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Consumers' perspective on product care: An exploratory study of motivators, ability factors, and triggers

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ABSTRACT

Product care is defined as all activities initiated by the consumer that lead to the extension of a product's lifetime. This research contributes to the literature by taking a consumer's perspective on product care, which is essential to postpone product replacement. We used Fogg's behaviour model as a theoretical framework to understand consumers' motivation, ability and triggers related to product care. Based on this, 15 in-depth interviews were conducted to explore consumers' current product care behaviour. Our findings show that many consumers are generally motivated to take care of their products, for example because they appreciate the product's functionality or because they are generally keen to consume in a sustainable way. They even have the right knowledge and tools or are at least motivated to get them. What is often missing are triggers that push people to take care of their products. Triggers can increase consumers' motivation or ability, for example by giving necessary tools to the consumer or by a helpful service offer. We also give suggestions for the practical implementation of our findings to support companies interested in a shift towards the Circular Economy.

1. Introduction

One approach for reducing the environmental impact of today's consumption pattern is to postpone product replacement and therefore use products for a longer period of time (Bakker et al., 2014b; Cooper, 2010; Mugge et al., 2005). The principles proposed to postpone product replacement (Van Nes and Cramer, 2005) range from enhancing the product's robustness, variability and use quality to design for repair & maintenance and product attachment (see also Mugge et al., 2005). At the moment, these principles are mainly used by companies during the product development process. The consumer's role in this transition has been underestimated so far (Piscicelli and Ludden, 2016), but is crucial for a successful implementation. The present research focuses on the design for repair & maintenance principle. This principle demands a strong role of the consumer, as he or she decides if and how the product is repaired or maintained. Indeed, it is of critical importance that consumers are willing and able to execute repair and maintenance activities for their products during the usage phase, or in other words, are willing to *take care* of their products. Thus we define the term *product care*, which does not only include repair and maintenance, but all activities initiated by the consumer that lead to the extension of a product's lifetime. These activities can be executed by the consumer him/herself or by a service. Product care goes beyond repair and maintenance, as it covers also preventive measures, such as protective covers for smartphones.

Prior research related to product care has focused on the product and how to change its design in such a way that repair and maintenance activities are feasible and easy (e.g. Cooper, 1994; Van Nes and Cramer, 2005; Vezzoli and Manzini, 2008). Strategies to facilitate maintenance contain a product design that avoids narrow slits and holes for easier cleaning, enabling the use of standard tools or a simplified access to components that should be maintained. Other possibilities to make repair easier are spare parts made available by the producer of the product (Mashhadi et al., 2016) or a product design that enables the disassembly and reassembly of a product. The latter approach is also known as Design for Disassembly (DFD) and can facilitate the maintenance, repairs, updating and remanufacturing of products as well as their recycling

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processes (Boothroyd and Alting, 1992; Harjula et al., 1996).

Other studies have explored business models in relation to easy repair and maintenance (e.g. Baines et al., 2007; Bakker et al., 2014b; Hirschl et al., 2003; Tukker, 2015). Rather than selling merely products, companies can keep the ownership of their products and offer product-service systems (PSS), an integrated combination of products and services, such as repair and maintenance. The Product Life-Extension Business model (Lacy and Rutqvist, 2016) also describes the role of a company as a provider of refurbishment, repair, upgrade, and maintenance services. As the ownership remains with the provider of the PSS, consumers no longer have to care about maintenance costs and efforts (e.g. Catulli, 2012; Edbring et al., 2015). PSS including maintenance and/or repair are quite common in business-to-business markets (e.g. printers from Xerox, aircraft engines from Rolls Royce) but are scarce in consumer markets.

At the moment, consumers often rely on taking care of their products by themselves. Although strategies to design for repair and maintenance have been proposed, it is still difficult or even impossible for consumers to repair many consumer goods, such as a fridge or a laptop, as this is often prevented by means of product design (Bakker et al., 2014a). iFixit.com, a platform that offers more than 10,000 repair guides online, is based on the belief that “people should be able to use their stuff how they want to, for as long as they possibly can” (Wiens, 2015, p. 124).

Even with the help of such websites, taking care of products requires time and effort from consumers and this in turn requires their motivation. An important factor that motivates people to invest time, money and energy into a product is product attachment, which suggests the presence of a strong emotional bond (see e.g. Chapman, 2005; Mugge, 2007; Page, 2014). Generally, product attachment leads to an increased likelihood of care activities towards the product and to postponing replacement (Belk, 1991). However, there are not that many products to which people feel attached. For a Circular Economy, it is highly relevant that consumers will also take care of products to which they do not feel attached.

This research contributes to the literature by taking a consumer's perspective on product care which remains a gap in the literature. It is not clear yet why people take care of product to which they do not feel attached. Specifically, we will investigate the different motivators for consumers to take more or less care of ordinary products. Also, we will explore what influences consumers' perceived ability to take care of their products. Additionally, we will identify events that trigger a care activity at a certain point of time. We followed an exploratory approach with 15 in-depth interviews to get an overall understanding of current product care behaviour. Fogg's (2009) behaviour model was used as a theoretical basis for our coding scheme during the interviews' analysis. This model has its origins in the field of persuasive technologies, which are technologies that change the user's behaviour in a certain way. As the aim of our research is to persuade consumers to enhance their product care behaviour, the transfer to the design of everyday products seemed appropriate. Our study provides the missing link between current design and business strategies on the one side and consumers' behaviour on the other side. Based on the factors that stimulate or reduce consumers' care activities, companies interested in moving towards a Circular Economy can adjust their product design, services, and communication in such a way that these care activities are more likely to be executed. Therefore, our findings support the implementation of the Circular Economy in practice.

The remainder of this paper is organized as follows. In Section 2, we present the Fogg behaviour model. In Section 3, we explain the used methodology. Section 4 reports and discusses the findings of our study. In Section 5, we discuss and conclude the findings and give an outlook on future studies.

2. Fogg's behaviour model

The behaviour model by Fogg (2009) claims that behaviour generally results from the concurrence of three factors: motivation (if people want to do it), ability (if people can do it) and triggers (a stimulus that provokes people to do it).

Motivators are pleasure, hope, or social acceptance, but also the corresponding negative aspects of pain, fear or social rejection. Pleasure or pain are immediate reactions to a situation. For example, when a person enjoys riding his/her bike, he/she will be motivated to repair it when it breaks down. On the other hand, hope and fear are reactions that are anticipated by the person. In some cases, people even accept discomfort (e.g. by lifting a heavy piece of furniture) to achieve pleasure (a newly renovated room). The aim to be socially accepted or avoid social rejection strongly influences people's everyday behaviour. For example, it is undesirable to waste resources for large groups of people. Therefore, taking care of products is a behaviour that is socially accepted.

Ability consists of six parts: time, money, physical effort, brain cycles, social deviance, and non-routine. If a behaviour requires a lot of time, money or physical effort, the required ability is perceived as demanding. Brain cycles describe the cognitive effort, which is needed for a certain task. If a behaviour means that one has to break with socially accepted rules or norms, this is classified as social deviance. People prefer things they do regularly, so non-routine behaviour is rated as less simple than everyday tasks. The assessment of ability depends on the person: While some people may regard 20 euros for a new shirt as too much money and therefore look for an alternative, such as repair, others would simply buy a new one. If a product care activity requires a demanding ability from the consumer, this can be regarded as a barrier towards product care.

A trigger is generally something that pushes people to perform a behaviour. Fogg describes three types of triggers: First, there are so-called sparks. A spark increases the person's motivation, for example by evoking a feeling of pleasure. An example is a waste bin that reacts with a smile if you use it and therefore evokes a positive feeling. Second, facilitators enable a person to behave in a way that he/she wants to. This means that the person is already motivated, but is lacking the ability. For example, by enabling the user to place his/her order online in a fast and convenient way, such as a ’one-click button’, his/her ability is enhanced. Third, signals are triggers that work if a person is motivated and has the ability needed; they often serve only as a reminder. Examples are notifications from a garage that remind customers of regular check-ups of their cars or a light that indicates a repair on a coffee machine.

The action line in Fig. 1 shows that motivation (y-axis) as well as ability (x-axis) have to be present to a certain extent to lead to an action: If either motivation or ability (or both) are very low, triggers will fail and no action will take place. But motivation and ability can also compensate for each other: If motivation is very high, people will try to realize a behaviour when a trigger occurs. If a behaviour is very easy to execute, triggers can push people to conduct care activities, even at a very low level of motivation. It is important to point out that these three factors – motivation, ability and triggers – have to be present for a person at the same time to lead to a certain behaviour.

3. Method

To understand the motivation, ability, and triggers of people to take care of their products, in-depth interviews were conducted at

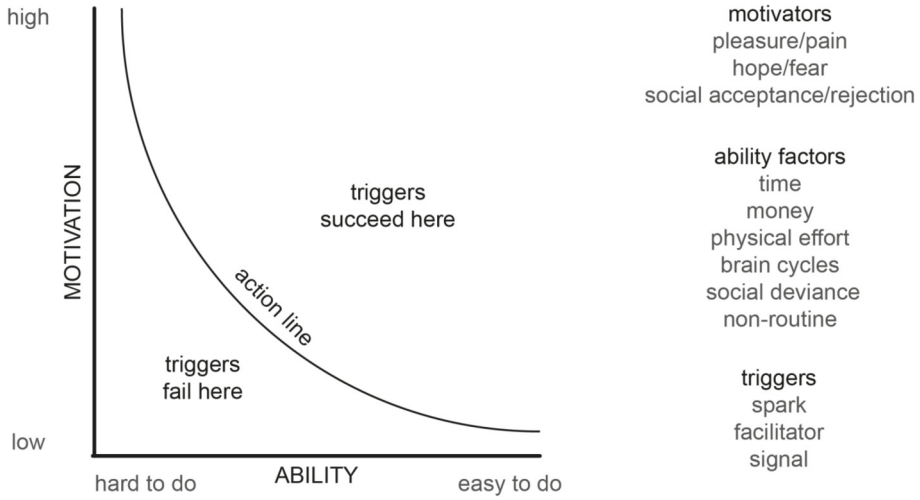

Fig. 1. Fogg's behaviour model (own illustration, based on www.behaviormodel.org).

the participants' homes. After a pilot study with two participants whose data were not used for analysis, we continued the study with 15 people (8 male, 7 female). Their mean age was 33.4 (12.6) years. Participants were selected from the personal environment of the researchers, aiming at a large variety in gender, age, occupation, and housing situation (alone, with family or roommates).

3.1. Procedure

The study was conducted via semi-structured, face-to-face interviews, in which the respondents were encouraged to explain their answers in detail. This ensured that all relevant topics were included and allowed us to ask additional questions. Interviews lasted around 25 min on average. We visited the participants at their home so it was easier for them to find examples for the products we asked them about. Before the interview, participants signed an informed consent form and possible questions were answered by the researcher. We also explained the concept of product care by emphasising that it does not only include repair activities, but all activities that can prolong the product's lifetime.

Research in the field of repair and maintenance has often focused on electronic products, such as smartphones or laptops (see e.g. Flipsen et al., 2016; Mashhadi et al., 2016). It has been shown that consumers' attitudes vary greatly between different product groups (Edbring et al., 2015) and thus different design strategies are needed (Bakker et al., 2014a). Therefore, our interviews covered a broad range of everyday products to identify not only general phenomena, but also aspects that are specific for certain groups of products. This would allow developing strategies that make the design for repair & maintenance principle relevant for society. At the same time, the amount of different topics had to be workable, so we included product groups for which most people should own at least one product. We selected the product categories to cover different ends of scales, such as products of high (e.g. communication devices) and low (e.g. clothes) complexity or utilitarian (e.g. tools) and hedonic (e.g. shoes) products. We also included products for which a service for repair and maintenance is often used, such as cars. These decisions were based on a pre-existing list, which included the most frequently owned products of 1386 Dutch households. As a result, the following six groups were selected:

- household appliances and tools (e.g. drilling machine, coffee maker, vacuum cleaner)
- consumer electronics and communication devices (e.g. laptop, smartphone, tv)
- means of transport (e.g. car, bike, motorbike)
- furniture and interior design items (e.g. table, curtains, bed)
- clothes, shoes and fashion accessories (e.g. shirts, handbags, scarfs)
- sport equipment, accessories for hobbies and leisure (e.g. ski, sport shoes, fishing rod)

For each group of products, the participant was asked to name a product that he/she takes care of, that is he/she devotes effort and/or attention to, so it remains usable for a longer period of time. Depending on the answer, further questions included the reason (as insights into motivation) and the process of taking care as well as possible problems (as insights into ability) by doing so. After that, we asked participants to specify a product that he/she does not devote effort and/or time to, even if that means that he/she cannot use it for a long period of time. Again, reasons and barriers for this behaviour were requested. We used this approach of positive and negative examples as we aimed to get real experiences on the dimension taking care/not taking care. Finally, socio-demographic data were collected (age, gender, profession and household composition).

3.2. Analysis

All interviews were audio recorded and fully transcribed. After a verbatim transcription of the interview recordings, a qualitative content analysis was conducted making use of the software f4/f5 (www.audiotranskription.de). The coding process started by a full coding of two interviews by the main researcher, which resulted in 97 codes. The three factors of the Fogg behaviour model – motivation, ability, and triggers – served as a basis for this coding, but it became clear that more codes and subcodes would be needed to cover all relevant aspects. Thus, after a discussion among the three members of the research team, more relevant codes were added. This led to a coding scheme of 154 codes, which was then applied to all 15 interview transcripts. These codes are also presented in Appendix A. During a further coding session, two researchers refined and merged these codes. We also examined the point of saturation, after which new data produces little or no change to the codes (Guest et al., 2006). Saturation had been reached after interview 12, as the remaining interviews mostly confirmed previous insights. We therefore concluded that 15 interviews were a

sufficient sample size for this study.

4. Results and discussion

Based on the analysis of our interviews, we clustered the findings into general insights on product care as well as into motivation, ability, and triggers. We will also discuss ideas how these aspects can be addressed by companies in the following section.

4.1. General insights on product care

Activities of product care identified in our study were repair, maintenance and keeping the product clean. Furthermore, product care activities included improvements, the purchase of adequate accessories and protective tools as well as a generally careful and thoughtful handling. Improvements can be actions of personalization, such as changing parts of clothes for a better fit. Examples of adequate accessories are care products, such as descalers:

> *"I use these descalers to avoid the [washing] machine being damaged by the water, so that the machine does not get broken so fast."* [1] (P11, 9)

Thoughtful handling was realized by using the product only for the intended use, regular controlling of the product and avoiding to overstress the product:

> *"You just don't want to overstrain it [kitchen machine]."* (P06, 18)

Services are mainly used for repair and maintenance in the transport category (cars, bikes), but in some cases also for household items (e.g. washing machine) or consumer electronics (e.g. laptops).

We identified different degrees of product care intensity among our participants. This factor describes the amount of time and effort people spend on care activities.

Participants with a low degree of care intensity do not take care of a certain product, often because they do not really need it. They would also not replace it when it is broken. A medium degree of care intensity relates to care activities for which as little effort and time as possible is invested. Consequently, product care is not done on a regular basis, but mostly after the product is broken. Even then, there is often no urgency to repair it. This degree of care intensity also includes care activities that have to be done to avoid negative effects in the long term. The products of this degree of care intensity are needed or valued, which leads to their owners' interest in prolonging their lifetimes. The highest degree of care intensity describes a strong care towards the product, which is also done on a regular basis. The underlying reasons can be cognitive ones, like financial aspects, or affective aspects, such as an emotional attachment towards the product. Both result in an explicit wish to keep the product usable as long as possible.

We also identified different stages of care determination. Care determination describes the extent to which the participants are convinced that their executed care activities are appropriate. It is high for participants who take good care of their products, often due to their intrinsic motivation and a general attitude towards longevity of products:

> *"Generally … if I buy myself household appliances, for example a mixer or whatever … we don't have one, but it would be the same for a Thermomix: If I spend the money, then I will take care of the product and I won't buy a new one after 2 years."* (P7, 9)

But it can also be high for people who have no intention to take care of their products as long as they strongly believe that this behaviour is right, for example, because they think it is part of their personality to change products often.

On the contrary, a low care determination means that people are not sure if taking care of their products makes sense at all and should be done in the future:

> *"And then with sneakers … you cannot really take care of them. They will get broken anyway somehow."* (P15, 67)

Many consumers are doubtful whether they should take care of their products, resulting in a low care determination. These people often base their decisions on rational reasons, such as the money or effort needed for repair. Addressing these rational reasons and enhancing the consumers' motivation can therefore be an important strategy for companies to increase consumers' likelihood to take care of their products.

4.2. Motivation to take care

Although motivation alone will not lead to product care behaviour, its absence prevents people from performing it. Our findings indicate that at least a strong interest in topics such as obsolescence and sustainable consumption is common in our society. The nine motivators found in our study are based on either the product (financial aspects, pleasure, functionality, aesthetics), the person itself (intrinsic motivation, rebellion against brand policy), or the relationship between person and product (irreplaceability, fit with the participant's identity, shared ownership).

4.2.1. Product-related motivators

There are four product-related motivators:

First, *financial aspects* play an important role for participants' motivation to take care of their products. A high price of a product leads to consumers expecting a better quality. As a long lifetime is expected from high-quality products, consumers are willing to do their part by investing money and effort in product care activities:

> *"I take care of an expensive product [more than of a cheaper one], so I can keep it for a longer period of time." [talking about household items in general]* (P7, 25).

On the other hand, high prices for spare parts or a service keep some consumers from taking care. For companies, these insights suggest that a combination has to be found between a high selling price of the product, but also moderate prices for product care activities, either done by the consumers or by a service. An online tool that calculates if it is feasible to repair the product or if it should be disposed of could support consumers in their decisions. Companies could also offer a 'no worries-time' after purchasing a product. Within this time, the consumer could bring the product back and all necessary care activities would be conducted for free. Another possibility is a service flat-rate, which can be understood as an extension of the already existing insurances for laptops, smartphones etc. By paying a fee, care activities as well as theft or destruction would be covered.

Second, participants are motivated to take care of products that are associated with activities of *pleasure*, for example, because they represent a hobby or provide social experiences (e.g. a kettle used for drinking tea with friends). On the other hand, products that are

[1] As the interviews were conducted in German, quotes were translated from German into English.

annoying or do not provide fun are usually taken care of less. When consumers associate fun and pleasure with the product, they tend to take more care of it:

> *"And Paulchen [a camper] has […] a kind of fun factor, I associate travelling with it … and we invested a lot of love and time to make it pretty and make it nice for us"* (P 17, 133).

Consequently, household appliances or tools are only seldom taken care of. To enhance consumers' product care behaviour, it is therefore important for companies to connect the usage of a product to more positive feelings, such as fun, or pride.

Third, the *functionality* of a product seems to play an important role for the participants' motivation. This includes the product's quality as well as the features it offers. Aside from the general quality of a product, participants often mentioned functional product characteristics that are (or were at the time of purchase) relevant for their decision. The high functionality then leads to a regular use of the product and, as a result, to regular product care:

> *"I really use it [the laptop] every day. I always pay attention for these kind of products, so they really work well"* (P13, 21)

A high functionality also leads to a fear of negative effects such as a premature breakdown of the product due to missing care activities, such as the calcification of a washing machine.

While a product that is often used is usually taken care of, a product that is only regarded as a temporary solution or whose lifetime seems to be limited by external factors will not get this amount of attention. The functionality aspect is also relevant for features that are legally obligated, such as the regular inspection of a car:

> *"If bringing your car to a regular service is regarded as taking care, then my car is taken care of necessarily, just due to the legal situation."* (P17, 122)

Products that are technically out-dated, such as older mobile phones, are likely to be replaced by a newer version. A low product care degree is also relevant for products that are generally needed, but are not cherished by the participants on an emotional or personal level. This often applies to very functional products, such as a vacuum cleaner or tools. The participants often reported that they do not take care of them and described these products as *"It is just there"* (e.g. P11, 21).

Another factor that affects motivation are the product's *aesthetics*. This factor concerns very aesthetically appealing products that are often taken care of:

> *"Yes [I would bring it definitely to a repair service]. If I regard it as being nice, I don't care if it is custom jewellery or expensive jewellery."* (P10, 90)

To avoid owning products that are not in vogue any more, some participants prefer timeless products. Especially within the clothes category, they prefer to take care for pieces that can be used over a longer period of time and are not dependent on fashion trends.

4.2.2. Person-related motivators

With regard to the person himself/herself, *intrinsic motivation* was found to influence product care activities. This includes a general attitude towards longevity, which motivates the participant to take care of products:

> *"I do not want to throw away things generally."* (P03, 13)

This general positive attitude towards product longevity motivates some participants to take care of all of their products, while others differentiated more, either between different product categories or between different products within one product category. On the other hand, there are participants who do not want to take care of their products and prefer to buy new products regularly instead. This behaviour is often independent from the product category:

> *"I am the type of person who always buys everything new."* (P08, 18)

These persons always strive to own the latest products, even when the current ones are still of good quality and functionality.

A more specific motivator is the *rebellion against the brand policy*, which enhances the motivation to repair products. It describes the attitude of participants who are generally satisfied with a certain product, but become annoyed if their product needs to be repaired or if they need spare parts. The only solution is often to contact the brand's service provider and pay high prices for the repair. This is mainly frustrating for participants who are motivated to repair products on their own, but who are declined the possibility to do so by the brand policy:

> *"And I do not want to be part of that game. Apple does that … I fancy Apple products. I think Apple produces good products … but it is disgusting, that the products are closed … in every sense."* (P03, 81)

4.2.3. Motivators related to the person-product relationship

Three motivators are linked to the relationship between the consumer and the product. The first motivator is the product's *(ir) replaceability*. Often a product is regarded as irreplaceable because the participant is emotionally attached to it, for example, because it is an heirloom, an own creation or because it reminds the owner of an event:

> *"It [the dress I wore for my graduation ceremony] has also an emotional value."* (P04, 87)

In contrast to these cherished products, there are products that are easy to replace. This often applies to certain clothing items, such as socks or underwear, which are so cheap and easy to be replaced that it is not worth to take care of them:

> *"Underwear is not something that could not be replaced very easy"* (P12, 85)

Second, people are motivated to take care of products that *fit with the participant's identity*. If the person has the feeling that the product does not represent his/her lifestyle or represents an unsustainable way of consumption, it may cause a decreasing amount of care, because the person is not interested in using the product as long as possible:

> *"It did not really fit into my way of life. It was neither a city car nor a camper. […] I never stood by it, it never suited me."* (P03, 45)

Last, the *shared ownership* of some products is a reason for low product care. The fact that other people own the product seems to

lead to a decreased responsibility to take care of the product. This effect is also described in shared flats, where flatmates do not seem to invest as much time and effort in taking care for the product than the owner:

> *"There are flatmates who use it [the kitchen machine] every day and who do not [clean it afterwards]"* (P13, 3)

Motivation is an important aspect to consider when designing for product care, as people will not change their product care behaviour without being motivated to do so. There always has to be a reason for consumers to take care. While person-related motivators and motivators related to the person-product relationship are difficult to influence, there is a big potential for companies regarding the product-related motivators pleasure, functionality, and aesthetics, which can be directly influenced to enhance consumers' product care behaviour. One promising approach that encourages the user to spend more time on the meaningful parts of the interaction is called Slow Design (Fuad-Luke, 2002). Care activities as meaningful and conscious interactions between consumer and product could contribute to more attachment between them. The application of Slow Design on mass consumer products is a relevant approach for a prolonged use of products as the positive involvement of the consumer is increased (Grosse-Hering et al., 2013). Product care could therefore be encouraged in two ways: On the one hand, it keeps the product usable for a longer period of time and contributes to more appealing aesthetics. On the other hand, the underlying activities lead to a stronger bond between consumer and product, which results in the consumer's wish to extend the product's lifetime. However, it is of high importance to find a balance between involving the consumer by requiring more time to use, learn and understand the product on the one side and not to slow him/her down so much that he/she becomes irritated by the interaction (Grosse-Hering et al., 2013). Generally, it is important to explain to the consumer that the product is not only of high quality, but that its lifetime can be extended by the consumer himself/herself easily. This results in the acceptance of a higher price at the time of purchase, which in turn enhances the motivation to take care of the product (see *financial aspects*).

4.3. Ability to take care

The ability factors presented in this paper should be understood as the perceived ability of the participants. For example, it describes how difficult the care activities are judged by the interviewees. Four factors seem to affect participants' perception of their ability to take care of their products: knowledge and skills, time and effort, lack of tools and general repairability.

The first one, *knowledge and skills,* ranges from participants who think they are able to take care of the product to those who either do not have enough knowledge and skills or at least think so. Not enough knowledge and skills are often mentioned for electronic or technical products:

> *"Well, because I am not a master of technical things anyway. I have always fears and reservation that I might damage something by handling it in a wrong way."* (P05, 11)

Some of the participants indicated an interest in gaining (more) knowledge or skills, although in the majority of the cases they did not have enough time to learn it until now. Also, participants may have tried to take care of their products, but failed:

> *"I tried [to fix it]. I searched online for Mac cleaning programmes and was quite convinced. But then I did not know what files I could throw away … no, I would outsource this in the future"* (P03, 29)

Participants' perceived knowledge and skills vary strongly between the reported care activities: Care activities such as keeping clean do not seem to be problematic for the participants, regardless of the product category. On the other hand, repair is often regarded as a challenge, depending strongly on the particular group of product categories. For example, participants seldom repair their technical products, especially those with electronic components or software, such as laptops or mobile phones. They often report of their fear to damage the product further or to hurt themselves. It became clear that participants without technical knowledge are scared of repairing these products without any help. Even other groups of products challenge the participants: Especially in the clothes category they often reported that they do not know how to sew, darn or otherwise work on tissues. Their solution is often to bring the products to professionals or family members, mostly their mother, who will do this handiwork for them.

The second aspect is the *time and effort* required for the care activity. Participants mentioned that they either do not have enough time to take care of their products or do not want to spend the required effort:

> *"But at one point you do not have the time anymore. This is the second aspect … the first one is the money; the second one is the time. And then you think: Is it worth the effort to bring it to the service or spend my own time? Because I do not have this time, especially because of the kids"* (P07, 27)

Third, the participants mentioned a *lack of tools*. This factor relates to tools that are necessary for the care activity or tools to enhance their knowledge or skills such as tutorials:

> *"It is not possible [to repair it], because there is a hole in the tire and I do not have the appropriate tools"* (P16, 69)

The last factor that influences the ability to take care is the *general lack of repairability* of a product. It describes the fact or the assumption that a product cannot be repaired in principle. This is often the case for technical products or products with electronic components, which are designed deliberately in a way so that consumers cannot open them:

> *"I think you cannot open it [kitchen machine] generally, to be honest."* (P08, 56)

This factor also applies to products that can be repaired, but will not be as nice or practical as before:

> *"But it [a pair of winter shoes] is not worth to repair, because it will never be as before"* (P07, 71)

In addition to insights about self-care activities, participants provided comments concerning the usage of services for product care. Participants reported to use a service for difficult or annoying tasks, often regarding technical products, such as a car, a bike or a laptop. Some participants use services not only for tasks they cannot perform themselves, but also because they really enjoy the experience and are happy with the results:

"It is a very good feeling. That [a cobbler shop] is a service I appreciate a lot." (P03, 41)

To enhance people's ability to repair a product, various strategies that focus on the consumer could be implemented: Generally, skills and knowledge could be enhanced. As participants reported a general willingness to learn more about care activities for their products, this might be a good strategy. It could be realised by free video tutorials or better instructions, which lead to more advanced knowledge on how to take care of the products. Repair & maintenance workshops offered by the producer could also address this problem and additionally solve the problem of missing tools. To make sure that product care activities do not require too much time or effort, companies could also offer accompanying services to support their customers. Repair and maintenance services are well accepted by participants. Some participants even stated that a service offer for repair etc. is an important aspect of their buying decision.

4.4. Triggers to take care

Five different triggers – stimuli that push people to perform a certain behaviour immediately – could be found by analyzing the interviews: appearance triggers, time triggers, social triggers, previous care activity experiences and a challenge-based approach.

First, the participants' motivation can be increased by *appearance triggers* when the product does not look nice anymore. This can for example be due to traces of a longer period of use:

"Yes, [I painted my piano] simply black. Because you realise after some time that this black does not look so nice anymore." (P10, 105)

This trigger applies to the fact that the product's aesthetics can serve as a motivator for product care: When products that looked fine before loose their 'perfect' appearance, this trigger enhances the owner's motivation to take care of it and to re-establish its aesthetics.

Another category of triggers are *time triggers*. For example, care activity may be carried out regularly, independent from the actual state of the product.

"It [the car] is cleaned twice a year" (P17, 113)

This trigger is also relevant for activities that have to be done on a regular basis due to regulations, such as an annual vehicle inspection.

The third kind of triggers are *social triggers*. They relate to the influence of the social environment, such as family or friends. Their influence can work in both directions by either decreasing or increasing the motivation to take care.

While the first three triggers can be seen as external triggers, whose origin can be found either within the product or within the environment of a product, the last second triggers are based on the consumers themselves, so they can be described as internal triggers.

Previous care experiences are triggers, which relate to a former experience of taking care. This describes how the care activity, either done by the participant himself/herself or by a service provider, was perceived and how it affects the motivation or ability for future care activities. It can be a positive experience, granting the participant for example pride and pleasure:

"I always recognize that the bike works better afterwards, that you can drive with it in a better way. I am happy that it works better again and mostly the driving experience is also better than before." (P04, 53)

Regardless of having observed a positive or a negative care experience, the participant is biased by his/her feelings afterwards. As a result, previous care activity experiences serve as triggers for the future care activities (either done by the person himself/herself of by a service provider):

"I always bring my shoes to the shoemaker and afterwards I come back very proud […] I think that is a nice thing for him to do. I am always very happy when I get the shoes back then." (P03, 63)

Some participants seem to follow a *challenge-based approach*: They want to try out what they can do by themselves and where their personal boundaries are:

"Simply to find out if I can do it. And because I put the demand on myself to try it by myself first without seeking help immediately. Because I like to figure out if something will work." (P13, 36)

Notably, this trigger can influence the motivation as well as the ability: Challenging themselves increases the participants' intrinsic motivation to take care of the product. Additionally, if they are lacking some skills or knowledge, they can gain it to 'overcome the challenge', so it can also increase their ability. Because the feeling of being part of a challenge can stimulate an immediate product care activity, we define this challenge-based approach as a trigger, although it could also be seen as an intrinsic motivator or as an ability factor.

Companies can trigger their consumers by either focusing on external or internal triggers.

Time triggers range from simple measures such as a reminder for an annual check-up to more complex ones such as a signal that is integrated in the product and attracts attention to itself after a certain time of usage. Appearance triggers can be realised so that a look at the product triggers the consumer to conduct a product care activity. An example might be a surface of the product that changes over time. This might work well for furniture, but can also be used for other product categories, such as electronic devices. Social triggers work if people take care of their product, because they do not want other people to look down at them, but also if people want to be admired for taking care of their products. A product that emanates its care state, for example by a small display, so that it is also visible for other people, could therefore be a social trigger. Internal triggers, such as previous care activities, focus on the experience of the product care activity, regarding the process of taking care as well as its outcome. This could be achieved in multiple ways, for example by a design that does not provoke frustration during repair. A challenge-based approach could be realised by an accompanying service, which allows consumers to compete in their care activities, but also on a more individual level by daring the consumer to take care by a demanding, but at the same time not too difficult care activity.

Table 1 provides an overview of the factors related to motivation, ability, and triggers. The table presents each factor, its definition as well as its expected effect on product care. For example, with respect to financial aspects, we propose that the higher the price of the product is, the more likely consumers are to take care of this product. However, the more expensive spare parts of a product are, the less likely consumers are to take care of this product.

Table 1
Identified factors of motivation, ability and triggers.

	Factor	Definition	Effect on product care
motivation	financial aspects	high price of the product	positive
		high price of spare parts	negative
	pleasure	fun or joy provided by the product	positive
	functionality	high functionality and therefore regular use of the product	positive
	aesthetics	concerns very aesthetically appealing products	positive
	intrinsic motivation	general attitude towards longevity	positive
	rebellion against the brand policy	consumers' reaction as the brand tries to prohibit them from repairing their products	positive
	irreplaceability	emotional attachment, for example, because product is a heirloom	positive
	fit with participant's identity	product represents consumer's lifestyle	positive
	shared ownership	other people owning the product leads to a decreased feeling of responsibility for the product	negative
ability	knowledge and skills	consumer knows how to take care of the product	positive
	time and effort	consumer has enough time for taking care	positive
	lack of tools	consumer has no access to suitable tools	negative
	general lack of repairability	the fact or the assumption that a product cannot be repaired in general	negative
triggers	appearance triggers	product does not look nice anymore	positive
	time triggers	care activity after a certain amount of time, independent from the actual state of the product	positive
	social triggers	influence of the social environment, such as family or friends	positive
	previous care activity experiences	previous care activity was positive	positive
	challenge-based approach	consumers want to try out what they can do by themselves and where their personal boundaries are	positive

5. Conclusion and general discussion

The aim of our study was to identify existing motivators, ability factors, and triggers for product care in different groups of product categories. By conducting 15 in-depth interviews, we gained new insights into consumers' perspective on product care. To design products that can change consumers' product care behaviour, we used Fogg's behaviour model. Based on our findings, we discussed several ideas for companies to enhance consumers' product care activities. To tackle the identified challenges in product care, quantitative studies are needed. This would allow identifying the most relevant motivators, ability factors and triggers for different people, different product categories and different situational contexts. Insights into factors that influence consumers in the decision between using a service or taking care by themselves could help companies to decide whether their focus should be on product features or on a service to support product care. As the circular economy is a global approach, the influence of different cultural backgrounds could be explored in the long term.

As described above, Fogg (2009) identified the three positive motivators pleasure, hope, or social acceptance – as well as their negative counterparts – pain, fear, and social rejection.

We observed nine motivators that can mostly be linked to Fogg's findings: Our product-related motivators pleasure, functionality and aesthetics are a representation of Fogg's pleasure, as they all contribute to a positive experience with the product. The irreplaceability of a product can be seen as the consumer's fear of losing memories connected with the product. The wish to be accepted in society corresponds with a general interest in sustainability, and the fit between the product and one's own identity: People do not want to care for products if they do not match with their own personality. Participants also sometimes mentioned that they take care of some products because they are legally obligated to do so. This means that not taking care could be considered as social deviance, which people try to avoid according to Fogg. Participants reported of having not enough time to take care of their products, mentioned the high prices for spare parts or services and their cognitive or physical struggle with some tasks. These statements support Fogg's ability factors time, money, physical effort, brain cycles, and non-routine. Additionally, we identified the access to tools and equipment as well as the general repairability of a product as ability factors.

Our interview questions focused on motivators and ability factors to take care or to not take care of products. Most of the triggers found in our interviews decrease or enhance the person's motivation and are therefore classified as sparks. Previous care activities also work as facilitators, as previous experiences influence the ability to take care. The observed gap between attitude – a high interest in longevity of products – and action – a general low level of product care – is likely caused by the absence of triggers. Missing triggers represent missing stimuli that provoke immediate care activities. Consequently, even though the participants were motivated and had the ability to carry out the care activities, the absence of a relevant trigger was all too often the missing piece to conduct product care. Unfortunately, consumers are often not consciously aware that certain triggers are absent. More research is needed to explore how these triggers can be designed in order to encourage product care. While Fogg's model was developed for a different purpose, it helped us to explain the specific phenomenon of product care behaviour. Fig. 2 shows a specified version of Fogg's model based on our findings.

For each factor, suggestions for practical implications for companies were given. In general, companies have to start to take care of their products *together* with their consumers – it is a shared responsibility that has to be addressed. An interesting aspect in this context is the motivator *rebellion against brand policy* that emerged from our interviews. During the last years, products became more difficult if even impossible to repair for the consumer (If it's broken, you can't fix it, 2017). This applied for example to products, such as smartphones, whose parts are often glued together or whose repair requires special tools. Also, digital ownership has become “more slippery”, as companies, such as Tesla, control via software how their products are used (Take back control, 2017). Though, recent developments such as the Repair Association (www.repair.org), that wants US states to pass “right to repair” laws, or the French law to prohibit planned obsolescence, show that a lot of consumers are interested in taking care of their products and that they are not willing to accept these restrictions.

The shift towards a Circular Economy also bears some challenges for companies: One necessary step is a shift from current business

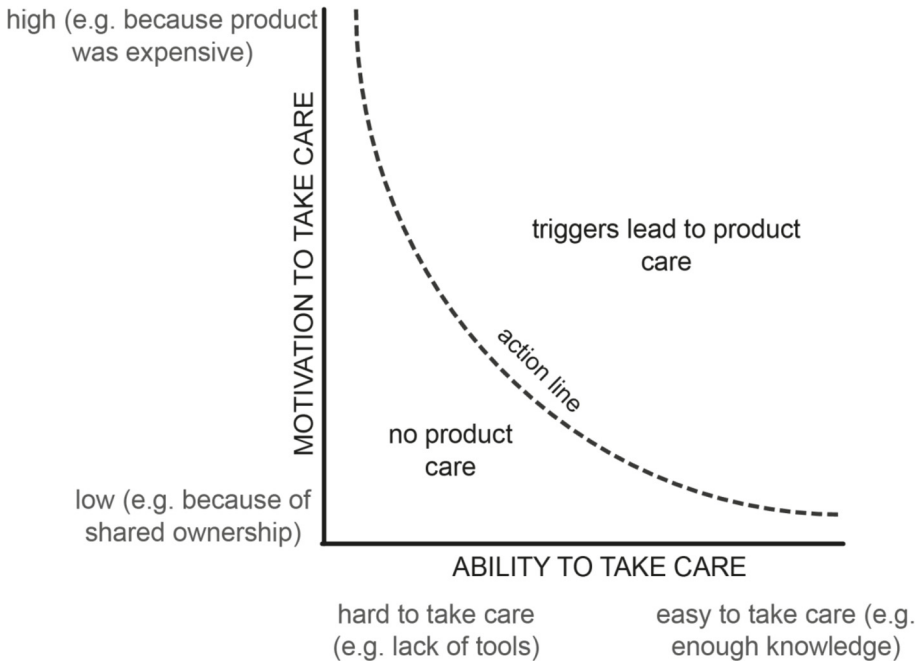

Fig. 2. Specified Fogg's model based on the uncovered factors of motivation, ability and triggers for product care.

models towards new approaches that do not primarily focus on selling products, but also consider accompanying services (see e.g. Bocken et al., 2016). Therefore, the relationship with the consumer has to be considered throughout the lifetime of a product to be able to take care of it. Another aspect for future research is the communication of product care-related features of a product or a service. Often people do not seem to know if or how a product can be repaired at all, which already decreases their motivation to take care of it. Companies should encourage product care, because they can also benefit from that behaviour. Factors, such as the usefulness of repair information and complexity of repair, do not only affect current care activities: They were also identified as determinants on future purchase decisions as well as on recommendations of the brand (Sabbaghi et al., 2016). This means that companies cannot only earn money by offering spare parts or services for repair and maintenance, but that a more product care-friendly strategy increases also future sales and affects the company's image in a positive way.

Appendix A. List of codes

The following table shows the codes derived from the content analysis (second column), the category (third column) and the overall aspect (fourth column), which is also discussed in Section 4.

Number	Code	Category	Overall aspect
1	housemates do not take care as intensive as participant	participant takes care	care activity
2	restauration		
3	repair		
4	included service as an important factor for buying decision		
5	thoughtful and well-informed buying decision		
6	updates		
7	exchange parts		
8	created by participant		
9	improvement		
10	customization		
11	avoid (further) damage		
12	buys adequate accessories etc. for the product		
13	uses protective tools for the product		
14	regular controlling		
15	uses product only for the intended purpose		
16	no overstressing of the product		
17	use care products		
18	keep clean		
19	maintenance		
20	insurance		
21	kept packaging for future transport		
22	stores product in a way that it stays „present“		
23	presents product in a special way		
24	repair		

(*continued*)

Number	Code	Category	Overall aspect
25	keep clean	participant's family member takes	
26	participant is not interested in learning how to take care of product, because he/she uses service, family and/or friend	care without participant	
27	for production or realization of own ideas	service is used	
28	for changing size or modification		
29	for repair		
30	for maintenance		
31	repair is done to a certain extend, then service is used	service dependent on price of service	
32	wants to keep product well-reserved for future reselling	financial aspects	motivation
33	has not enough money to buy new one		
34	low (or no) price paid for product		
35	expensive product		
36	repair is more expensive than buying new product		
37	service is expensive so own care is tried first		
38	product is taken care of dependent on price		
39	product provides pleasure	pleasure	
40	product provides fun		
41	social aspects (used together with friends etc.)		
42	annoying product or activity		
43	product represents a hobby		
44	product does not provide fun		
45	unique value	(ir)replaceability	
46	own creation		
47	attached towards product		
48	easy to buy replacement		
49	product was not easy to find		
50	own investment		
51	alternative product available		
52	waited a long time to receive product		
53	is proud to own the product		
54	wanted to have unique version		
55	dependent on emotional attachment		
56	product is needed	functionality	
57	product is often used		
58	product is not often used		
59	product is technically out-dated		
60	participant would prefer older or former version		
61	product is for children and might become broken away		
62	worth the care: high quality is expected because of the high price		
63	good quality		
64	high functionality		
65	regarded as temporary solution		
66	bad quality		
67	broken		
68	no good functionality		
69	legally obligated		
70	dependent on quality		
71	aesthetic appeal	aesthetics	
72	not dependent on fashion trends		
73	not in vogue anymore		
74	not nice anymore		
75	generally important for own identity/lifestyle	identity fit	
76	represents unsustainable consumption		
77	wants to support idea behind the product		
78	positive feeling associated with buying decision		
79	fits well		
80	does not fit well		
81	does not represent own identity/lifestyle		
82	general attitude towards longevity in this category		
83	does not want to throw things away generally	intrinsic motivation	
84	does not buy things that are not important to him/her at the moment		
85	products are not so important to him/her		
86	does not own things that are not important to him/her		
87	treats all products well		
88	same amount of care as for other products		
89	could not name a negative example		
90	changes or replaces products quite often		
91	does not want to support brand's service	rebellion against brand policy	
92	own care activities, because no willingness to pay for service		
93	prefers to rent things (car-sharing etc.)	shared ownership	
94	shared possession		
95	not sure if (and how) one should take care	knowledge and skills	ability
96	tried to take care but failed		
97	does not know what could help to extend product's lifetime		
98			

(*continued on next page*)

(*continued*)

Number	Code	Category	Overall aspect
	thinks he/she does not have enough knowledge and skills, but is interested in gaining it		
99	has no confidence in his/her own knowledge or skills		
100	thinks he/she has enough knowledge or skills		
101	care requires time and effort	time and effort	
102	lack of time		
103	video tutorials	tools	
104	personal assistance		
105	lack of tools		
106	frustration, if product cannot be repaired	general lack of repairability	
107	thinks that none of the products in this category needs care		
108	most products in this category are not cared for		
109	thinks product cannot be repaired at all		
110	easy to take care of product		
111	when product is not nice anymore	appearance triggers	triggers
112	mockery, but doesn't care	social triggers	
113	after long time of usage	time triggers	
114	own care activities = pleasure, positive experience	previous care activities	
115	service = pleasure, positive experience		
116	own care activities = negative experience, not fun		
117	tried to take care, but failed		
118	annoyed that he/she has to take care		
119	care is accepted because it was known at time of purchase		
120	challenge: participant likes to try out if he/she can repair product	challenge-based triggers	
121	wants to take care himself/herself generally		
122	changes with time		care intensity
123	plans to throw product away	ready to throw away	
124	would not be replaced when broken	no care, because product is not needed	
125	does neither want to buy new one nor take care of current one		
126	thinks he/she has no choice than to use this product	no care, but product is needed	
127	current product is out-dated but participant would take care for newer version		
128	no special attention paid („it's just there")		
129	product is only used		
130	product is used as long as possible without taking care		
131	likely to be replaced when broken		
132	no possession	no care, because product is not owned	
133	seldom	takes care, but does not invest much time or effort	
134	knows that more care activities could/should be done		
135	knows that more care activities could be done, but has no bad conscience about it		
136	takes care as less as possible		
137	often, but not regularly	takes care, but only when necessary	
138	has to be done to avoid negative effects		
139	even when broken, no urgency to take care		
140	when necessary, e.g. broken		
141	appearance is less important than functionality		
142	small defects are accepted		
143	regularly	strong care	
144	repair when financially reasonable, otherwise replacement	strong care - cognitive decision	
145	price of repair		
146	not worth the repair (financial aspects)		
147	future replacement dependent on financial situation		
148	explicit wish to keep it usable as long as possible	strong care - affective decision	
149	would be kept even when broken		
150	present from family or friend		origin
151	brought product himself/herself		
152	give-away by company etc.		
153	present from another person		
154			general statement

References

Baines, T.S., Lightfoot, H.W., Evans, S., Neely, A., Greenough, R., Peppard, Roy, R., Shehab, A., Braganza, A., Tiwari, A., Alcock, J.R., Angus, J.P., Bastl, M., Cousens, A., Irving, P., Johnson, M., Kingston, J., Lockett, H., Martinez, V., Michele, P., Tranfield, D., Walton, I.M., Wison, H., 2007. State-of-the-art in product-service systems. Proc. Inst. Mech. Eng. Part B J. Eng. Manuf. 221 (10), 1543–1552.

Bakker, C., Wang, F., Huisman, J., den Hollander, M., 2014a. Products that go round: exploring product life extension through design. J. Clean. Prod. 69, 10–16.

Bakker, C., den Hollander, M., Van Hinte, E., Zijlstra, Y., 2014b. Products that Last: Product Design for Circular Business Models. TU Delft Library, Delft.

Bocken, N.M.P., de Pauw, I., Bakker, C., van der Grinten, B., 2016. Product design and business model strategies for a circular economy. J. Ind. Prod. Eng. 33 (5), 308–320.

Belk, R.W., 1991. Possessions and the sense of past. In: Belk, R.W. (Ed.), SV Highways and Buyways: Naturalistic Research from the Consumer Behavior Odyssey. Assoc. Consum. Res., Provo, pp. 114–130.

Boothroyd, G., Alting, L., 1992. Design for assembly and disassembly. CIRP Annal. Manuf. Technol. 41 (2), 625–636.

Catulli, M., 2012. What uncertainty? Further insight into why consumers might be distrustful of product service systems. J. Manuf. Technol. Manag. 23 (6), 780–793.

Chapman, J., 2005. Emotionally Durable Design: Objects, Experiences and Empathy. Earthscan, London.

Cooper, T., 1994. Beyond Recycling: the Longer Life Option. New Economics Foundation, London.

Cooper, T., 2010. Longer Lasting Products: Alternatives to the Throwaway Society.

Gower Publishing, Surrey.
Edbring, E.G., Lehner, M., Mont, O., 2015. Exploring consumer attitudes to alternative models of consumption: motivations and barriers. J. Clean. Prod. 123, 5–15.
Flipsen, B., Bakker, C., van Bohemen, G., 2016. Developing a reparability indicator for electronic products. Electr. Goes Green +, 1–9.
Fogg, B.J., 2009. A behavior model for persuasive design. In: Proc. 4th Int. Conf. Persuas. Technol, p. 40.
Fuad-Luke, A., 2002. 'slow Design' – a Paradigm Shift in Design Philosophy?. In: Design by Development Conference, Bangalore.
Grosse-Hering, B., Mason, J., Aliakseyeu, D., Bakker, C., Desmet, P., 2013. Slow design for meaningful interactions. In: Proc. sigchi Conf. Hum. Factors Comput. Syst. Paris. ACM, pp. 3431–3440.
Guest, G., Bunce, A., Johnson, L., 2006. How many interviews are enough? An experiment with data saturation and variability. Field Meth. 18 (1), 59–82.
Harjula, T., Rapoza, B., Knight, W.A., Boothroyd, G., 1996. Design for disassembly and the environment. CIRP Annal. Manuf. Technol. 45 (1), 109–114.
Hirschl, B., Konrad, W., Scholl, G., 2003. New concepts in product use for sustainable consumption. J. Clean. Prod. 11 (8), 873–881.
If it's broken, 2017. You Can't Fix it – Tinkering in the Digital Age, pp. 57–58. The Economist, September 30th 2017.
Lacy, P., Rutqvist, J., 2016. Waste to Wealth: the Circular Economy Advantage. Palgrave Macmillan, Basingstoke.
Mashhadi, A.R., Esmaeilian, B., Cade, W., Wiens, K., Behdad, S., 2016. Mining consumer experiences of repairing electronics: product design insights and business lessons learned. J. Clean. Prod. 137, 716–727.
Mugge, R., 2007. Product Attachment (Doctoral dissertation). Delft University of Technology, TU Delft.
Mugge, R., Schoormans, J.P.L., Schifferstein, H.N.J., 2005. Design strategies to postpone consumers' product replacement: the value of a strong person-product relationship. Des. J. 8 (2), 38–48.
Page, T., 2014. Product attachment and replacement: implications for sustainable design. Int. J. Sustain. Des. 2 (3), 265–282.
Piscicelli, L., Ludden, G., 2016. The potential of Design for Behaviour Change to foster the transition to a circular economy. In: Proc. of the Des. Res. Soc., Brighton, pp. 27–30.
Sabbaghi, M., Esmaeilian, B., Cade, W., Wiens, K., Behdad, S., 2016. Business outcomes of product repairability: a survey-based study of consumer repair experiences. Resour. Conserv. Recycl. 109, 114–122.
Take back control, 2017. Property in the Digital Age, p. 16. Economist, September 30th 2017.
Tukker, A., 2015. Product services for a resource-efficient and circular economy – a review. J. Clean. Prod. 92, 76–91.
Van Nes, N., Cramer, J., 2005. Influencing product lifetime through product design. Bus. Strateg. Environ. 14 (5), 286–299.
Vezzoli, C.A., Manzini, E., 2008. Design for Environmental Sustainability. Springer Science & Business Media, London.
Wiens, K., 2015. The right to repair [soapbox]. IEEE Consum. Electr. Mag. 4 (4), 123–135.