Distinctive Characteristics of Smart PSSs[1]

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Abstract: Advances in technology have facilitated the integration of products and e-services into innovative solutions, Smart Product-Service Systems (PSSs). This paper discusses six distinctive characteristics of Smart PSSs that can be influenced by designers, and have an effect on the perceptions of consumers: *Consumer empowerment, individualization of services, community feeling, service involvement, product ownership and individual/shared*. Understanding the characteristics of Smart PSSs is important for designers to create Smart PSSs that convey the appropriate value and experience for consumers. Moreover, our insights can assist practitioners in the creation of new tools and methodologies for the effective integration of products and services.

Key words: Product-service system, consumer experience, value creation, product design, service design

1. Introduction

Product-service systems (PSSs) are market offerings that combine products and services, and present them as single solutions to consumers [5]. In contrast to the traditional services attached to products e.g., warranty), the service in a PSS significantly adds value to the consumer. Launderettes (i.e., shared laundry facilities) are an example found in the existing literature. This PSS is composed of washing machines (the products) that are made readily available to consumers for self-service purposes (the service). A benefit of this PSS for consumers is the avoided cost of purchasing state of the art machines [12]. Because the ownership of the products remains with the service provider, consumers do not worry about high investments, installation or maintenance. Furthermore, consumers can access the launderette at any time of their convenience.

Three types of PSSs are generally acknowledged in the PSS research field: result-oriented, use-oriented and product-oriented PSSs [1, 19]. These PSSs are generally described as business models with economic and environmental benefits for companies and society. In result-oriented PSSs, companies sell results or competences rather than tangible products. A specific product may not be pre-determined by the service provider, and may consequently play a less noticeable role on how the solution is delivered [19]. The ownership is usually kept with the provider, who is responsible for the maintenance and good performance of the product. Many of the examples in this category relate to business-to-business solutions, where companies sign deals to manage activities (e.g., printing).

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In use-oriented PSSs, products have a more prominent role. Different to result-oriented PSSs, providers of use-oriented PSS sell the accessibility and use of specific products. Providers maintain the ownership of products while their goal is to maximize their use and lifespan [1]. Examples in this category include the sharing, leasing and pooling of products [19].

Finally, in product-oriented PSSs, a tangible product is sold and its ownership transferred. Additional services are offered to guarantee the correct functionality and durability of the product [1]. Examples in this category include after-sales services (e.g., maintenance), needed during the use-phase of the product, or advise on how to operate the product [19].

In this paper, we focus on an emerging type of PSS that is targeted to individual consumers exclusively. New technological advances have made it possible to combine products and services in innovative ways. Today, many traditional products can be equipped with information technology, which enables them to connect to the Internet. For instance, Laundry View, an Internet application created by Mac-Gray Corporation[2], has brought launderettes to a new level (http://www.laundryview.com). Laundry View is an Internet application that serves as a communication channel between the provider of the launderette and individual consumers. Laundry View allows consumers to check the availability of washing machines, view an estimated time of availability, and set notifications when a required machine becomes available.

We refer to this type of PSSs as Smart Product-Service Systems. We call them smart because they "contain information technology (IT) in the form of, for example, microchips, software and sensors and that are therefore able to collect, process and produce information" [15, p. 25]. However, in contrast to smart products, Smart PSSs integrate a service with the product to jointly address the needs of consumers. For example, Philips' Direct Life (http://www.directlife.philips.com) is a Smart PSS designed to improve the health of consumers. The product in Direct Life is a small sensor that consumers can carry with them to measures their movements. This sensor is coupled with an e-service (i.e., web platform) that consumers can access to: 1) store the personal data that was measured during the day, 2) to access descriptive graphs of their chronological progress, and 3) to get in touch with health experts for professional advice on how to use the data to improve their health.

The presence of Smart PSSs in the marketplace is growing. For designers, this means a shift in the conventional way of creating products and services. Designers have adequate tools to create discrete products and services. However, due to the specific characteristics of PSSs, the appropriateness of conventional design tools for creating PSSs has been questioned [13]. According to Morelli [13, p.5], "the involvement of designers in the development of PSS[s] implies an extension of the traditional disciplinary domain of design, towards new domains that provide designers with the necessary expertise to manage the particular characteristics of PSS[s]". Our research aims to address this growing need by providing insights into the unique characteristics of Smart PSS. By outlining the unique characteristics of Smart PSSs, designers can have a better understanding of the features that consumers will expect in Smart PSSs, and create solutions that bring the appropriate value and experience to consumers. Accordingly, our study contributes to the limited research on PSSs aimed at consumers. Our insight can be used in the creation of new tools and methodologies to equip designers in the creation of Smart PSSs.

[2] Mac-Gray Corporation is a leading laundry facilities contractor in the United States

1.2 Smart Product-Service Systems

Although the classification in result-oriented, use-oriented and product oriented has provided interesting insights for managers concerning the different business models of PSSs, the classification is less relevant for designers of PSSs. For designers, it is important to understand how technology influences the design of PSSs, by facilitating the interaction between service provider and consumer. In this section, we provide a conceptualization for Smart PSSs. By looking at PSSs from a technology perspective, we set the ground to identify the distinctive characteristics of Smart PSSs, which can be influenced by designers in creating value for consumers.

Smart products are market offerings characterized by the high content of IT technology, and their ability to process and produce information [15]. Smart PSSs are 'smart' because they carry some of the characteristics of smart products, such as the capacity to transform data into knowledge that can help consumers perform more effectively [4]. Several conceptualizations for the smartness of products have been proposed before (e.g., [8, 15]). For example, according to Rijsdijk and Hultink [15], the smartness of a product is determined by the extent to which it possesses, to a greater or lesser degree, one or more of the following dimensions: Autonomy, adaptability, reactivity, multifunctionality, the ability to cooperate with other devices, the human-like interaction of the product, and personality. For example, Direct Life is an autonomous Smart PSS because the sensor measures movement unobtrusively throughout the day while consumers continue with their daily routines. Direct Life is adaptable because it bases its measures on personal information, such as age or weight. Thus, the data and advice provided by the Smart PSS adapts to the personal conditions of individual consumers. Furthermore, Direct Life is able to cooperate with other devices because the data collected through the day must be transferred to a computer to access it. Finally, Direct Life is reactive because its sensor has embedded lights that light up according to how much consumers have moved (i.e., the more consumers move the more lights will light up).

An important difference between Smart PSSs and smart products is that they integrate a service with the product to jointly address the needs of consumers. Many of these services are e-services that deliver value to consumers through electronic means [18]. One important characteristic of e-services is their capacity to support a two-way dialogue between consumer and service provider [17]. Through the course of this dialogue, providers can collect relevant specific information about consumers, which facilitates the creation of customized services to satisfy their individual needs. Furthermore, self-service technologies have been reported to provide a sense of control to consumers who can handle their transactions any time they want [10]. In this respect, Rust and Kannan [17] predicted an increase in technology-enabled innovations, capable of supporting the delivery of e-services to consumers, which allow consumers to experience a high level of control over their transaction. We argue that Smart PSSs are such technology-enabled innovations, which creates new dynamics in the relationship between the service provider and the consumer.

To conclude, we define Smart PSSs as the integration of smart products and e-services into single solutions delivered to the market to satisfy the needs of individual consumers. Our conceptualization of Smart PSSs focuses on the technology embedded in the PSS solution, and the possibilities it offers to enhance the interaction between consumer and service provider. While the characteristics of PSSs have been previously discussed, there is a gap in the literature concerning the characteristics of (Smart) PSSs in terms of technology and/or benefits for consumers. Understanding these characteristics is pivotal for designers who will be confronted with this new type of market offering. Moreover, integrating product and service is a process that requires special attention by designers.

Creating a PSS that is perceived as congruent could have a positive effect on the evaluations of consumers [20]. Designers have the power to manipulate the characteristics of Smart PSSs, devise the integration of product and service, as well as the experience and perceptions of value by consumers. In this study we set out to gain a deeper understanding of Smart PSSs, and to provide designers with new knowledge that can help them create Smart PSSs more effectively.

2. Method

A classification task was created, where participants grouped examples of PSSs spontaneously. Participants had the freedom to decide the number of groups and examples of PSS belonging to each group [6]. They were asked to group the stimuli based on their perceived similarities, and by doing so, to elucidate the distinctive design characteristics defining groups of PSSs.

2.1 Participants

Participants (n=16) were experts in industrial design engineering (BSc degree), who are trained to understand how users experience and interact with products and services. Given the focus on Smart PSSs, it was particularly important to have participants capable to rationalize and explicate their grouping decisions in design-related terms. Moreover, their expertise in the industrial design field enabled them to evaluate PSSs in detail, for example, in terms of technology and interaction, which increased the potential to unveil relevant design characteristics for the definition of Smart PSSs.

2.2 Stimuli

Based on extensive Internet research and discussions with companies, a set of 29 existing PSSs was created. The selected PSSs differed considerably in the balance between product and service and the purpose of the offering or situations in which they are used. Moreover, examples of traditional PSSs that are often mentioned in the literature were included in the final list, with the purpose of obtaining insights in the differences between them that are important for the user experience.

The development of the final stimuli consisted of different phases. First, a storyboard for each PSS was created. In order to create the individual storyboards, the main researcher diagrammed the process followed by consumers in each PSS, from purchase to use, depicting the main product and service interactions with consumers. This resulted in 29 different product-service-user interaction diagrams. Then, the 29 individual storyboards were sketched by a graphic designer making use of professional software (Figure 1). The final storyboards were included in a booklet as sensitizing material for participants to learn about each PSS prior to the session. This booklet contained: An image of the PSS taken from the official website, an extensive description of the product and the service in the PSS and how they interrelate, the storyboard, and a notes-section for participants to write comments or questions to be addressed prior to the session. Finally, individual cards were made to facilitate the classification task by showing participants each PSS at a glance. The individual cards contained the name and picture (as shown in the booklet) of the PSS, and the storyboard.

2.3 Procedure

Participants were contacted two weeks before the session. A booklet was provided to each participant, which they were encouraged to read at their own time and pace. Before each session, remaining questions regarding each

PSS were answered. Furthermore, participants were verbally instructed on the classification task; a classification example was provided as part of the instructions, thereby ensuring that participants understood the task.

During the session, individual cards were randomized for each session and laid facing down on the table. Participants were instructed to take two cards, grouping them in a rational manner, based on their perceived similarities. Participants were asked to think aloud to reveal the rationale behind their classification choices. Moreover, they were encouraged to group stimuli in aspects related to the user interaction, therefore avoiding simplistic categorizations based on product features (e.g., shape, category). Once a set of two cards was categorized, participants were instructed to continue with the classification process, taking one card at the time. This procedure was repeated until the total set of 29 cards was discussed and classified. Following, participants were asked to label every distinctive group using a name describing their classification criteria. Participants took 55-145 min to complete the task. All stimuli were categorized and labeled. Participants recognized the differences between traditional and Smart PSSs, drawing comparisons between them, and aiding in the identification of the distinct characteristics of Smart PSS.

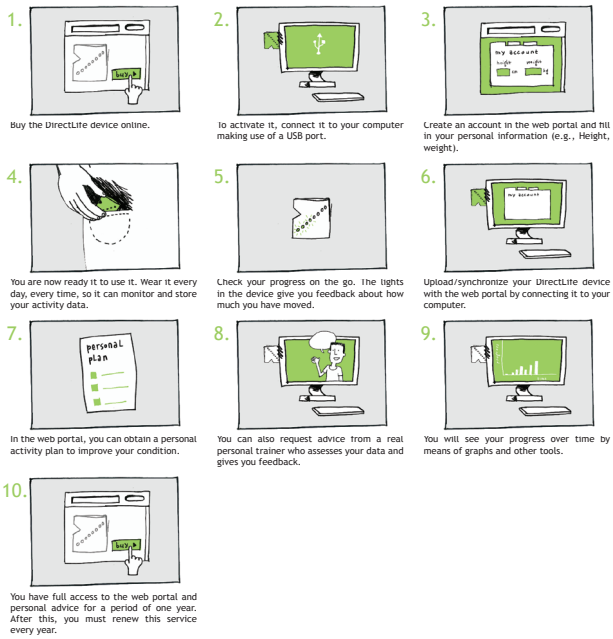

Figure 1. Example of a storyboard for Direct Life used in the final stimuli. The storyboard depicts product, service and user interactions in the PSS.

All interviews were recorded and fully transcribed. The data was analyzed using the software program Atlas.it. Transcribed interviews were coded looking for patterns and interesting themes in the data. This process was followed interview by interview until no significant amount of codes was added to the list, resulting in an initial set of 100 codes. This set of codes was discussed with the main and secondary researchers, identifying codes with similar meanings, and main subjects in the data. This process allowed reducing the list to a total of 55 codes. Once the list of codes was refined, the remaining interviews were transcribed.

3. Findings and Discussion

We identified six highly interrelated characteristics of Smart PSSs, which can have an effect on how consumers perceive Smart PSS: *Consumer empowerment, individualization of services, community feeling, service involvement, product ownership and individual/shared experience.* Importantly, some of these characteristics can be manipulated directly by designers, while others need to be discussed at a more strategic level with other functional areas (e.g., high management) to assure the correct design and value creation for consumers. In this chapter, we will present each of these characteristics and discuss the implications for designers.

3.1 Consumer Empowerment

Consumer empowerment is a characteristic of Smart PSSs that most participants recognized during the interviews. Smart PSSs empower consumers by giving them the necessary tools to make decisions or take action in their own terms. We identified two main sources of empowerment in Smart PSSs: delivering *feedback* to consumers, and *enabling consumers to select their own content*.

Feedback is relevant information that can be used by consumers to assess a specific situation, and take action accordingly. Different features of Smart PSSs facilitate the delivery of feedback to consumers. First, Smart PSSs enable consumers to *measure their own data* at a specific moment in time. Because this information is usually stored online, this grants service providers access to relevant input on consumers' states and activities. By having access to data related to individual consumers, service providers can create personalized overviews of the measured data, thereby enabling consumers to *track their progress over time*. Furthermore, data is transformed into *graphs, diagrams and other pictorial representations*; information intended to be easily understood by consumers. This type of feedback was often associated with Smart PSSs that facilitate the achievement of goals. For example, the WiFi Body Scale provides real-time feedback by displaying the weight and BMI of the consumer in the scale's screen when the Smart PSS is used. Furthermore, it provides long-term feedback by automatically sending these measurements to a web portal, which creates illustrative graphs of these over time. Together this information will empower consumers, because consumers who want to lose weight can use such feedback to understand how their eating habits affect the achievement of their goals.

Next to the capacity to track one's progress in a certain activity, Smart PSSs enable consumers to *track the status of products*, such as their availability and location. For example, Laundry View is a Smart PSS that enables consumers to check the availability of (specific) washing machines. Laundry View empowers consumers by helping them have control over the process, for example, by visiting the laundry room only when a laundry machine is available. Finally, Smart PSSs provide feedback by *delivering relevant information regarding product features or content* prior to purchase. Such is the case with smart phones and app stores (e.g., iPhone and iTunes), which provide descriptions, images and free trials of applications, but also enable consumers to give feedback to each other about the quality of the apps (See Section 3.3). Thus, this type of feedback empowers consumers by providing relevant information to make a purchase decision.

Finally, Smart PSSs can empower consumers by enabling them to *select their own content*, and have an experience that fits closer to their individual needs. For example, Amazon's Kindle is an e-book that consumers can use to read, buy and store e-books. Through the e-service in Kindle, the Kindle Store, consumers can browse and buy from a wide range of content, including e-books, e-magazines, e-news and games. Because of the wide range of options Kindle provides, consumers can select content that fits their individual taste or mood.

Furthermore, enabling consumers to select their own content was associated with *service availability*; a service that can be accessed at any time and is always available to them.

Design for empowerment is clearly a topic of interest for designers. The role of design practices, such as do-it-yourself (DIY) solutions and co-design, for giving consumers a sense of authority in the design of traditional products, has been previously discussed [14, 21]. Furthermore, it has been suggested that e-services and technology-based self-service options provide consumers with a sense of control (e.g., [3, 16]). However, Smart PSSs offer innovative opportunities to combine these and thus the challenge for designers lies in this specific combination of e-services with tangible products, and how these new combinations create new ways to empower consumers. Above, we presented different features in the integration of products and services that facilitate consumers' empowerment. However, these features are not exclusive and other ways of providing control and authority to consumers may be viable. Moreover, designers ought to be aware of the features enabling empowerment, and how they influence consumers' evaluations of the Smart PSSs' quality. This suggests a more wide-ranging role for designers, who should go far beyond the traditional product-design related manipulations, to account for consumers' evaluations towards Smart PSSs. Furthermore, past research has suggested that feeling in control of the process of service delivery, has a positive effect in consumers' evaluations of such process and quality [3]. Although we presume that the above-mentioned features empower consumers, their effect on consumers' perceptions of control and consumers' attitudes is still unknown. Thus, future research should set out to explore these interactions to provide more accurate advice to designers.

3.2 Individualization of Services

The individualization of services refers to how Smart PSSs make consumers feel important by addressing them as unique individuals. Smart PSSs individualize their services for consumers in different ways. First, because of their digital nature, Smart PSSs make use of *user accounts to identify consumers*. E-services support the two-way communication between service providers and consumers [7, 16]. Through this communication, and by identifying consumers, service providers can collect data specific to them, and create more personalized solutions to satisfy their needs [16]. For example, Green Wheels makes cars readily available to consumers, for specific periods of time, in a convenient way. Upon registration, consumers receive a personal e-card and pin code, which grants them access to the vehicles. Because Green Wheels has personal information about the consumers, such as their locations and demand, they can adjust they offer accordingly.

Closely related to user accounts, Smart PSSs make use of *virtual servicescapes* to communicate with consumers. These virtual servicescapes are an important touchpoint to implement tactics in the individualization of consumers. While some Smart PSSs make use of web portals, accessed from computers, others allow consumers to access the virtual servicescapes directly through the product. Amazon's Kindle is a Smart PSS that provides both options. Consumers of Kindle can access the Kindle Store to buy content directly through the e-reader, or access it through the Internet making use of a separate computer. Because consumers are identified with a (personal) user account, needed to access the virtual servicescapes in both instances, purchased content is linked to the individual consumers, stored, and automatically synchronized through all virtual servicescapes.

Finally, Smart PSSs vary in the *human-like interaction* [15] of the service provider. Some Smart PSS make use of real people to interact with consumers. For example, Life Line is a Smart PSS for the elderly, which consumers can use in case of emergency. When a consumer is in a life-threatening situation, he/she can press the button in the

Life Line collar he/she wears, and an emergency call is automatically placed to a Philips representative. The Philips representative will then communicate with the consumer via an intercom, assess the situation, and send medical help when needed. Other Smart PSSs make use of artificial means (or automated responses) to communicate with consumers. For example, Nike+ is a Smart PSS that enables consumers to track their progress during running workouts. The product in Nike+ measures data, such as burned calories, distance and trajectory. The service in Nike+ is a web platform that gives consumers access to graphs and overviews of the data related to their workouts. Nike+ encourages consumers to exercise by awarding them with trophies and other achievement-related prizes. When a consumer reaches a goal (e.g., 10 kilometers running), he/she receives pre-recorded cheering messages from celebrity athletes. Thus, Nike+ communication towards consumers is automated, human-like, and linked to the specific development of individual consumers.

The above-mentioned features are examples of how Smart PSSs address and individualize their services for consumers. These, however, may not be the only tactics designers can implement to create a more personal experience with Smart PSSs. The integration of products with services poses great opportunities for designers. The perceptions towards the service can be greatly influenced by the tangible evidence that surrounds it [2]. Because the product in Smart PSS is central to the experience of consumers, designers have the opportunity to strengthen the individual value of the service through the physical characteristics of the product. In this respect, designers must have a good understanding of the message companies want to communicate to consumers. Past research has suggested that the integration of services and products with a congruent meaning can have a positive effect on consumers' attitudes towards the offering [20]. Thus, the challenge for designers lies in bringing the service closer to consumers while safeguarding the overall value of the Smart PSS offering. Consequently, creating individuality in the service through the product is a task for which other important stakeholders in the development of the Smart PSS should be involved; it is a task that requires the alignment from different functional areas to ensure that the correct value is communicated to consumers.

3.3 Community Feeling

Community feeling refers to Smart PSSs that *facilitate the communication between their consumers*. This communication typically takes place through *social media*. Consumers give feedback to each other, share and exchange information regarding the Smart PSS. For example, Wattcher is a Smart PSS developed to make consumers more aware of their energy consumption at home. The product in Wattcher is a sensor that measures and displays the consumed energy. The service is a web portal where consumers can store their measured data and track their development over time. An important feature of this web portal is an Internet forum that consumers can use to talk to each other, to compare measured data, and share advice on how to reach energy consumption goals. Other types of social media that are typically implemented in Smart PSS include the evaluative rating of content by consumers, *connecting and sharing of information* through social networks, such as Facebook, and the possibility of sharing information via email.

Thus, through the use of social media, Smart PSSs enable consumers to share their opinions about, and personal experiences with the product and service. A good implementation of these communication channels could have significant implications for maintaining momentum in the use of Smart PSSs. Internet facilitates the rapid dissemination of word-of-mouth. Companies experience reduced control over the opinions of consumers, which could imply diverse repercussions for the adoption of market offerings [9]. However, by implementing

social media as complement to their communication strategies, companies can engage consumers, communicate directly, provide targeted information, shape, and monitor their opinions [9]. Thus, designers need to be aware of the important role that social media plays in the adoption of Smart PSSs, and their relevance in bringing such services closer to consumers. Moreover, the implementation of social media in Smart PSSs may be an important expectation of consumers. Thus, future research could set out to define the instances in which these communication channels are desired, and how they create value for consumers (e.g., Is the communication expected to take place directly through the product? How does communicating through the product influence consumers' perceptions of the Smart PSS? Does it increase perceptions of empowerment?). Finally, because social media also supports the two-way communication between consumers and service providers (as seen in Section 3.2), creating a feeling of community may be an important way of individualizing and bringing the service closer to consumers. How the product in the Smart PSS can be used to support this communication, and for which touchpoints in the provider-consumer interaction, are interesting avenues for future research.

3.4 Service Involvement

Service involvement refers to the nature of the relationship between consumer and service provider. As described in the preceding sections, Smart PSSs promote the *recurrent interaction* between providers and consumers. This recurrent interaction facilitates the deeper understanding of consumers, and the provision of more targeted solutions to them. Consumers and service providers are engaged in recurrent two-way communications that prolong the relationship between them. For example, consumers of Kindle may access the Smart PSS several times in one month, reading and participating in user reviews, or simply buying Kindle content. Every time consumers access Kindle, Amazon can listen, follow up their preferences, and learn from them. In contrast, other types of PSSs (including those with lower or no content of IT technology) focus on particular stages of the consumer journey and involve fewer interactions between consumers and service providers. In tools sharing, for instance, consumers pay to make temporary use of professional tooling for gardening, construction, and other purposes [11]. After being used, the tools are returned so other consumers can make sequential use of them. Thus, different to Smart PSSs, the interaction between service provider and consumers is virtually non-existent during the use of the product use, and between rental periods. Furthermore, because the product has no IT technology in it, it does not connect the service to the product, making it more vulnerable to market replacements. Smart PSSs, on the contrary, have the unique potential to recurrently link product, service and consumers, which could translate into important benefits for consumers (e.g., personalized solutions, prompt reaction to consumers' needs).

For designers, it is important to understand the level of involvement that service providers aim to attain with their consumers, and vice versa. This understanding can be used as a framework in the developing Smart PSSs that support the correct level of interaction. Having Smart PSSs that involve consumers extensively, but without the correct infrastructure to support it, may be detrimental for their adoption. Establishing an accurate level of involvement could lead to more congruent Smart PSSs, where product and service features are in balance.

3.5 Product Ownership

Product ownership is related to the business model of the Smart PSS, and could have an effect on how the experience for the consumer is designed. Product ownership is linked to prior classifications (i.e., types) of PSSs. First, the tangible product in the Smart PSS can be sold to the consumer and its *ownership transferred* to him/her. Then, consumers are responsible for the maintenance of the product. Maintenance includes installing software

updates, developed by the service provider, to guarantee the correct functionality of the Smart PSS. This corresponds with the product-oriented PSS previously discussed [1, 19]. However, an important difference with the traditional PSS classification is that consumers buy the product to gain access to and value from the service. Owning the product grants consumers unlimited access to the PSS, unless restricted by other business-model related aspects, such as the need of monthly fees to access the service. Examples of Smart PSSs where the ownership is transferred to consumers include Nike+, Wattcher and Kindle.

Second, the *ownership of the product can be kept with the provider*, who is responsible for the maintenance and correct functionality of the products. This is in accordance to the use-oriented classification of PSS [1, 19]. In this case, consumers have limited access to the PSS, typically for specific periods of time. Different to Smart PSSs where the ownership is transferred, consumers interact with service providers to gain access to the tangible products. Examples of Smart PSS where the ownership is kept with the provider include Green Wheels and Laundry View.

3.6 Individual/Shared Experience

Highly related to ownership, Smart PSS provide *individual and shared experiences* with the Smart PSS. Products that are owned by the consumer are generally used on an *individual basis*. A variation of this individual use can be found in Smart PSSs that facilitate the *group experience* of individual consumers. For example, Nike+ encourages groups of friends, who all own Nike+, to compete with each other in reaching common goals. Because each consumer makes use of Nike+, the individual experience with the Smart PSS is maintained. However, the idea of goal sharing, and the simultaneous use of the Smart PSS, creates a group experience with the Smart PSS.

Furthermore, Smart PSSs whose product ownership is kept with the service provider are typically *shared by different consumers*. Although consumers make individual use of the Smart PSS, different consumers can make sequential use of it during a day. Such is the case of Green Wheels, whose cars can be used by different consumers, located in the same area, throughout the day.

Designers ought to be aware of this aspect because designing the experience for an individual, versus designing the experience for groups, may result in important differences for the definition of Smart PSS. For example, in designing group experiences, designers may need to consider features that support the interconnection of the products, and provide conjoint feedback to those consumers sharing the experience. Differently, designing experiences for shared Smart PSSs, may turn the focus of designers on creating a Smart PSS that feels unique and individual to each consumer.

4. Conclusion

This research contributes to the literature on PSSs by identifying and discussing six distinctive characteristics of Smart PSSs. Some of these characteristics can be directly manipulated by designers. Others require the involvement of diverse functional areas within the company, to define Smart PSS that address the needs of both service providers and consumers.

Our insights can help designers in different ways. First, we have set the ground for designers who are confronted with the new task of integrating products and services in market offerings. By identifying the distinctive characteristics of Smart PSSs, designers can have a better understanding of how variations in Smart PSSs can be created, and which benefits these can bring for both companies and consumers. Second, our findings

can help designers to establish the preferred level of interaction between consumer and service provider, and by doing so, establish how the product-service integration can support the relationship between them. Moreover, our findings take a first step in understanding the features and characteristics that consumers will expect in Smart PSSs, and to create experiences for consumers that bring value to them. Finally, there is a need for more tools supporting the development of Smart PSS for the consumer market. Our findings can aid designers in the creation of such tools, in order to integrate products and services more effectively. The distinctive characteristics outlined in this paper should not be considered as exclusive. Technology, and consequently, Smart PSS evolve rapidly, and new features supporting the integration of products and service may emerge. Furthermore, we have outlined different research opportunities that can strengthen our findings. In particular, it is important to obtain a better understanding of the value that the Smart PSS can bring to consumers. Participants in our research were industrial design experts, who could more easily elucidate aspects related to technology and interactions. Thus, future research should set out to explore the value of the Smart PSS characteristics for consumers, so that designers have the know-how to successfully design these offerings.

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