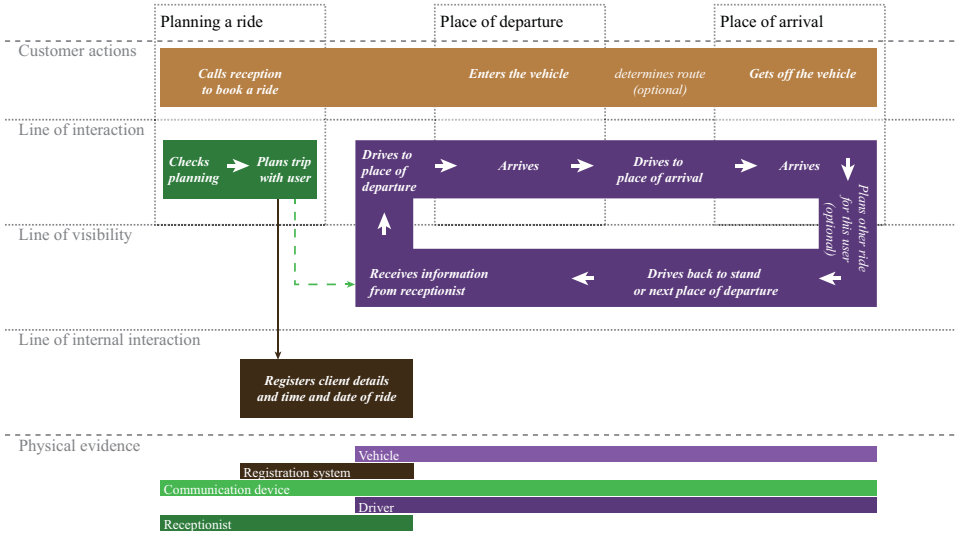
Insight in how to cope with user habits is desirable for PSS acceptance. However, as a starting point it is important to understand how habits can be influenced. The following case study suggests that the strength of user habits can change over time and that knowledge on coping with user habits may be very valuable to designers of PSSs.

6 Skewiel Mobiel, a case study

An example of a PSS that seems to be offered at the right moment to meet the right needs is Skewiel Mobiel: a case study carried out in Trynwâlden, a rural area in Friesland, located in the northern part of The Netherlands. The service is provided by care organisation Skewiel Trynwâlden (currently part of the Tellens Group) for their elderly clients. Skewiel Mobiel was designed as a use-oriented PSS to fill the gap that conventional public transport left behind when cutting back services in less populated areas (Joris, 2008). Skewiel Mobiel offers demand-driven, short-range mobility to elderly and the service is funded through a subsidy from the provincial government. This subsidy is intended to increase mobility for inhabitants of the rural environment of Friesland using environmentally friendly vehicles. The value for the care provider comes from the goodwill and reputation the PSS offering delivers for the care organisation. It supports its philosophy to be "a supermarket for wellbeing and happiness" (Skewiel Trynwalden, 2009).

The service is used to make trips to the supermarket, convenience stores, friends, family, the cafe, and more. It is very locally-based, as it connects just a small group of villages. The service design is displayed in Figure 2: *Service design of Skewiel Mobiel*. Typical trips of Skewiel Mobiel can go, i.e., from one side to the other side of the street, spanning just 100 metres or shopping trips to the neighbouring village, 1 kilometre away, where not only the supermarket is visited, but consequently also the butcher and the pharmacy. Users can have mobility levels that vary from homebound walks to recreational trips in the neighbourhood.

Figure 2 Service design of Skewiel Mobiel (see online version for colours)



Source: Joris (2008)

The physical part of the service consists of an electric propelled vehicle, a registration system, a communication device, a volunteer driver and a receptionist. The vehicle used is a low-speed, neighbourhood electric vehicle that was, at the time of its introduction, "the only electric passenger vehicle of its kind permitted on the road in The Netherlands" (Joris, 2008). It is owned by the care provider. The vehicle is identical to, for example, the ones used in the DaimlerChrysler PSS project in Playa Vista, which was a community-based car sharing service in the USA (Skinner et al., 2004), and many other local area applications.

From a client perspective, the care organisation is the service provider and Skewiel Mobiel shares many similarities with use-oriented services. This is different from the care organisation's perspective where it shares more similarities with product-oriented services, as the vehicle is purchased, but maintenance is outsourced to a local garage or distributor and insurance to an insurance company.

System-wise Skewiel Mobiel may look similar to other demand-driven taxi services. WMO-taxi and Valys are two other examples of Dutch subsidised transport services for elderly. WMO taxi is intended for regional trips with a price tag comparable with Skewiel Mobiel. Valys covers longer trips and the user is offered a yearly kilometre budget. Especially, WMO taxi offers an identical short distance functionality and Skewiel Mobiel users are familiar with it.

The influence of the Skewiel Mobiel service on users and non-users were described in a comprehensive evaluation (Degen, 2013a, 2013b). Open interviews were conducted among 25 Skewiel Mobiel users and eight non-Skewiel Mobiel users who fitted the user profile. From this study can be learned that Skewiel Mobiel was able to increase the activity of users. Before the service became accessible, a large share of users stayed home or asked relatives to bring them if necessary, although 20 users already used WMO taxi. However, compared to WMO-taxi services, Skewiel Mobiel must have a definite advantage, seeing that it activates users and pulls users away from the taxi. The reason

that non-users did not use the service was that enough alternatives exist – seven used WMO-taxi and some additionally had access to a car – and that the odd design of the vehicle acted as a barrier. In those cases, the functionality of Skewiel Mobiel and its physical appearance seem to be unnecessary or lower valued than current alternatives.

WMO-taxi is often used for trips to family and the hospital. Sometimes it is also used for shopping in the shopping mall nearby. These destinations are not far away, but outside the service area of Skewiel Mobiel. Inside the Skewiel Mobiel service area, WMO-taxi offers service for small distances too, but many respondents indicate that such distances are too short, hence being home bound and relying on relatives. Instead, Skewiel Mobiel is preferred.

WMO taxi is satisfying for most users, although restrictions as waiting time – which is relatively long compared to the duration of some daily activities – and inefficient routing are mentioned. A restriction is that WMO taxi does not wait until the user finished his/her visit. A stop-and-go, which is very common for Skewiel Mobiel, is also permitted, but very exceptional. Therefore, Skewiel Mobiel is also preferred.

In short, Skewiel Mobiel is preferred as it is more flexible and can be used to visit various locations during one trip. Activities are generally simple daily activities and the driver can offer support during these. The result that Skewiel Mobiel offers fits very well with the regular daily pattern that most people have and with the way that they are (or were) used to perform their activities.

To examine the concept of Skewiel Mobiel in another environment, a two-day experiment was organised in the city of Eindhoven, the fifth biggest city in the Netherlands. Demographic characteristics were the opposite of Trynwâlden and public transport was very comprehensive. Other initiatives of small-scale, low cost taxi-like services already existed in this area. The goal of this experiment, called Aevus, was to replicate the Skewiel Mobiel service in Eindhoven and to see how it would be organised and used. It was based on a preregistration model to control the number of users and to decrease uncertainties in the registration process. A major difference was that Aevus was free. This may have biased the results, although it could also give insight in what users would really want, if money were no object.

Clients were unanimously happy with the service and with this door-to-door service. Clients appreciated being alone in the vehicle and driving through the city along many memorable places. Most clients would not have left their home if Aevus were not available. One client was very pleased that she could travel by herself and she was not aware of other taxi-like services. Another client visited the bookstore he had not seen for years. He did not buy anything, and he would not have made this trip otherwise, because there was no obvious reason. However, the visit addressed a high value (need) of being up-to-date.

A difference with Skewiel Mobiel was that the city context resulted in longer trips and longer activities. Instead of doing daily activities such as visiting the supermarket, many users decided to do a recreational activity in the city centre and drink coffee, do shopping or visit the theatre. Aevus therefore merely behaved as a pick-up-and-return service instead of a fully supported service where the driver accompanies the client during his activity. Both types of support are familiar to both Skewiel Mobiel and Aevus, but the ratio varies.

This example shows the difference between the functional result that a standard taxi service offers and the experience that Skewiel Mobiel and Aevus offer. The activities from both Skewiel Mobiel users and Aevus users were similar and based on needs or

wants people had. They were not restricted by regulations or fixed services. The PSS is therefore not only used to go from a to b, but it offers an added value that is of a higher order, such as independence and freedom. An important transition can be noticed here: Skewiel Mobiel is not only the use-oriented PSS it used to be, but also shows clear characteristics of result-oriented PSSs. The results that the services deliver – providing freedom and independence – are on a higher level than the results that the definition of result-oriented PSSs prescribes.

Many PSSs are considered to be suffering acceptance problems, because they require people to change their behaviour. A possible explanation why Skewiel Mobiel does not suffer acceptance problems may be the way it fits to the existing or lost and familiar behaviour of the users. These elderly are already in a context of change as growing older results in decreasing mobility. Therefore, walking becomes more demanding, cycling becomes unsafe, and not being able to drive a car anymore results in decreasing independence. These unwillingly changing, but personal circumstances have a large influence on one's life and force a user to change behaviour.

When an innovation is introduced to overcome this changing situation of physical decline, the acceptance problems might disappear. In this way, the innovation can compensate for the loss and this could contribute to a more acceptable PSS. Changing behaviour is in this case not a condition, but an opportunity to improve acceptance.

The case of Skewiel Mobiel that was discussed here describes an innovative care provider that has thoroughly reorganised its business processes to offer services to the community and to help its clients in such a way that they can shape their own way of living (Skewiel Trynwâlden, 2009). Skewiel Mobiel fits well in this vision and the organisation was prepared and willing to implement such a PSS. The vision, combined with appreciation from its users, is one of the reasons why the organisation has plans to expand the service to other locations. This proves that acceptance is not always inherently a problem that lies at the provider's side, although other barriers may be found, for example in terms of economic sustainability or operational organisation.

7 Conclusions

PSSs can work very well in theory, but their wider implementation remains limited. Key barriers are user-acceptance and radical shifts in business culture. User acceptance seems to be related to the way users need to change their behaviour. However, a case like Skewiel Mobiel shows that behavioural change can be an opportunity, instead of a condition to stimulate user-acceptance. Skewiel Mobiel still looks like many other PSS pilot projects, but it seems that personal circumstances that result in users having to change their behaviour can have a higher impact on acceptance than external influences, such as governmental or environmental impulses cited by many authors.

We expect that when a PSS is presented during or after the process of behavioural change due to unwanted circumstances, there is an intrinsic and personal driven motivation to use the PSS, as long as it provides the opportunity to continue desired behaviour. Addressing already changing behaviour may therefore be more successful in fostering acceptance than initiating behavioural change, because addressing changing behaviour makes it possible for users to regain or sustain familiar behaviour.

Furthermore, unwanted changing behaviour should not only be defined by functional results, such as a user's physical performance, but also by higher order results the user

wants to achieve, such as a feeling of independence or social connection. This leads to opportunities for PSS development irrespective of how radical they are.

Summarised:

- First, new PSSs could be introduced to compensate for or redirect an unwillingly changed context. A user might for example lose his ability to walk, to see, or his familiar living environment due to relocation and has to reconsider the ways to satisfy daily patterns.
- Second, PSSs should focus on the higher order needs users may have, for instance, being free to go wherever one wants, the ability to choose one's own food at the supermarket, or to be up-to-date about the product range of the local bookshop.
- Third, considering habits may be a useful method for PSS development, as acceptance is expected to improve when people are able to associate PSS implications or PSS use with past or previous experiences.

8 Discussion and future research

It is remarkable how well Skewiel Mobiel is accepted, being an innovative PSS aimed at an elderly target group. However, PSSs are often successful during the pilot phase, but most of them fail when scaling-up is the next step. Skewiel Mobiel was a pilot project, but becomes increasingly an established service. The care provider has plans to expand the system to other locations and other target groups, so the up-scaling phase has already started. This should prove whether Skewiel Mobiel indeed consists of the right ingredients to be successfully implemented.

However, it is highly questionable whether people without a mobility limitation would use Skewiel Mobiel. Skewiel Mobiel is very much seen as a means to overcome limitations that keep users from being independent. In use scenarios, Skewiel Mobiel can be regarded as the second best option.

What we can learn from Skewiel Mobiel is its ability to suit user needs very well. However, Skewiel Mobiel can currently only exist by the support of a subsidy and costs have to be considered thoroughly. The price for a trip is, just as it is for WMO-taxi, kept artificially low. Therefore, it is questionable whether the service would have been equally successful if it had to be financially sustainable by itself, just like many regular taxi companies.

Nevertheless, in The Netherlands mobility is a key aspect towards a healthy aged population. Therefore, various facilities are offered such as mobility scooters, wheeled walkers, and the aforementioned taxi services, and all these facilities are to a greater or lesser extent subsidised. These might very well also suffer high acceptance barriers if the list prize has to be paid.

Increasing mobility of the aged population brings up questions on the environmental sustainability of Skewiel Mobiel. Skewiel Mobiel, being a 'sustainable' mobility service, increases the activity pattern of users. Consequently, it can support and increase consumption. This is not what most PSSs try to pursue. Letting the user stay home and connect to the world virtually, may be better seen from an environmental perspective.

However, we think this is not a desired situation from a social perspective. Every person has a wish to be independent and physical decline should not be a reason for

reduced mobility and independency. Someone may very well decide to connect to the world virtually, but alternatives should be offered for being physically part of society. The choice for the preferred situation lies with the user and not with the designer.

Acknowledgements

This research was funded within the Creative Industry Scientific Programme (CRISP). CRISP is supported by the Dutch Ministry of Education, Culture, and Science.

References

Aarts, H. (2009) 'Gewoontegedrag: De automatische piloot van mens en maatschappij', in Tiemeijer, W.L., Thomas, C.A. and Prast, H.M. (Eds.): *De Menselijke Beslisser*, pp.65–86, Amsterdam University Press, Amsterdam.

Aarts, H., Verplanken, B. and Knippenberg, A. (1998) 'Predicting behavior from actions in the past: repeated decision making or a matter of habit?', *Journal of Applied Social Psychology*, Vol. 28, No. 15, pp.1355–1374, doi:10.1111/j.1559-1816.1998.tb01681.x.

Baines, T.S., Lightfoot, H.W., Evans, S., Neely, A., Greenough, R., Peppard, J. and Shehab, E. (2007) 'State-of-the-art in product-service systems', *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, Vol. 221, No. 10, pp.1543–1552, doi:10.1243/09544054JEM858.

Besch, K. (2005) 'Product-service systems for office furniture: barriers and opportunities on the European market', *Journal of Cleaner Production*, Vol. 13, Nos. 10–11, pp.1083–1094, doi:10.1016/j.jclepro.2004.12.003.

Ceschin, F. and Vezzoli, C. (2010) 'The role of public policy in stimulating radical environmental impact reduction in the automotive sector: the need to focus on product-service system innovation', *International Journal of Automotive Technology*, Vol. 10, Nos. 2–3, pp.321–341 [online] http://inderscience.metapress.com/index/e86203h16p3n0837.pdf (accessed 16 October 2012).

Christiaans, H. (2011) 'Interaction between product and user profiles – how to increase users' satisfaction and avoid mistakes', *Symposium Usability Methods & Tools*, Utrecht.

Degen, P. (2013a) 'Onderzoek optimalisatie duurzaam Skewiel Mobiel', *Mobiliteit ouderen in de regio Trynwalden*, in press, Leeuwarden.

Degen, P. (2013b) 'Mobiliteit, verkeersveiligheid en participatie', *Mobiliteit ouderen in de regio Trynwalden*, in press, Leeuwarden.

Dell'Era, C., Marchesi, A. and Verganti, R. (2010) 'Mastering technologies in design-driven innovation: how two Italian companies made design a central part in their innovation process', *Research-Technology Management*, Vol. 53, No. 2, pp.12–23 [online] http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=49258593&site=ehost-live (accessed 13 March 2012).

Gale, B.T. (1994) *Managing Customer Value. Creating Quality and Service that Customers Can See*, Macmillan Publishers New Zealand Ltd., Auckland.

Goedkoop, M.J., Halen, C.J.G. van, Riele, H.R.M. and Rommens, P.J.M. (1999) *Product Service Systems, Ecological and Economic Basics*, Dutch ministries of Environment (VROM) and Economic Affairs, (EZ), The Hague.

Henze, L., Mulder, I., Stappers, P.J. and Rezaei, B. (2012) 'Right service & service right: how collaborating heterogeneous networks at the front end of service development benefit the process to get the service right' [online] http://www.crispplatform.nl/sites/default/files/right-service-service-right1.pdf (accessed 31 October 2012).

Herodes, M. and Skinner, I. (2005) *Car Sharing: The Motivations of Industry*, Institute of European Environmental Policy (IEEP), London.

Hill, P. (1999) 'Tangibles, intangibles and services: a new taxonomy for the classification of output', *The Canadian Journal of Economics*, Vol. 32, No. 2, p.426, doi:10.2307/136430.

Jager, W. (2003) 'Breaking bad habits: a dynamical perspective on habit formation and change', *Understanding and Assisting Human Decision-Making* [online] http://www.rug.nl/staff/w.jager/jager_habits_chapter_2003.pdf (accessed 15 January 2013).

Joris, I. (2008) *Sustainable Mobility in a Frisian Community*, Eindhoven University of Technology, Eindhoven.

Lovelock, C. (2004) *The Future of Services Marketing: Trick or Treat for Practitioners, Customers, Students, and Academics* [online] http://www.lovelock.com/associates/images/news/Frontiers2004FutureofServicesMarketing.pdf (accessed 17 October 2012).

Manzini, E. and Vezzoli, C. (2002) *Product-Service Systems and Sustainability: Opportunities for Sustainable Solutions*, United Nations Environment Programme (UNEP), Paris [online] http://www.unep.org/resourceefficiency/Portals/24147/scp/design/pdf/pss-imp-7.pdf (accessed 9 August 2012).

Manzini, E. and Vezzoli, C. (2003) 'A strategic design approach to develop sustainable product service systems: examples taken from the 'environmentally friendly innovation' Italian prize', *Journal of Cleaner Production*, Vol. 11, No. 8, pp.851–857, doi:10.1016/S0959-6526(02)00153-1.

Mont, O. (2002) 'Clarifying the concept of product-service system', *Journal of cleaner production*, Vol. 10, pp.237–245 [online] http://www.sciencedirect.com/science/article/pii/S0959652601000397.

Morelli, N. (2002) 'The design of product/service systems from a designer's perspective', *Proceedings of the Common Ground Design Research Society International Conference*, pp.5–7 [online] http://www.score-network.org/files/825_15.pdf (accessed 31 October 2012).

Rifkin, J. (2000) *The Age of Access: The New Culture of Hypercapitalism Where All of Life is a Paid-For Experience*, Tarcher, New York.

Skewiel Trynwalden (2009) *Skewiel Trynwalden: at der wat is dan binne se der. Oentjserk: Skewiel Trynwalden* [online] http://www.ikpfryslan.nl/files/10605/lr_boek_skewiel_2009.pdf (accessed 3 December 2012).

Skinner, I., Haines, D., Bowyer, C., Fergusson, M. and Senft, L. (2004) *Mobility Services: Setting the Policy Framework – First Year Project Report: A Review of Experience*, London [online] http://www.ieeplondon.org.uk/assets/173/mobilityservices.pdf (accessed 14 November 2012).

Tan, A. (2010) *Service-Oriented Product Development Strategies*, Technical University of Denmark [online] http://orbit.dtu.dk/fedora/objects/orbit:82986/datastreams/file_5177222/content (accessed 16 October 2012).

Tiemeijer, W.L. and Thomas, C.A. (2009) *De menselijke beslisser: Over de psychologie van keuze en gedrag* editd by H. Prast, p.328, Amsterdam University Press, Amsterdam.

Tukker, A. (2004) 'Eight types of product-service system: eight ways to sustainability? Experiences from SusProNet', *Business Strategy and the Environment*, Vol. 13, No. 4, pp.246–260, doi:10.1002/bse.414.

Tukker, A. and Tischner, U. (2006a) *New Business for Old Europe: Product-Service Development, Competitiveness and Sustainability*, edited by A. Tukker and U. Tischner, Greenleaf Publishing Limited, Sheffield.

Tukker, A. and Tischner, U. (2006b) 'Product-services as a research field: past, present and future: reflections from a decade of research', *Journal of Cleaner Production*, Vol. 14, No. 17, pp.1552–1556, doi:10.1016/j.jclepro.2006.01.022.

Vezzoli, C., Ceschin, F., Diehl, J.C. and Kohtala, C. (2012) 'Why have 'sustainable product-service systems' not been widely implemented?', *Journal of Cleaner Production*, November, Vol. 35, pp.288–290, doi:10.1016/j.jclepro.2012.05.050.

Williams, A. (2006) 'Product-service systems in the automotive industry: the case of micro-factory retailing', *Journal of Cleaner Production*, Vol. 14, No. 2, pp.172–184, doi:10.1016/j.jclepro.2004.09.003.

Williams, A. (2007) 'Product service systems in the automobile industry: contribution to system innovation?', *Journal of Cleaner Production*, Vol. 15, Nos. 11–12, pp.1093–1103, doi:10.1016/j.jclepro.2006.05.034.

Wise, R. and Baumgartner, P. (1999) 'Go downstream: the new profit imperative in manufacturing', *Harvard Business Review*, October, Vol. 77, No. 5, pp.133–142.

Wood, W., Witt, M.G. and Tam, L. (2005) 'Changing circumstances, disrupting habits', *Journal of Personality and Social Psychology*, Vol. 88, No. 6, pp.918–933. doi:10.1037/0022-3514.88.6.918.