



Delft University of Technology

Let It Go

Designing the Divestment of Mobile Phones in a Circular Economy from a User Perspective

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Goodbye

Let It Go

Designing the Divestment of
Mobile Phones in a Circular Economy
from a User Perspective

Flora Poppelaars

Let It Go

Designing the Divestment of Mobile Phones in a Circular Economy from a User Perspective

Dissertation

for the purpose of obtaining the degree of doctor at Delft University of Technology
by the authority of the Rector Magnificus Prof.dr.ir. T.H.J.J. van der Hagen; Chair of the Board for Doctorates
to be defended publicly on Thursday 8, October 2020 at 12:30 o'clock

by

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Summary

The problem

The circular economy (CE) offers a promising approach for mitigating the negative impact of the production and consumption of electrical and electronic equipment (EEE) on the environment, the economy and human health. For a successful transition towards a CE, it is essential that products are returned at their end-of-use to be reused, refurbished, remanufactured and/or recycled. In other words, products should be looped back into the economy with a minimum loss of value and utility. However, in the case of mobile phones in the business-to-consumer (B2C) market, the transition is impeded by users who often store their devices in drawers after use or even throw them away. For instance, in the United Kingdom, more than half of replaced mobile phones were kept unused by their owners (Wilson et al., 2017), simply piling up after two to three years of average use (Manhart et al., 2016). These phones were kept twice as long in drawers than they were used in the first place (Wilson et al., 2017). In France, a total of 54 to 113 million phones are estimated to be left unused in their owners' homes (Rochat et al., 2019).

The main objective of this research

To ensure the minimum loss of value and utility, it is important that products come back into the system. From a company perspective, *collection* rates should be improved and the number of products kept by users should be reduced. From a user perspective, users should be stimulated to *return* their products timely in as good condition as possible. This dissertation focuses on closing the loop for mobile phones from a user perspective. The main objective of this research is to find potential solutions to increase the return of mobile phones after use so as to foster a transition towards a CE.

This research addresses two modes of consumption to achieve the return of mobile phones: (A) the contractual return at the end of the contract in access-based consumption, and (B) the voluntary return after use in ownership-based consumption. In access-based consumption, the user does not have legal ownership of the product and has to comply to the contract requirements of returning the device after use. In ownership-based consumption, the legal ownership of the product is transferred to the user, who then can control its destiny.

Research design

This research is guided by the research paradigm of constructivism, abductive reasoning, and qualitative methods. As social change starts with the individual, the individual user was stipulated as agent to approach the envisioned user behaviour change (versus a collective level or other stakeholders). The Consumer Decision Process (CDP) model by Blackwell et al. (2006) was selected as the basis of the conceptual model for this research to structure the concepts, relationships and actors deemed relevant to achieving the objective. The new conceptual model builds on this CDP model and provides further detail based on literature and empirical studies to answer research question RQ1.

RQ1: What conceptual model could be used to understand the interaction between users, mobile phones and providers for both (A) the acceptance of access-based consumption and (B) the return of phones in ownership-based consumption?

RQ2: What design interventions could enable users to accept accessing mobile phones instead of owning them?

RQ3: What design interventions could influence users to divest their mobile phones and voluntarily return them?

The first part of this dissertation concentrates on the acceptance of access-based consumption. It answers RQ2 through systematic literature reviews and in-depth semi-structured interviews.

The second part relates to the voluntary return of devices in ownership-based consumption. This part answers RQ3 through literature reviews and takes a Research through Design (RtD) approach to generate new divestment knowledge for design practitioners and researchers.

Main findings: The contractual return at the end of the contract in access-based consumption

From a CE perspective, access-based consumption seems to be an interesting avenue to explore. In this consumption mode, the legal ownership of a product remains in the hands of the service provider, who sells the right of use of a physical product for a limited period of time (e.g., through lease or pay-per-use). By retaining the control over their products in this manner, companies could ensure closed loops and secure a steady stream of used products to be reused, remanufactured, refurbished and/or recycled. Nevertheless, the acceptance of access-based consumption is limited as ownership-based consumption remains the dominant mode of consumption.

To address the lack of acceptance, factors influencing the rejection of access

services for mobile phones were explored based on interviews with adopters and non-adopters. These findings were then compared to those from car access services to identify areas for improvement. During the adoption phase (i.e., up to the purchase of the service based on expectations), the factors leading to the rejection

RQ2

of smartphone access services were the unawareness and unfamiliarity with these unusual services, the perceived poor image of the service provider, the unsatisfactory compensation for the sacrifice of owning, sustainability concerns, and the innate habit of owning things. During the acceptance phase (i.e., after the purchase of the service based on actual experiences of the services), factors such as the misunderstanding of the access service, the perceived stranglehold of the service provider and the perceived subpar service by the service provider hindered acceptance.

A social and business logic shift is required to transition from the industrial exchange logic of value creation where manufacturers create value and their customers destroy it during consumption, to a new logic of co-creation where all stakeholders contribute to value creation. The car access service interviews demonstrated the need for service providers to prompt trust by lowering expected risks and uncertainties, to take over risks and issues of ownership with an all-inclusive service, and to leverage users' gut feeling (vs rational decision-making). Based on these insights, design interventions prompting the adoption and acceptance of access services for smartphones would include clear and homogeneous communication to avoid misunderstandings and negative repercussions during the use and divestment phases. By taking over the issues specific to ownership while retaining its enjoyment, a desirable experience could be created for users. Special attention should be paid to developing a carefree repair process.

Main findings: The voluntary return after their use in ownership-based consumption through divestment

Even though access-based consumption is emerging in the B2C market, owning a product is still the dominant form of consumption. In ownership-based consumption, users are not contractually obliged to return their mobile phone after use. The product is theirs and they have the legal right to do whatever they please with it. As illustrated above, the return rates of mobile phones are relatively low despite the range of return options (e.g. municipal waste collection sites, trade-in programmes or donations to charity).

The exploration of how to stimulate the return of these products after use started by reviewing the literature to create a better understanding of the concept of divestment for design researchers and practitioners. The term 'divestment' refers

to the final phase of the consumption cycle after the purchase and the use phases. Divestment is the combination of the disposition process, during which the user physically separates from the product, and the detachment process, during which the user mentally and emotionally separates from the product. Despite its importance for a CE, divestment receives little attention in comparison to the purchase and use phases. To remedy this imbalance, the divestment phase was structured in six distinct stages. (1) Dilemma recognition occurs when the user considers whether to keep the product in the current use cycle or to end its use cycle. (2) The user starts to search for divestment options (i.e., a way to separate from the product). (3) These divestment options are evaluated and the user selects one to pursue. (4) The product and user are prepared for divestment. (5) The user acts on their divestment intention by performing the final act of disposition, physically severing with the product through the chosen divestment option. (6) The user is left with the divestment outcomes of the action taken in the past stages.

Numerous factors influencing the stages of divestment were gathered from the literature. Several parallels could be drawn with previous findings on the acceptance of access services. For instance, users are also unaware of and unfamiliar with mobile phone-specific divestment options such as trade-in schemes. Users are uncertain as to what to do with their unused devices and what happens to their products (and data) when returned. Moreover, users are not stimulated enough by the compensation offered in exchange for the product (e.g., a discount or the feeling of doing a good deed). The perceived effort to return the devices through the return options does not contribute positively to return rates. Finally, here again, users seem stuck in a habit; they are in the habit of passively going through the decision process of divestment which leads to the lion's share of mobile phones ending up in drawers.

To address the lack of design literature on the topic of divestment from a user perspective, a Research through Design (RtD) approach was adopted through seven design projects with design professionals and students on the design of a divestment experience for smartphones. The empirical studies focused on what factors were considered during the creation of design interventions, as well as on what design insights and design principles could be derived from them. Several patterns emerged from the literature and empirical studies. These design insights were summarized in a proposal of ten 'design for divestment' principles to help design practitioners and researchers create solutions for a more valuable and valued divestment experience. The design principles are visualised in Figure S1.

RQ3



Figure S1. Proposal for Design for Divestment principles in the case of mobile phones

Contributions to science and practice

To find potential solutions to increase the return of mobile phones after use, this research has brought behavioural science and design research together by emphasizing the user perspective in Design for Circular Economy and integrating divestment knowledge into design research.

Throughout the research process, the conceptual model was enriched based on the insights from the literature and empirical studies. This is presented in Figure S2. The resulting conceptual model fittingly conceptualizes user behaviour regarding the return of mobile phones. As the decision process itself is not linear, the process model is iterative and represents the situation once it has occurred.

RQ1

To improve the acceptance of access-based consumption, access services for mobile phones were explored from a user perspective through an in-depth field study. It contributed to the body of work on access-based consumption for smartphones by identifying influencing factors and design interventions to improve their acceptance. As this mode of consumption is still in its infancy, these findings support practitioners in the development of access services.

To increase the return rates in ownership-based consumption, the lack of attention for the last phase of the consumption cycle – namely, divestment – was addressed. The new research field of design for divestment was explored using the still formalizing approach of Research through Design (RtD). The research contributed scientifically by providing a better understanding of divestment by studying the case of mobile phone return after use. It defined the concept of divestment in design, structured the phase in six stages, provided design insights from design projects on smartphone divestment experiences, and drafted design

for divestment principles. In addition to the scientific contributions, this new design for divestment knowledge shows practitioners how the user perspective could be considered (as opposed to solely focusing on the technological and business aspects) to improve the return rates of products.

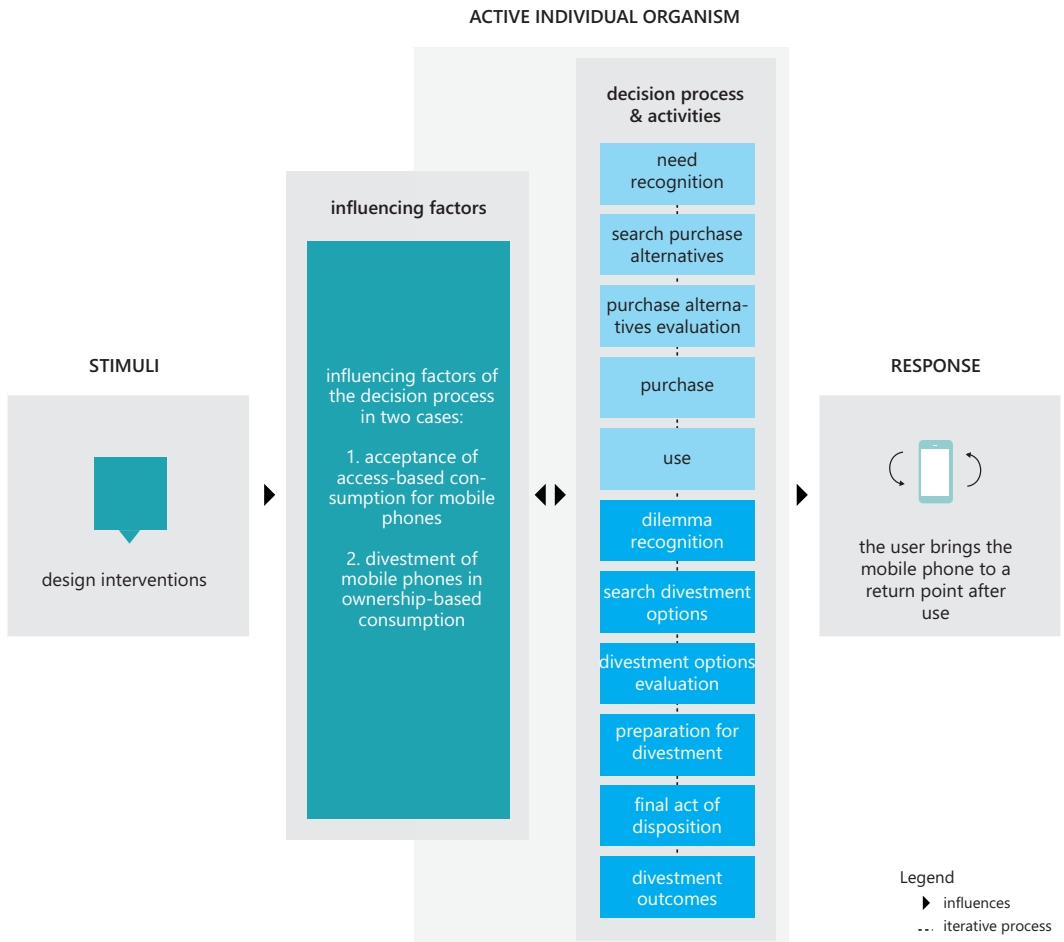


Figure S2. Conceptual model used for this research (based on the CDP model by Blackwell et al., 2006)

CHAPTER 1

Introduction

1. Introduction

1.1 Rationale for the research

1.1.1 The current linear economy and its problems

Since the Industrial Revolution, industrial systems have been designed to 'take-make-dispose' of products in a linear way. Companies extract materials to manufacture products; these are then sold to users before being ultimately discarded when their users¹ are finished with them (Frosch & Gallopoulos, 1989). In recent decades, the production and consumption of electrical and electronic equipment (EEE) in a linear economy has had a negative environmental, economic and human health impact (Baldé et al., 2017; PACE, 2019). Moreover, these effects are also unequally distributed geographically.

EEE is composed of up to 60 elements from the periodic table including hazardous (e.g. nickel) and scarce materials (e.g. rare earth metals) (Baldé et al., 2017). These materials have a great effect on life thanks to their energy-intensive extraction and inadequate end-of-life solutions. As EEE is the world's fastest-growing domestic waste stream (PACE, 2019), issues accompanying their use are expected to rise even further. For instance, with increasing material scarcity, critical raw materials vital to the core functions of mobile devices will become more expensive, have greater price volatility, and hinder competitiveness (Rabe et al., 2017).

This throughput of products is particularly relevant for mobile devices like the mobile phone in your pocket, the wearable on your wrist, and the laptop on your desk. This dissertation focuses on the case of mobile phones due to the tension between their negative and positive impacts on their users and society as a whole. The situation for mobile phones is exacerbated by their increasing numbers, their relatively short lifespans, and their loss-inducing disposal paths after use. Belkhir & Elmeligi calculated that 8.7 billion mobile phones will be in use by 2040 (Belkhir & Elmeligi, 2018). These phones will eventually form an equal amount of e-waste (i.e., waste from EEE, also called WEEE), piling up after two to three years of use on average (Manhart et al., 2016). Figure 1 visualises the flows of mobile phones after users in Switzerland are done with them.

¹ The term 'consumer' has been deliberately avoided throughout this dissertation as it holds the negative connotation that people "eat up" resources (e.g. (Coghlan, 2009)), and thus diminish products' utility and quality over time. The term 'user' is therefore preferred as it does not imply any devaluation. An exception will be made when referring to the concept of the business-to-consumer (B2C) market.

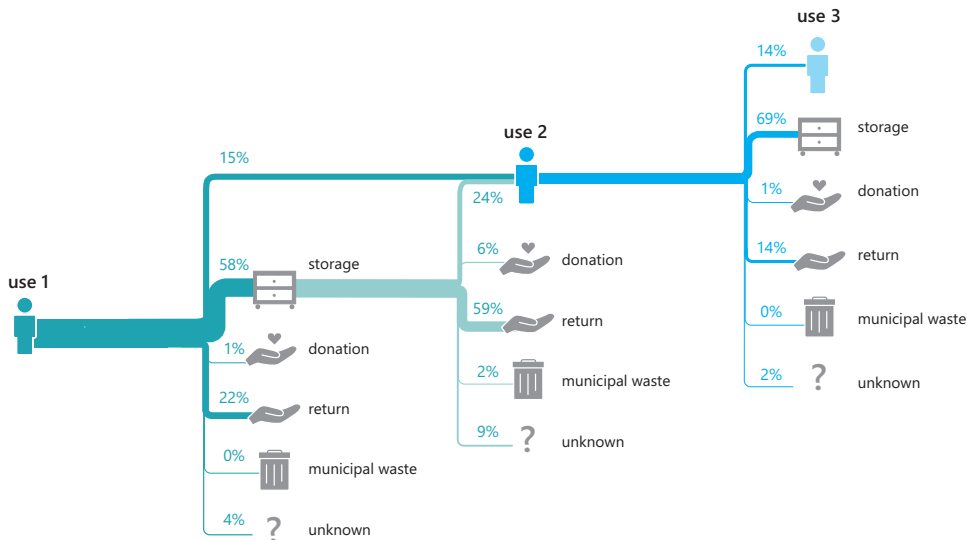


Figure 1. Estimated flows of mobile phones in Switzerland from a user perspective (based on data from Thiébaud et al. (2017))

The Swiss return² rate is considered one of the best in Europe (Rochat et al., 2019). Even there, the storage of phones after use represents an important issue, as 58% of phones are stored and 22% returned after their first use. According to a French market study, the stock of hibernating phones amounts to 54 - 113 million phones including two thirds still functioning (Rochat et al., 2019). This is approximately double the stock of phones actually in use by private users (Rochat et al., 2019). Data from the United Kingdom shows that on average, hibernating³ phones are kept twice as long in drawers than they were used in the first place (Wilson et al., 2017). During this hibernation, the various types of value of the product decrease over time (Wilson et al., 2017). For further commercial reuse of the mobile phones, it is essential that the time between the users is as short as possible: a three-year old smartphone is worth more than a nine-year old one.

Moreover, some mobile phones enter household waste streams. Although 0% of phones are thrown into the municipal waste in Switzerland immediately after first use, 2% of the 58% stored phones will end up there. In 2018 in France, this amounted to 200,000 - 400,000 mobile phones (Rochat et al., 2019). A Dutch market study showed that in 2017, of the various possible paths for the device, defective

² The term 'return' is used when referring to the user perspective of bringing a product to a collection point.

³ The term 'hibernation' is used as a synonym of 'storage', for example by (Wilson et al., 2017)

mobile phones were thrown in household waste in 12% of the cases (Witte & van Grinsven, 2017). Still functioning mobile phones were thrown in household waste in 2% of the cases in 2017 (Witte & van Grinsven, 2017).

1.1.2 Circular economy as an alternative

To counter these negative impacts on the environment, economy and human health, Circular Economy (CE) proposes a different production and consumption⁴ model. It entails an economy “that is restorative by design, and which aims to keep products, components and materials at their highest utility and value, at all times” (Webster, 2015). As presented in Figure 2, products made from technical nutrients can be maintained, reused, redistributed, refurbished, remanufactured, and recycled to avoid the input of newly mined raw materials and leakages of materials and energy throughout the production and consumption system.

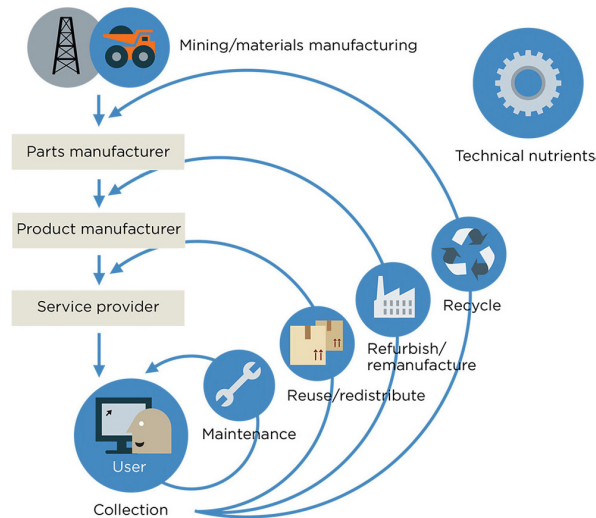


Figure 2. Technical side of the Butterfly model developed by the Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2013a)

In this context, the stock of unused mobile phones constitutes exploitable secondary materials (Ongondo et al., 2015). The term ‘urban mining’ refers to “the

⁴ To avoid confusions, note that the term ‘consumption’ refers to the greater concept of the combination of (1) purchasing, (2) using and (3) divesting products and services. Although it holds the same connotation of eating resources as the term ‘consumer’ does, the choice was made to keep this denomination. The term ‘use’ is too closely related to the action of using a product or service, whereas ‘consumption’ is currently employed at a higher and more general level. The author invites readers to reflect on the use of the term ‘consumption’.

systematic reuse of anthropogenic materials from urban areas” (Brunner, 2011). Mobile phones are made up of more important concentrations of precious (e.g. gold and palladium on the printed circuit board) and critical metals (e.g. neodymium in the speakers) in contrast to other EEE product categories (Cucchiella et al., 2015; Manhart et al., 2016). Because of their material content and financial value in product form, mobile phones are an especially valuable WEEE stream (Cucchiella et al., 2015). Leveraging these urban mines will lessen the problems linked to the production and consumption of these products while providing jobs and economic growth (PACE, 2019). For instance, the production of recycled metals is 2-10 times more energy-efficient compared to virgin material (PACE, 2019).

To harness the potential of these urban mines, the flow of products and materials needs to be collected to be diverted into productive use. This flow is also referred to as ‘closing the loop’ (Lifset, 2002). As illustrated in Figure 2, the collection⁵ of products is a prerequisite for the proper circular processing of resources. Securing the flow of mobile phones fosters the control of the quality, volume and timing necessary for circular processing (Fleischmann et al., 1997). Thus, eliminating hibernation and stimulating systematic return⁶ is essential to maximize the utility and value of the embedded resources in mobile phones.

1.1.3 Potential solutions for the return of mobile phones

To close the loop for mobile phones in a business-to-consumer (B2C) market, the systematic collection of mobile phones will only occur if users have the means to return their products and if they accept the need to participate and act on their decision. Two ways to achieve this transition are (a) contractual return at the end of the contract in access-based consumption, and (b) voluntary return after their use in ownership-based consumption.

Users “are the most important, dynamic and illusive element” of collection (Casey et al., 2019). Ultimately, the user has the power to either close the product loop or not. At the start of the consumption cycle, they choose whether or not to close a contractual relationship with a service provider to access a phone and to compulsorily hand-in their device when the contract ends. And, at the end of the use cycle in ownership-based consumption, they hand in their device to a company or, for instance, put it away in a drawer making it hibernate.

⁵ In this dissertation, the term ‘collection’ is employed when referring to a company perspective of getting a product back to them.

⁶ The term ‘return’ is used when referring to the user perspective of bringing a product to a collection point.

Contractual return at the end of the contract in access-based consumption

An original way of closing the loop would be to focus on the start of the consumption process. From a CE perspective, access-based consumption is an interesting avenue to explore (Ellen MacArthur Foundation, 2013b; Stahel, 2010). Access-based consumption is defined as “transactions that may be market mediated in which no transfer of ownership takes place” (Bardhi & Eckhardt, 2012, p. 881). Access-based consumption (as a whole but also in parts) is referred to in various ways, including use-oriented models (Tukker, 2004), access models (Bakker et al., 2014), and product-as-a-service (Lacy et al., 2014). Users pay for the right to use the device over an agreed period of time and are legally obliged to return it at the end of the contract. As the return of products is contractual, this means that a high return rate (up to 100%) of products can be achieved at contract end or as required by the service providers.

Although logically advantageous for the environment, the spread of access services for mobile phones and their acceptance is limited. To illustrate, smartphones can be accessed through, for instance, private lease or hybrid services via the telecom provider (e.g. Sprint and T-mobile), manufacturers (e.g. Samsung and Apple) or other parties (e.g. Swapphone and Go Lemon). At the start of the 2010s, a leading Dutch telecom provider attempted to durably seize this market with a lease programme, but this was quickly discontinued. The order of magnitude of this emerging market remains low, with an assumed market penetration of below 5% of the more than 15.8 million Dutch smartphone users in 2019 (Centraal Bureau Statistiek, 2019; personal communication, 10th of February 2020).

Voluntary return after use in ownership-based consumption

The return of a device in ownership-based consumption is the result of a voluntary action from users after use. In ownership-based consumption, once the device has been purchased by the user⁷, its ownership is transferred from provider to user, and its path from then on solely depends on the deliberate decision made by its user. After use, the user can choose to give their device to another user or organisation, sell it, bring it to return programmes, dispose of it in the garbage, or keep it (Glover, 2012); see Appendix A for an overview of options.

Unfortunately, despite efforts from Original Equipment Manufacturers (OEMs),

⁷ In this dissertation, the ‘user’ is the term used for the person who purchases the product, uses it and dispenses with it.

retailers, carriers, non-profit organisations, and governments, current return rates remain low. In Switzerland, benchmarked as one of the most successful return systems worldwide (Rochat et al., 2019), 22% of mobile phones are returned after their first use (Thiébaud et al., 2017).

1.2 Research gaps, Objective, Research questions and Scope

1.2.1 Research gaps

In the field of CE, social innovation is underexposed even though it is inseparable from technical innovation (Çelik, 2018). Heiskala defines social innovations as “changes in the cultural, normative or regulative structures of the society which enhance its collective power resources and improve its economic and social performance.” (Heiskala, 2004, p. 74). Organizations can design products and services to circulate in a regenerative CE, however they will only be a durable success if users are willing to actually use these solutions. This is emphasized by the low diffusion of recent circular initiatives with mobile phones, “enabling systemic change through innovation can only happen through societal acceptance” (Çelik, 2018). Accordingly, being an interface between users and consumption, design may play an important role in sparking a societal shift towards circular consumption (Moreno-Beguerisse, 2013).

Although the success of a circular transition depends on user behaviour (Piscicelli & Ludden, 2016), their position in a CE is underexplored (Kirchherr et al., 2017; Selvfors et al., 2019; Wastling et al., 2018). To understand how behavioural change (i.e., from the current behaviour of users who do not return devices, to the desired behaviour of users returning them after use) can be fostered, user behaviour needs to be better understood. Why do users not yet accept access-based consumption on a large scale in the case of mobile phones? Behaviour research currently focuses on the purchase and use phases of the consumption process (Saunders, 2010). However, what occurs after the use phase? And, why are users currently neglecting return solutions when separating from their mobile phones?

Knowledge is lacking of how design can influence users to return their mobile phones. Circular user engagement is, however, one of the core competencies required for designers to successfully create circular products and services (Sumter et al., 2020). Little research has been conducted on the possible design interventions to enhance the acceptance of access-based consumption for mobile phones (Annarelli et al., 2016; Wallaschkowski et al., 2016). When it comes to improving the return rates of phones in ownership-based consumption, more understanding is required of the divestment phase (Glover, 2012; Hanson, 1980; Jacoby et al., 1977; Lastovicka & Fernandez, 2005; Roster, 2001; Selvfors et al., 2019). The term ‘divestment’ is the

last phase of the consumption process during which users go through the physical process and emotional/mental process of separation from their product.

1.2.2 Objective of the research and research questions

The main objective of this research is to find potential solutions to increase the return of mobile phones after use so as to foster a transition towards a CE.

In this dissertation, the stimulation of the return of mobile phones is studied in two distinct ways. Firstly, by enhancing the acceptance of access-based consumption for mobile phones and secondly, by encouraging users to return their devices when dispensing with their product in ownership-based consumption.

First, to bridge the current research gaps, the identified problems need to be made researchable. For this purpose, a conceptual model needs to be developed to represent both types of consumption (i.e., access-based and ownership-based) as well as their distinct issues. This raises the following question:

Research Question 1 (RQ1)

What conceptual model could be used to understand the interaction between users, mobile phones and providers for both (A) the acceptance of access-based consumption and (B) the return of phones in ownership-based consumption?

A conceptual model is a simplified representation of the phenomenon studied in order to create understanding of the relations between concepts and actors grounded in existing scientific knowledge.

The interaction between the users, mobile phones, and providers (e.g. OEMs, service providers, retailers, and carriers) is central to consumption and therefore at the core of understanding behaviour (change).

In access-based consumption, the legal ownership of a product remains in the hands of the service provider, who sells the right of use of a physical product for a limited period of time (Malone et al., 2006) (e.g., through lease or pay-per-use).

Once a conceptual model has been created, the research directions can be more clearly defined. To achieve this dissertation's main objective, knowledge needs to be generated on how design can influence user behaviour. This leads to the

second research question about how to influence behaviour change in access-based consumption:

Research Question 2 (RQ2)

What design interventions could enable users to accept accessing mobile phones instead of owning them?

In other words, how can users say goodbye to product ownership?

The term 'design interventions' refers to actions that influence user behaviour through the (re)design of product and service solutions. 'Accessing' refers to access-based consumption defined in RQ1.

The third and final research question asks for an answer about how to influence behaviour change in ownership-based consumption :

Research Question 3 (RQ3)

What design interventions could influence users to divest their mobile phones and voluntarily return them?

In other words, how can users say goodbye to their products? In RQ3, it is assumed that the users legally own their mobile phones. The term 'design interventions' is defined in RQ2. 'Divest' is derived from the noun 'divestment' and refers to users physically, emotionally and mentally separating from their product.

1.2.3 Scope

The primary lens of this research is design. Herbert Simon formulated the broadly accepted definition of design: "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones." (Simon, 1988). Industrial design engineers are especially educated and trained to deal with the complexity of current societal challenges (van Boeijen & Daalhuizen, 2010). Design thinking combines technological, business, and people aspects to create feasible, viable and desirable solutions. As illustrated in Figure 3, the focus of this dissertation is the user perspective, while still considering the technical and business concerns. Design is considered within the confines of an industrial production and consumption system for professional design practitioners and researchers. More

specifically, the design interventions developed in this dissertation concentrate on the design of products and services combining tangible and intangible aspects.

Within a CE, this research focuses on closing the loop of mobile phones from a user perspective. The assumption is made that the return of a product at an official return point will result in its proper circular processing. Both the hardware and software aspects of mobile phones are taken into account, although the emphasis is on the material resources that need to be processed. Their packaging and accessories are out of this research's scope. It is also known that these technologies will further develop in the future (e.g. Blockchain or multipurpose public surfaces instead of individual screens). Thus the results of this research are based on the current shape of these products, however as the leverage points are not at a material level but rather on the interaction with users, it is expected that these findings will provide valuable input for future technological developments.

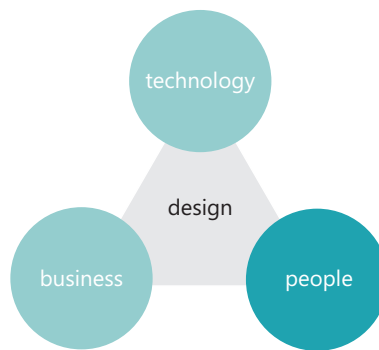


Figure 3. The focus of this research in the context of design thinking

This research is limited to the B2C market of mobile phones where the provider directly interacts with the user. It does not include the business-to-business (B2B) market. Nor does it include peer-to-peer solutions, consumer-to-business-to-consumer solutions, or Product Service Systems (PSS) where no financial exchange occurs.

1.3 Dissertation Outline

The dissertation is structured as visualised in Figure 4.

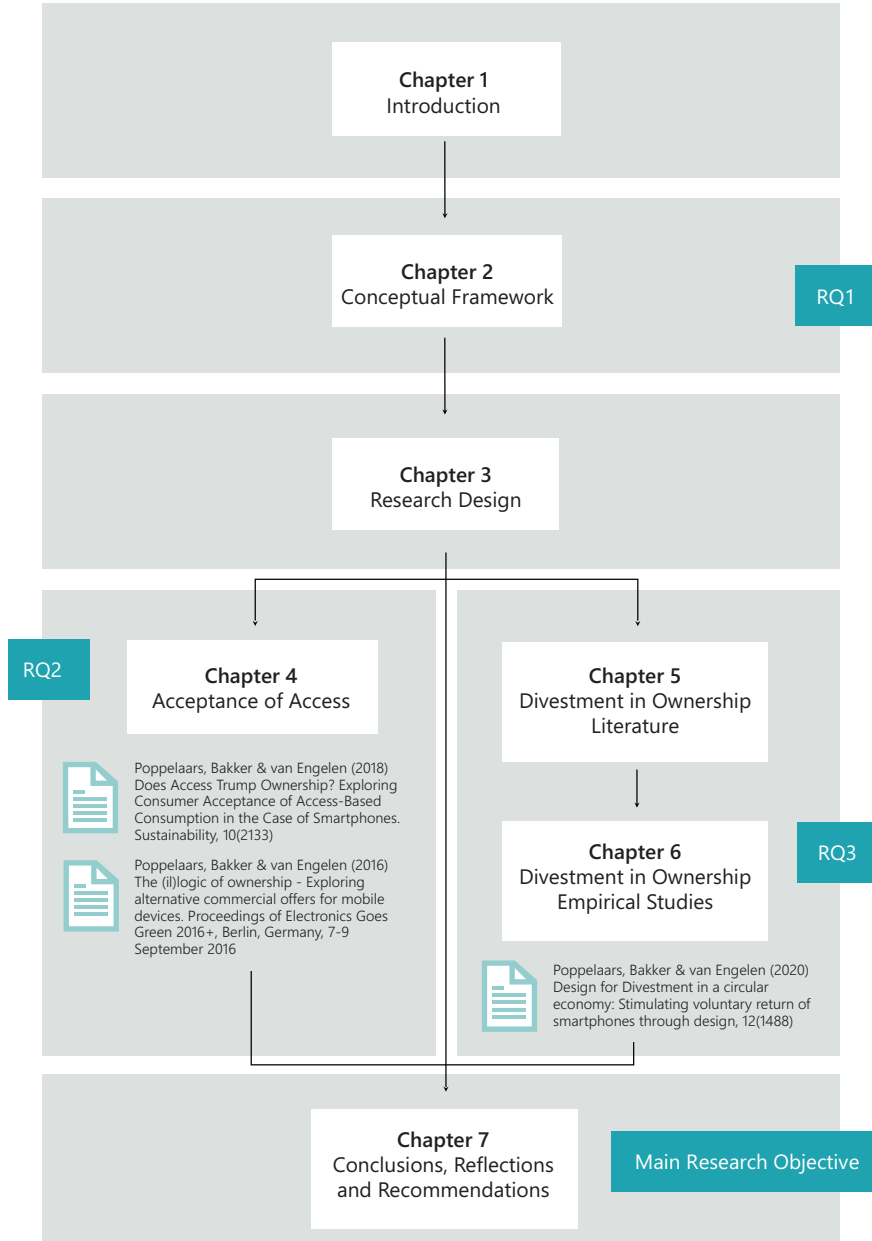


Figure 4. Dissertation outline

Chapter 1 introduced the social problem of the lack of users returning mobile phones after use and presented the potential of return solutions. It closed with the research questions and the scope of this research.

Chapter 2 frames the research, looks at the scope of this social problem, and provides a conceptual model for the research. By scoping the problem, identifying gaps and how to fill these, the social problem becomes researchable. Chapter 2 thus answers RQ1.

Chapter 3 gives readers a glimpse of the mind of the author of this dissertation regarding the research design (i.e., research paradigm, type of reasoning and research, and methodological choices).

Chapter 4 explores reasons for why users have rejected the access-based consumption of smartphones. By conducting a literature review and a series of interviews, it answers RQ2. The chapter includes two published papers.

Chapters 5 and 6 both study the last phase of the consumption process in ownership based consumption (i.e., divestment) in detail. Chapter 5 reviews the available literature on divestment, and Chapter 6 fills in discovered knowledge gaps by conducting empirical studies. It also includes a published paper. These two chapters formulate an answer to RQ3.

Chapter 7 brings the previous three chapters together by discussing the implications and limitations of the conceptual and empirical findings. It also concludes the dissertation by presenting answers to the research questions, evaluating their validity, providing the scientific and social contributions, and provides recommendations for further research.

CHAPTER 2

Conceptual Framework

2. Conceptual Framework

2.1 Introduction

Link to previous chapter

As introduced in the previous chapter, the objective of this research is to find solutions to increase the return of mobile phones after their use to foster a transition towards a CE. Current return rates should be improved and hibernating stocks should be reduced.

Objective of this chapter

The objective of this second chapter is to make the main objective of this dissertation researchable by creating a conceptual model that will be used to understand the interaction between users, mobile phones and providers for both the acceptance of access-based consumption and the divestment of devices in ownership-based consumption. Based on existing scientific knowledge, a simplified representation of the studied phenomenon is defined to create understanding of the relationships between concepts and actors.

The first step to make the main objective researchable is to identify how to approach the required behaviour change illustrated below.

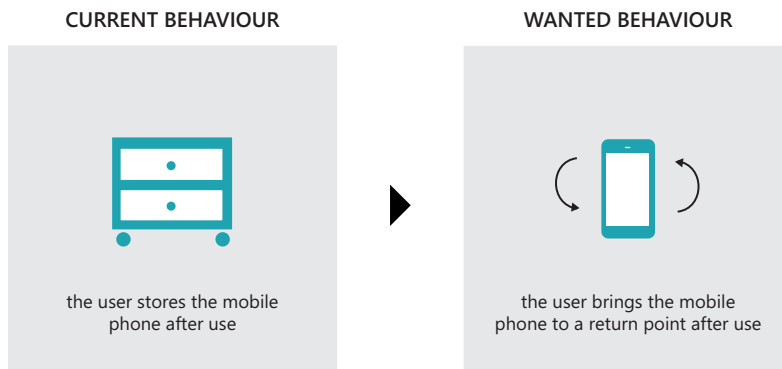


Figure 5. Behaviour change required to transition to the return of mobile phones

Behavioural research is “the study of processes involved when individuals or

groups select, purchase, use or dispose of products, services, ideas or experiences to satisfy needs and desires.” (Solomon et al., 2006, p.6). These processes include visible physical activities as well as invisible mental and emotional activities (Wilkie, 1994).

The way to approach user behaviour is a point of discussion in social sciences. What needs to be addressed first to stimulate societal change? Is it the individual's decisions that start societal change or does a collective need to change influence individuals to change?

As design research and practice are experienced with user-centred design, designers are familiar approaching individual behaviour change. Therefore, the starting point of this research is to stimulate behaviour change at an individual level, thus putting the decision process of the individual central to this dissertation.

The interplay between collectives and individuals is acknowledged as the spread of this changed behaviour through social networks will occur by activating other individuals. The dissemination is however out of the scope of this research, as this dissertation focuses on the basis element of individual behaviour.

Outline of this chapter

In section 2.2, a review of theories and models approaching behaviour at an individual level is made. The scope of the review is clarified (2.2.1), five theories and models are explained (2.2.2 – 2.2.6) and their suitability for this research is evaluated (2.2.7). In section 2.3, although out of scope, a short reflection is done on the alternative approach of studying behaviour at a collective level. Here, practice theories (2.3.1) and complexity theory (2.3.2) are described, and their suitability for this research is discussed (2.3.3). Then, in section 2.4, the choice of the Consumer Decision Process model as the foundation of the conceptual model is argued in detail. Finally, in section 2.5, the conceptual model developed and its implications for the research is discussed.

2.2 Approaching behaviour at an individual level

In this section, the scope of the review of theories and models enabling the analysis of behaviour is first defined. An overview of relevant theories and models is then provided. Finally, the most appropriate theory or model is selected as a starting point for the conceptual model of this research.

2.2.1 Scope of the literature review of theories and models of behaviour

Sources studied

Disciplines from Social Sciences other than design offer much knowledge on the processes and interactions involved in human behaviour. In order to get a better overview of the available knowledge, this literature review was performed with Scopus using the search string {theories OR models AND review AND "consumer behaviour"} in the subject areas of Business, Management and Accounting; Social Sciences; Economics, Econometrics and Finance; Psychology; and, Decision Sciences. It included literature up to 2015. The reviewing process is illustrated below. The output sought for were publications providing reviews of theories and models of consumer behaviour.

Through a process of snowballing, 2 additional publications were found. The consultation of existing reviews resulted in more than 150 different theories and models conceptualising consumer behaviour (available in Appendix B).

Selection criteria

The selection criteria of the theories and models of behaviour are stipulated as followed.

- As mentioned in section 2.1, the assumption is made that the seed of the envisioned behaviour change is with the individual (Boudon, 1996). Individuals must change their behaviour in order to transition towards a CE. Therefore, this research considers the individual human as the elementary unit to study the interaction between users, products and providers (Elster, 1989; Scott, 2000). The selected set of theories and models thus **solely considers behaviour at an individual level**.
- The selected theories and models need to **fit this research scientifically**. The

theories and models have to attend to the research objective and research questions. They should provide a basis to set up theoretical and empirical studies within the resources available to the researcher (e.g. time and scale of intervention). The concepts and relationships mentioned by the theories and models should support the understanding of user behaviour and how it is influenced. Also, they should be applicable to both the acceptance of access-based consumption and the divestment of devices in ownership-based consumption. Toolkits are considered out of scope, but the theory they are based on is in scope.

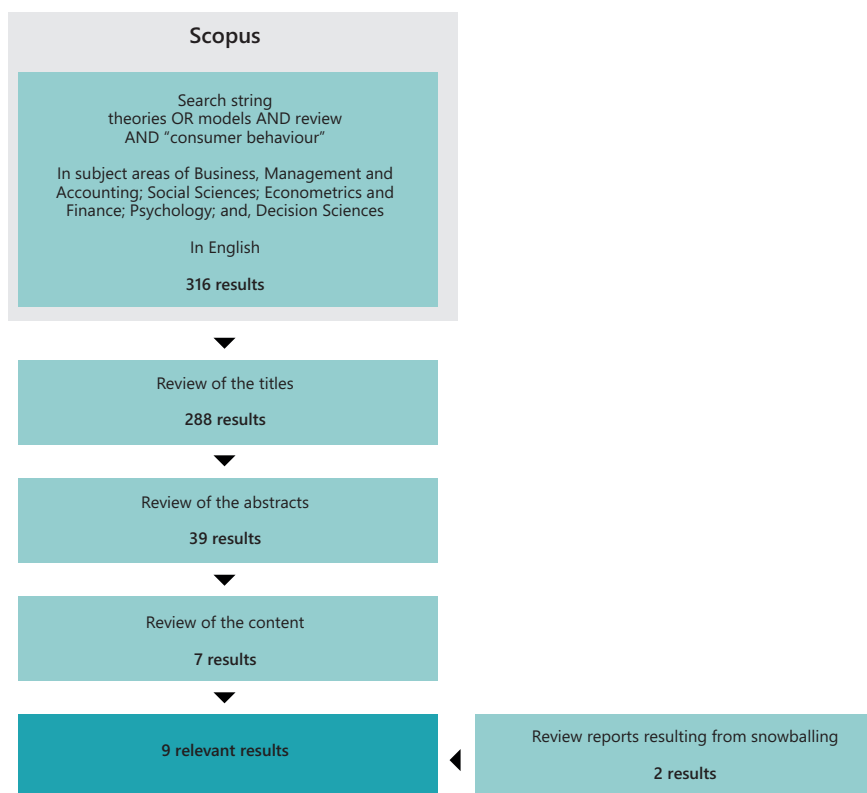


Figure 6. Flow diagram of the systematic reviewing process of overviews of theories and models of consumer behaviour

- The theories and models selected should have **shown impact in behaviour literature and in practice**. This impact is measured by their frequent application in textbooks, organizations' strategies and scientific publications.
- Being the target audience of the results of this research, designers have

to be **familiar** with the language and concepts used. The language and concepts should connect to the world of design practitioners and researchers so that designers are able to easily understand the theories and models conceptually and recognize them in real life. As a result, these theories and models should be feasible to operationalize scientifically on a short term.

- The theories and models selected should have **concrete indications of how design can intervene** in stimulating a behaviour change. Process-based models (such as ones providing a model of decision processes) are preferred as they enable “to grasp visually what happens as variables and circumstances change” (Erasmus et al., 2001, p.83).
- Despite the previous stipulations, a certain level of the **arbitrary nature of the selection** of the theories and models is acknowledged by the inquirer. However, for this exploration, the author and her supervisory team believe that the set is relevant and contributing to the validity of the dissertation’s empirical findings.

Selected theories and models

The selection criteria guided the selection of a set of theories and models to take into consideration. The set considered includes Rational Choice Theory, the Consumer Decision Process model, the Reasoned Action Model, Norm Activation Theory and the Theory of Buyer Behaviour model.

The economic take of Rational Choice Theory on user behaviour has later been complemented with findings from other social sciences (Darnton, 2008). The following two models described (i.e., Consumer Decision Process model and Theory of Reasoned Action) draw on Rational Choice Theory but attempt to correct its limitations. Two other models considered in this overview have different starting points, as visualised in the figure below.

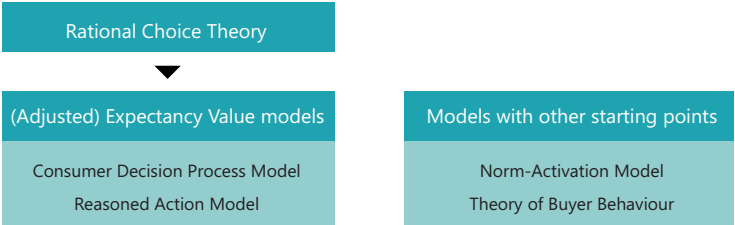


Figure 7. Overview of the theories and models considered in this section (based on the overviews of Jackson 2005 and Darnton 2008)

2.2.2 Rational Choice Theory

Description

According to Rational Choice Theory, also known as (Subjective) Expected Utility (Darnton, 2008), behaviour is the result of individual users acting rationally in order to maximize their utility through consumption (Jackson, 2005). Individuals therefore weight the prospective benefits against the costs of any action before executing it (J. Scott, 2000).

Rational Choice Theory emerged from economics in the 1950's, but was later also applied in sociology (i.e., in "exchange theory") (Darnton, 2008). Other models were developed based on Rational Choice Theory such as the Consumer Preference Theory or the Attribute (also named Lancaster) Model (Jackson, 2005).

The theory can be described by a series of axioms (Boudon, 2003):

- individualism: "any social phenomenon is the effect of individual decisions, actions, attitudes, etc." (Boudon, 2003, p.3);
- understanding of behaviour: "an action can be understood" (Boudon, 2003, p.3);
- rationality: "any action is caused by reasons in the mind of individuals" (Boudon, 2003, p.3);
- consequentialism: "these reasons derive from consideration by the actor of the consequences of his or her actions as he or she sees them" (Boudon, 2003, p.3);
- egoism: "actors are concerned mainly with the consequences to themselves of their own action" (Boudon, 2003, p.3);
- maximization: "actors are able to distinguish the costs and benefits of alternative lines of action and that they choose the line of action with the most favorable balance" (Boudon, 2003, p.4);

As a result, based on Rational Choice Theory, behaviour change can be achieved by developing a smart mix of incentives and disincentives. Indeed, users will choose for paths with rewards and avoid the ones with punishments (Homans, 1961).

Evaluation

On one hand, the use of Rational Choice Theory offers various advantages. The theory is well-known, which means that the language and concepts utilized are familiar to designers (Darnton 2005; Jackson 2005). The theory has often been employed by governmental organizations resulting in the adoption of solutions

stimulating the information of citizens and the provision of appropriate incentives (Darnton, 2008). The theory provides a simplified perspective of user behaviour by separating selected processes determining behaviour, which can be a beneficial foundation to further build complexity (Darnton 2008). Furthermore, Rational Choice Theory is applicable to the research as it assumes that behaviour involves planning ahead and that the purchase or divestment of a mobile phone happens to be a well-thought-through process for users (van Weelden et al., 2016). Also, Rational Choice Theory has also been applied to behaviours other than traditional purchase (Jackson, 2005), which would make it suitable to analyse access-based consumption as well as divestment.

On the other hand, this theory may be less suitable for this research for several reasons. The validity of the theory is questioned due to its simplification of reality. First, it neglects the influence of emotions, habits, heuristics (Darnton, 2008; Jackson, 2005), and social factors (Halpern et al., 2004; Jackson, 2005) on the decision process. Second, the linearity of the model can be questioned. Especially in the late 2010's (i.e., around 60 years after the emergence of the theory), the links between information processing and behaviour are not as causal anymore with the rapid spread of information from an increasing number of sources such as social media. Finally, the use of the model may be distorted as the evaluation of the expected outcomes by users is particularly difficult in the case of access-based consumption as the purchased PSS is not tangible. The solutions generated by the model (such as financial incentives) are often ineffective (Halpern et al., 2004) on the long term (i.e., the prospected behaviour change only happens as long as the incentive is provided to the user).

2.2.3 Consumer Decision Process model

Description

The Consumer Decision Process model, also known as the Engel-Kollat-Blackwell (EKB) or Engel-Blackwell-Miniard (EBM) model, is defined as “a roadmap of consumers’ minds” capturing “the activities that occur when decisions are made in a schematic format and shows how different internal and external forces interact to affect how consumers think, evaluate, and act” (Blackwell et al., 2006, p.70). The model was originally introduced in 1968, but evolved ever since. The most recent version, published in the 10th edition of Blackwell et al.’s *Consumer Behaviour* book, is visualised in Figure 8.

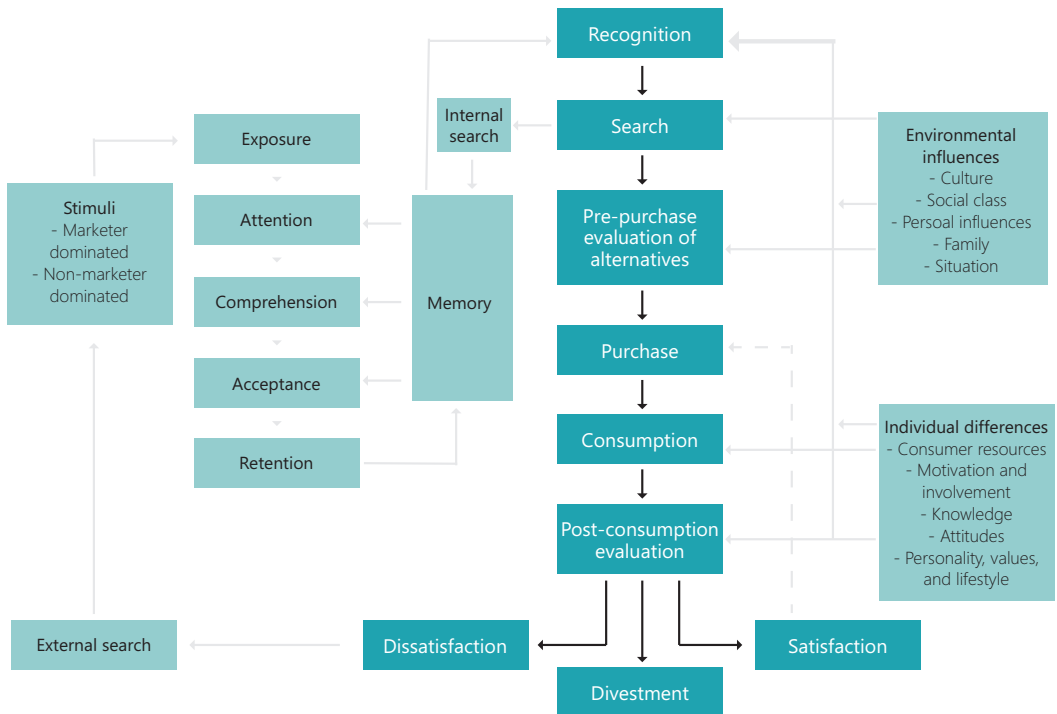


Figure 8. Consumer Decision Process model (Blackwell et al., 2006) [emphasis of the decision process by the author of this dissertation]

The Consumer Decision Process model is structured around the user's decision process. This process is composed of the stages of the consumption of products and services from need recognition to divestment. The decision process is influenced by environmental influences (i.e., the extent to which users' environment affects their decisions and behaviours) and individual differences (i.e., key characteristics of users). It is based on the user's information process (i.e., processing knowledge based on external and internal information), which is itself triggered by stimuli (i.e., marketer-dominated or non-marketer-dominated source of information or persuasion).

According to the model, behaviour can change if the right stimuli are designed to trigger the need recognition and be memorized to provide the information required for the search and eventually the purchase of the product or service.

Evaluation

The Consumer Decision Process model seems suitable as a foundation for this research. As an adjusted expectancy value model, the Consumer Decision Process

model attends to previous critique of the Rational Choice Theory by including external factors. The model is praised for its clarity (Bray, 2008), while offering an overview of the processes occurring before to the expression of a behaviour and the factors influencing these processes. It is also appreciated for its continuous evolution by for example including post-purchase stages of the decision process (Bray, 2008) or its feedback loops (Milner & Rosentreich, 2013). The inclusion of the full consumption process is beneficial for this research as it both enables to consider access-based consumption and divestment in the same model.

However, the Consumer Decision Process model has several limitations. Environmental and individual factors are shown to only influence the five first stages of the decision process although they also influence other stages and processes (Bray, 2008). Moreover, the predictive ability of this model is questioned as the variables are unobservable (i.e., behaviourist critique) (Bray, 2008). Also, as with Rational Choice Theory, it seemingly neglects emotions and mental shortcuts. Finally, despite the concept of divestment being mentioned in the decision process, it is not given the same level of attention as that of purchase, which may result in an imbalanced conceptual model.

2.2.4 Reasoned Action Model

Description

The Theory of Reasoned Action by Fishbein & Ajzen is a predictive model that conceptualises behaviour as the result of intention (Fishbein & Ajzen, 1980). It was developed to improve understanding of the relationships between attitude, intention and behaviour.

The model emerged in the discipline of psychology and was later expanded in the Theory of Planned Behaviour. The model has evolved over the past decades by adding predeterminants of the three determinants of intention with the latest version by Fishbein and Ajzen renamed 'Reasoned Action Model' in 2010.

According to the 1991 version of the model (highlighted in blue), behavioural intention (i.e., the extent to which people are willing to make an effort to carry out the behaviour results in a certain behaviour. This intention is influenced by the attitude toward the behaviour (i.e., assessment or judgement of the behaviour), perceived norm (i.e., the sensed social pressure to carry out the behaviour), and perceived behavioural control (i.e., the sensed degree of ease of carrying out the behaviour). The stronger these aspects, the higher the intention to perform a behaviour, and thus the higher the likeliness that the individual will act upon it

(Fishbein & Ajzen, 2010). The latter relationship is nevertheless moderated by the degree of actual control over the performance of this behaviour (Fishbein & Ajzen, 2010).

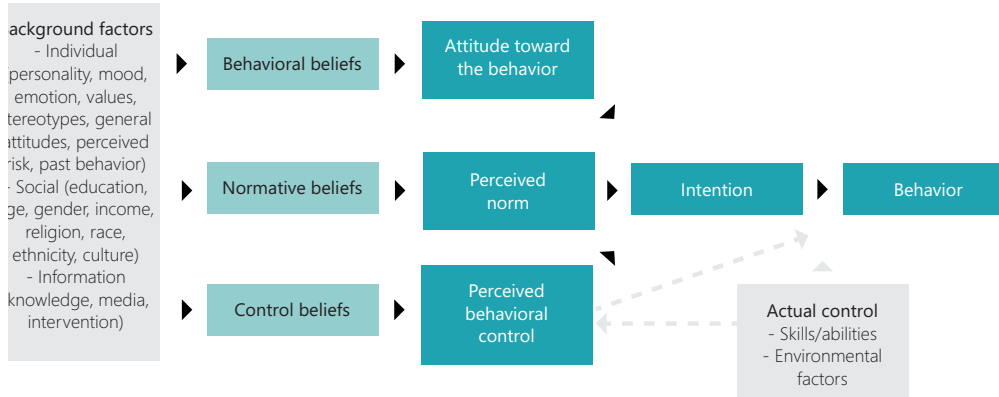


Figure 9. Reasoned Action model (Fishbein & Ajzen, 2010) (the components of the 1991 version are highlighted in blue)

Building up on the 1991 version, the latest version of the model states that behavioural beliefs (i.e., expectations of outcome), normative beliefs (i.e., sense of whether individual or social entities important to the person would approve of the behaviour or not) and control beliefs (i.e., sense of personal and environmental factors stimulating or inhibiting the performance of the behaviour) respectively influence the previous determinants of intention. All three types of beliefs are themselves influenced by a variety of background factors related to the individual, society and information.

Ajzen explains that researchers can better understand how to change behaviour by exploring behavioural, normative and control beliefs, and as a result identifying the determinants to shift the intention (Ajzen, 2012). When implementing the intervention, a focus should be put on ‘control issues’ by identifying which factors could make users act upon the intention to express the desired behaviour (Ajzen, 2012).

Evaluation

The Reasoned Action Model has multiple benefits for this research. It attended to several limitations of the Rational Choice Theory by correcting its neglect of social factors by including the concept of perceived norms (Darnton 2008), and background factors, and by implementing determinants of preference and attitude

(Jackson, 2005). The Reasoned Action Model and its predecessors are one of the most cited models of behaviour (Darnton, 2008). It is easy to understand (Bray, 2008; Jackson, 2005) and helps understanding why users accept a certain behaviour or not. It also fits a variety of scenarios (Bray, 2008; Jackson, 2005), which suggests that the model would be suitable for the use in the two cases studied in this research (i.e., both access purchase and divestment).

Nevertheless, the Reasoned Action Model still has been criticized. Most importantly, the predictive power of the model has been questioned, especially when it comes to acting on the intention (Sniehotta, Presseau and Araújo-Soares, 2014). The value-action gap is a shortcoming to consider, particularly when contemplating a transition towards a CE (as this gap is often observed in a pro-environmental context (Blake, 1999)). Indeed, there is a difference between what individuals say and/or think they find important (i.e., attitude, belief and norm), and what they actually do (i.e., behaviour). Furthermore, repeating shortcomings of the Rational Choice Theory, the model is said to disregard significant factors influencing behaviour such as habits (Darnton, 2008), emotions, spontaneity and cravings (Jackson, 2005). Also, the full meaning of used concepts like attitudes and beliefs as conceptualized in psychology and sociology may be less familiar to designers.

2.2.5 Norm Activation Model

Description

The Norm Activation Model (Schwartz, 1977) was originally developed as a framework to understand altruistic behaviour (Jackson, 2005). In contrary to the previous models, it is not anchored in Rational Choice Theory and is meant to explain how personal norms are developed resulting in a specific altruistic behaviour.

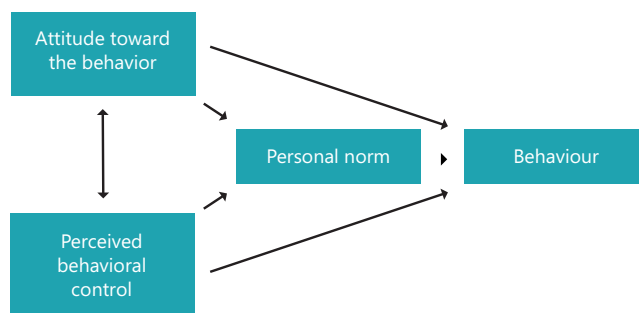


Figure 10. Norm Activation Model (Schwartz, 1977)

According to the model, personal norms (i.e., sense of moral obligation) guide behaviour. Both components are influenced by the awareness of consequences of a certain action (i.e., extent to which one is conscious of the repercussions of performing the behaviour) combined with the ascription of responsibility of these consequences (i.e., sense of accountability for the repercussion (de Groot & Steg, 2009)). The chance of a personal norm activating into behaviour is higher when the individuals are aware of the consequences of their actions and accepts the responsibilities (Jackson, 2005).

In order to change user behaviour, users should thus be made aware of the consequences of their (non-)actions and responsibility, and encouraged to accept it.

Evaluation

The Norm Activation Model could suit this research for multiple reasons. For one, the social issue researched in this dissertation fits the altruistic background of this framework (Jackson, 2005; de Groot & Steg, 2009). Second, as the Norm Activation Model contains a small amount of building blocks, it is easy to comprehend. It also employs foremostly comprehensible terms for designers. Moreover, as it does not build on Rational Choice Theory, it does not include its shortcomings.

Two main critiques may disqualify the Norm Activation Model as a starting point of the conceptual model of this dissertation. First, with personal norm being at the centre of the model, the value-action gap can be considered an important limitation of the model. This gap is especially important in pro-environmental topics, where users have been known to express pro-environmental norms but did not act on them (Blake, 1999). Second, the model does not provide concrete leverage points to design change further than raising awareness of consequences and responsibilities.

2.2.6 Theory of Buyer Behaviour

Description

The Theory of Buyer Behaviour, also known as the Howard-Sheth model, conceptualises purchase behaviour by providing an overview of influences on purchase choice (Howard & Sheth, 1969) (Figure 11). It considers behaviour as limited by the incomplete information gained by users and by their capacities. The decision model is introduced by Howard & Sheth in 1969 and altered in 1973 (adding exogenous variables).

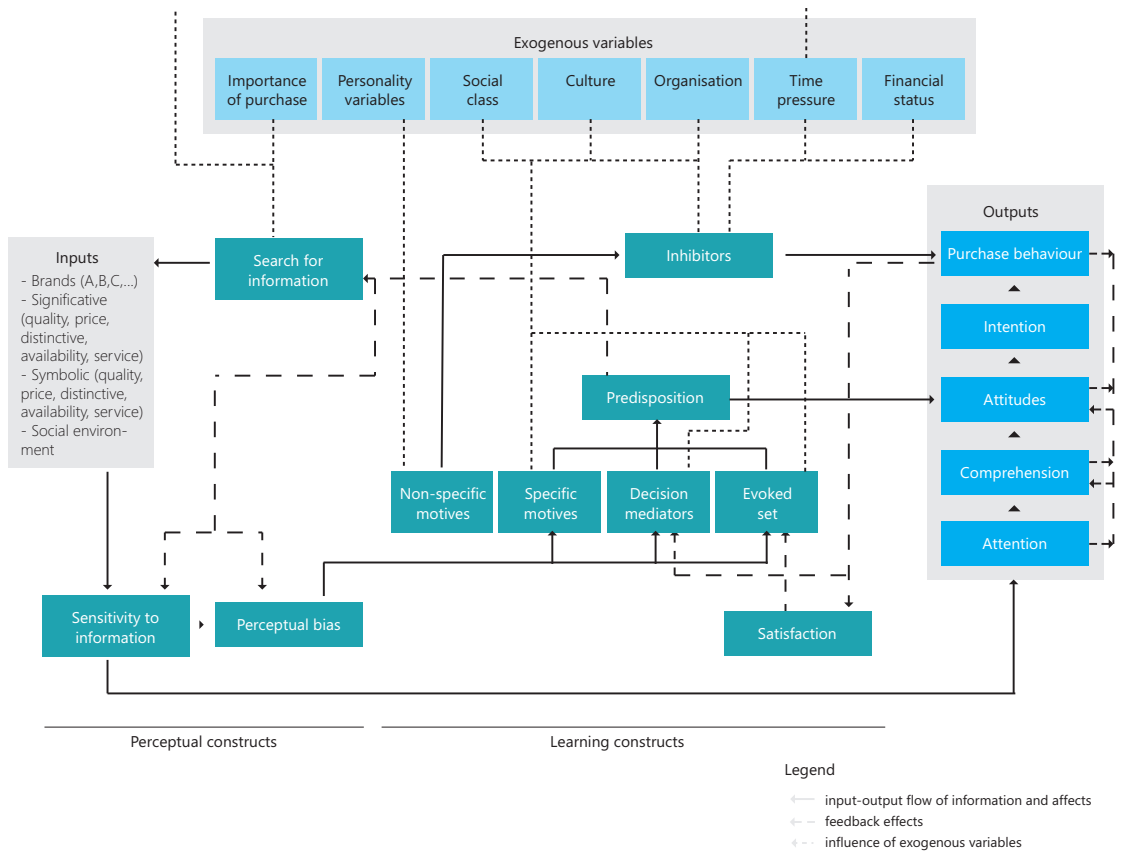


Figure 11. Theory of Buyer Behaviour (Howard & Sheth, 1969)

Input variables (i.e., environmental stimuli communicated to the user) and exogenous variables (i.e., external variables influencing the internal process) influence process variables (i.e., perceptual constructs and learning constructs), which result in output variables (i.e., purchase behaviour resulting from the process) (Bray, 2008).

The Theory of Buyer Behaviour emphasizes the influence of the users' relationship with brands, on the purchase behaviour (Jackson, 2005).

Evaluation

On one hand, the Theory of Buyer Behaviour is appreciated for its inclusion of a wide array of factors influencing behaviour including both internal and external factors (Jackson, 2005; Milner & Rosentreich, 2013). Also, the exogenous factors also

include the dimension of time by implementing the history of the buyer (Bray, 2008).

On the other hand, it has been criticized for various reasons. The Theory of Buyer Behaviour is said to be untestable and its variables to lack in specificity (Bray, 2008; Jackson, 2005). The concepts and the large amount of building blocks and relationships (Milner & Rosentreich, 2013) between them may not be easily understood by designers. This could explain why the model is currently rarely employed (Jackson, 2005). Moreover, it is criticized for its linearity (Bray, 2008; Milner & Rosentreich, 2013). Also, although the Theory of Buyer Behaviour would be beneficial for the exploration of factors behind the acceptance of access-based consumption, it would be less helpful for the study of divestment as it mainly focuses on purchase behaviour. Finally, the value-action gap can also be seen as a shortcoming as it here again assumes attitudes and intention lead to behaviour.

2.2.7 Overview of the suitability of the theories and models as a foundation of the conceptual model

Looking back at the selection criteria mentioned in 2.2.1, certain theories and models seem more suitable for the research at hand than others as summarized in Table 1.

Theory or model	Suitability for this research	
Rational Choice Theory	+ intuitive for designers	- neglects the influence of society - neglects emotions or habits
Consumer Decision Process model	+ includes external and internal influences + intuitive and familiar to designers	- neglects habits or emotions - visualises decision process linearly
Reasoned Action Model	+ includes external and internal influences + simple	- intricate concepts
Norm Activation Model	+simple	- value-action gap - lack of intervention insights
Theory of Buyer Behaviour	+includes the relationship between user and brand	- not suitable in the case of divestment - intricate

Table 1. Suitability of the theories and models as a foundation of the conceptual model

The Rational Choice Theory is intuitive to use for designers, however the theory provides a truncated analysis of behaviour by neglecting the influence of the interplay of society with the individual, and of internal processes like emotions or

habits.

To correct this, the Consumer Decision Process model and the Reasoned Action Model offer adjusted expectancy models by including external and internal influences. The Consumer Decision Process has the perk of being built around a decision process that is intuitive and familiar to designers. However, it still seemingly negates the effect of habits or emotions and visualises the decision process linearly as opposed to how it happens in reality. The Reasoned Action Model is a more parsimonious model than the Consumer Decision Process, but it involves more intricate concepts such as attitudes, norms and beliefs that are less understood by designers.

Taking norms as a starting point, the Norm Activation Model gives another type of overview of the determinants of behaviour. Its simplicity is appreciated, however the value-action gap and its lack of concrete insights on how to stimulate the acceptance of access-based consumption and circular divestment is questioned.

The Theory of Buyer Behaviour is prized for the variety of influences considered and its inclusion of the importance of the relationship between a user and a brand. Nevertheless, it may not be suitable to be used in the case of divestment, nor does it seem easily understandable by designers.

The selected theory or model is meant as an instrument for the analysis of the situation observed in practice to provide insights on how to change it. The leverage point of the individual's decisions and activities is frequently used in literature and applied in practice. Changing behaviour at a community level and leveraging social networks could have been chosen too, however – as will be discussed in sub-section 2.3 – this literature is currently in its infancy. The theories and models focusing on the individual are well-developed in social sciences literature and provide a robust foundation for the research.

The Consumer Decision Process model is selected as starting point for the conceptual model of this research as it can help provide understanding of the phenomena researched in a manner that is intuitive to designers. Although arguments can be found for other choices, the CDP model is relevant and useful for the scope of this research and certainly contributes to the validity of the findings of the empirical studies conducted in this research. The model provides a grip on behaviour by putting the decision process and its intuitive stages at its core. The CDP model and its interpretation in this dissertation are further explained in section 2.4. The concepts and relationships mentioned in other theories and models or their critique (e.g. attitude, habits or emotions) will be considered during the development of the conceptual model in section 2.5.

2.3 Reflecting on the alternative approach of behaviour at a collective level

Although this research approaches behaviour at an individual level, behaviour study can alternatively be conducted at a collective level. At this level, groups of people or society overall are considered as the scale of behaviour. Even though out of scope, the collective approach to behaviour is shortly reflected on in this section due to its interesting research avenues for future studies.

The interplay of society and individuals is inherent in the collective approach. This approach considers behaviour as a dynamic process and assumes that there is no universal solution to drive people in a specific direction.

The collective approach can be illustrated by practice theories and complexity theory described in this section. Their suitability for this research is discussed at the end of this section.

2.3.1 Practice theories

To understand behaviour, practice theories use practices as their core unit of analysis (Kuijer, 2014). These theories emerged from the work of amongst others Bourdieu, Foucault, Giddens, Latour, Taylor and Schatzki (Reckwitz, 2002).

A practice is defined as “a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, ‘things’ and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge.” (Reckwitz, 2002, p.249). It is composed of interlinked elements that can be categorised as stuff (i.e., materials), skills (i.e., competences) and images (i.e., meanings) (Shove and Pantzar, 2005).

Practices “emerge, persist and disappear” when these interlinkages are challenged (Shove et al., 2012, p.21). These links are thus essential for understanding change in practices (Kuijer, 2014) and therefore should be targeted to instigate this change. To stimulate the acceptance of access-based consumption and divestment of devices in ownership-based consumption, using access solutions and returning devices at the end of use should become the new normal to users.

2.3.2 Complexity theory

Complexity theory arose while various fields such as neuroscience, computer science and economics underwent advancements in the second half of the 20th century (Webster, 2015). This field of study has recently been applied on human

behaviour by amongst other Nijs (2014) and Webster (2015) and could offer interesting insights in the future.

Based on chaos theory, complexity theory studies non-linear dynamic systems and searches for macroscopic patterns in sets of numerous, active, and highly interconnected elements (Byrne, 1997). The elements “spontaneously organize and reorganize themselves into more and more elaborate structures over time” (Nijs, 2014, p.361) usually without knowing their whole system’s behaviour (Cilliers, 1998).

In order to instigate change in society, emergence is key and adaptive approaches are needed to “optimize the evolution of the ‘problem’ in the envisioned direction” (Nijs, 2014, p.21). It can be described as “the ‘coming into being’ of new processes, structures and entities” (Nijs, 2014, p.135). As complex systems act non-linearly, small changes can have big repercussions (i.e., the butterfly effect), meanwhile bigger ones can have none at all (Homer-Dixon, 2011). New attractors should be seeded and nurtured with energy to make this possible (Dimitrov, 2005) to attain a tipping point (i.e., critical mass) (Gladwell, 2000).

2.3.3 Suitability of the collective approach to behaviour for this research

On one hand, a collective approach is suitable for this research considering several selection criteria formulated in section 2.2.

The collective approach using either practice theories or complexity theory gives a representation of the real world that is closer to reality by simplifying it as little as possible. It thus fits the research as both the acceptance of access-based consumption and the divestment of devices in ownership-based consumption could be explained using either one of the theories.

Moreover, some blind spots identified in the individual approach are overcome in the collective approach. Practice theories consider both stability and dynamics within and between activities, minding time and changes over time (Kuijer, 2014; Pettersen, 2013). They also take the role of emotion and routine into account (Warde, 2005).

On the other hand, the collective approach is not suitable for this research for different reasons.

These theories and their application in social sciences are rather novel. Therefore, there is few experience with these theories, and design lacks a grip on these theories. These theories thus cannot be considered familiar to designers, nor can their impact yet be measured.

Also, little concrete indications are provided by the collective approach to be

used in practice from a design perspective. Further research is needed in order to apply the collective approach to the field of industrial design engineering (Nijs, 2014).

As a result, although the collective approach offers interesting research avenues in the future, this short reflection confirms the selection of the individual level as the best reasonable choice for this dissertation's research. Overcoming the gaps in the business-as-usual approach (i.e., individual level) is already a considerable research task. Overcoming the larger gaps of the collective approach would be even more challenging within the resources of this research project. In addition, design is known to be user-centred, which implies that an individual perspective of behaviour would be familiar to designers.

Evolution starts with an individual that takes action (see Nijs' Stairway to Heaven (Nijs, 2014)). Therefore, this research takes the individual user as focus point. The individual can be seen as an entity of the relation network of the collective and thus as a bridge towards the collective (Becker, 1993). Once the determinants of behaviour have been understood at an individual level, group dynamics may be leveraged as a necessary accelerator of the transition process. This research thus focuses on the individuals and their decision process, while acknowledging the impact of groups and networks as a first step towards changing behaviour at a large scale.

2.4 Using the Consumer Decision Process model

The Consumer Decision Process (CDP) was selected as a foundation for the conceptual model of this research as it focuses on what is considered the seed of behaviour change in this dissertation. It also is a prominent model in social sciences and it utilises concepts intuitive to designers.

In this section, the stepping stones between the CDP model and the conceptual model used in this research are described. The upcoming conceptual model (further explained in section 2.5) is amongst other meant to structure the empirical studies of this research in order to generate valuable data and offer a framework to analyse it.

Ultimately, the intent of this research is to enrich the CDP model considering the developments of production and consumption systems since 2006 (i.e., the year of the publication of the CDP model), such as the emergence of CE and the increasing influence of internet and social media. The conceptual model is to be used in similar conditions as the original CDP model following the Generalized Correspondence Principle. This principle is “the requirement that any acceptable new theory L should account for the success of its predecessor S by ‘degenerating’ into that theory under those conditions under which S has been well confirmed by tests” (Post, 1971, p.228).

Therefore, this section dives deeper into the CDP model. First, its background and evolution over time is studied. Then, the limitations of the model are discussed thoroughly while identifying take-aways for the development of the conceptual model.

2.4.1 Background and evolution of the CDP model

The underlying assumption of the CDP model is that users are currently at the core of the development of products, services and strategies (Blackwell et al., 2006). “Rather than attempting to influence consumers, the most successful organizations develop marketing programs influenced by consumers” (Blackwell et al., 2006, p.8). This statement makes it essential for organizations to understand why and how users obtain, use and divest products and services.

The original model (i.e., the EKB model) was introduced in 1968 in the first edition of the textbook *Consumer Behavior*, back when the field of consumer behaviour “was at its infancy” (Blackwell et al., 2006, p.XXV). Engel (one of the founders of the field of consumer behaviour), Kollat and Blackwell developed the pioneering model. It is meant as a roadmap to understand ‘consumer decision

making' based on the knowledge available from "psychology, economics, sociology, anthropology, and the few consumer behavior-oriented marketing studies that existed at that time" (Blackwell et al., 2006, p.XXV). The model has gained traction across marketing textbooks and programmes ever since (Blackwell et al., 2006).

In 1986, a fifth edition was published by Engel, Blackwell and Miniard, renaming the model as the EBM model to reflect Miniard's input (Blackwell et al., 2006).

The most recent edition of Consumer Behavior came out in 2006 and refers to the model as the 'Consumer Decision Process (CDP) model' (Blackwell et al., 2006). This tenth edition has a global perspective on consumer behaviour and includes insights from the changing situation coming with the democratisation of internet (Blackwell et al., 2006).

The key versions of the EKB, EBM and CDP models are visualised in Figures 12-14 and represent the evolution of the model over time.

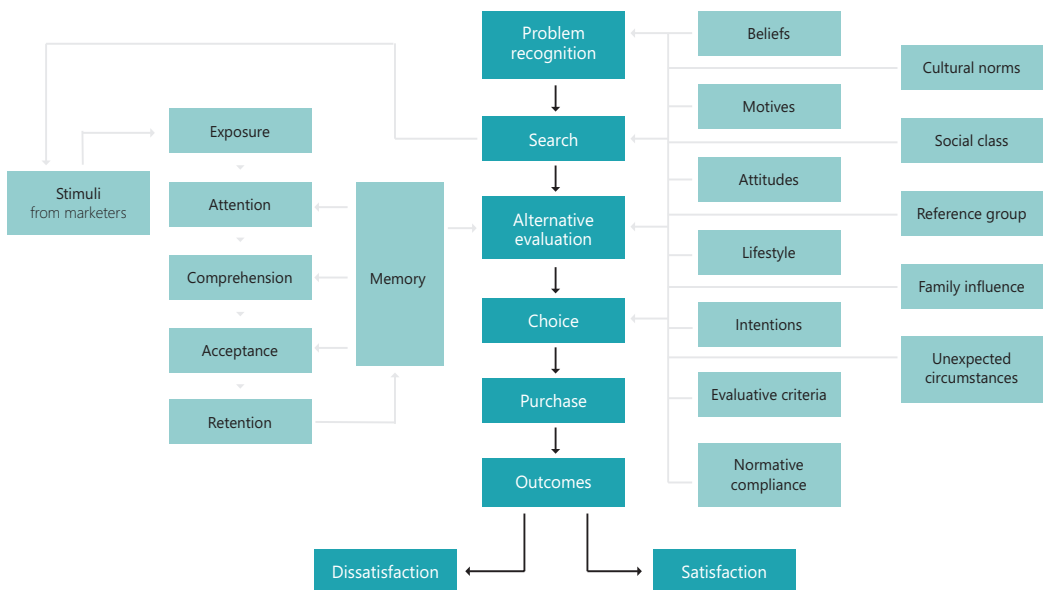


Figure 12. EKB model (1968)

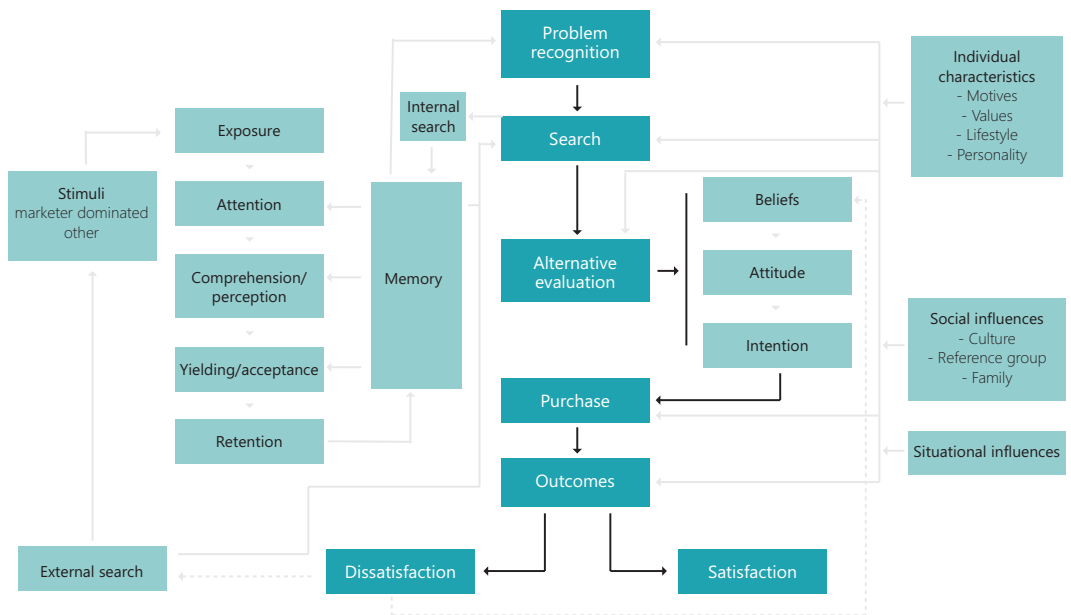


Figure 13. EBM model (1986)

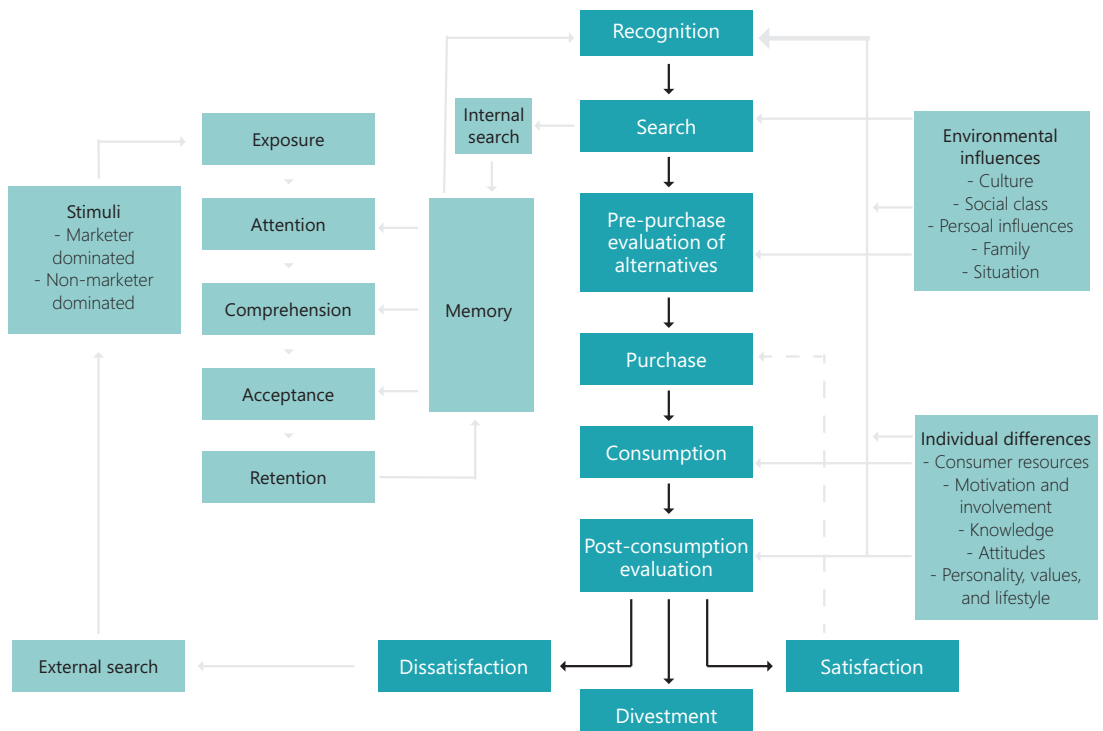


Figure 14. CDP model (2006) (Blackwell et al., 2006)

Although the model has evolved over time to include developments in the field of consumer behaviour as well as those in society, it is always structured around four main blocks: (1) input, (2) information processing, (3) decision process, and (4) variables influencing the decision process.

Input

Stimuli are considered the input of the CDP model. A stimulus can be marketer-dominated, meaning that “anything that the supplier does for purposes of information and persuasion, such as using advertising, salespeople, infomercials, websites, and point-of-sale materials” (Blackwell et al., 2006). A stimulus can also be non-marketer-dominated, meaning that the source of the information or persuasion is coming from for instance family members, online reviews, consumer associations, governmental reports or the media.

Information processing

The information processing starts with this input. The process builds on five steps: exposure (i.e., the information or persuasive communication reaches the user), attention (i.e., the user invests consideration to the input), comprehension (i.e., the user analyses the input according to meanings stored in their memory), acceptance (i.e., the input message is accepted or not), and retention (i.e., the input is stored in the user’s memory).

Starting with the EBM model, the blocks ‘internal search’ (i.e., “retrieving knowledge from memory or perhaps genetic tendencies” (Blackwell et al., 2006, p.74)) and ‘external search’ (i.e., “collecting information from peers, family, and the marketplace” (Blackwell et al., 2006, p.74)) were introduced to the model.

Decision process

The decision process at the centre of all the versions of the model builds upon the stages of buyer decision process by Dewey (1910). Dewey introduced five stages for this process: problem or need recognition, information search, evaluation of alternatives, purchase and post-purchase behaviour.

In the first version of the EKB model (1968), the decision process follows Dewey’s five stages but adds a ‘choice’ stage between the ‘evaluations of alternatives’ and the ‘purchase’ stages (which was later reintegrated into the purchase stage). It also changed the name of ‘post-purchase behaviour’ to ‘outcomes’. These outcomes lead to the seventh stages of ‘satisfaction’ or ‘dissatisfaction’.

The ‘outcomes’ were detailed in the 1995 version of the EBM model by

following the purchase stage with the stages of 'consumption', 'post-purchase alternative evaluation' (to mirror the rebranded 'pre-purchase alternative evaluation' stage) which leads to 'satisfaction' or 'dissatisfaction', and 'divestment'.

The CDP model (2006) kept these extra stages but changed the name of the 'post-purchase alternative evaluation' stage to 'post-consumption evaluation' stage.

After forty years of development, the decision process is modelled as follows:

- Need recognition: "an individual senses a difference between what he or she perceives to be the ideal versus the actual state of affairs" (Blackwell et al., 2006, p.71).
- Search: "receptivity of information that solves problems or needs, rather than a search for specific products" (Blackwell et al., 2006, p.74). It can be either performed passively by being more receptive to information, or actively by engaging in pro-active searching behaviour.
- Pre-purchase evaluation of alternatives: the options identified during the search to fulfil the need are assessed. At this stage, the user not only evaluates what to purchase but also where to purchase it.
- Purchase: first, the user decides where to purchase the product or service, then the (online or offline) in-store decision is made regarding what to actually purchase, and finally the product or service is purchased.
- Consumption: after purchase, the user gets to use the product or service. Consumption is considered the "most important determinant of satisfaction" (Blackwell et al., 2006, p.84).
- Post-consumption evaluation: the experience of consumption results in either satisfaction ("when consumers' expectations are matched by perceived performance" (Blackwell et al., 2006, p.83)) or dissatisfaction ("When experiences and performance fall short of expectations" (Blackwell et al., 2006, p.83)).
- Divestment: when a user is finished using the product or service, it is dispensed with.

Variables influencing the decision process

Variables influencing the decision process were first divided into 'decisional variables' (e.g. beliefs, motives and evaluative criteria) and 'external factors' (e.g. social class and unexpected circumstances). The variables were later split into three categories in the EBM model of 1986: 'individual characteristics', 'social influences' and 'situational influences'. It later returned to the two categories of 'environmental influences' (which include most of the previous external factors) and 'individual differences' (which include most of the decisional variables mentioned earlier).

Other variables shaping the decision process are not all visualised in the CDP model but are mentioned in the tenth edition of Consumer Behavior. These variables count three psychological processes of 'information processing', 'learning' and 'attitude and behaviour change'. Also, the involvement of users in the decision process influences this process depending on the purchase being a first-time purchase or a repeated purchase. The process can then range from a detailed decision process with extended problem solving (i.e., at a higher degree of complexity), to limited problem solving (i.e., at a lower degree of complexity), or even habitual decision making based on inertia (i.e., users may choose to not do anything at all or to choose the path with the least resistance) (Blackwell et al., 2006). To illustrate, getting a new mobile phone would require a more thorough decision process than buying new toothpaste.

2.4.2 Limitations of the CDP model and take-aways for the conceptual model

The CDP model was selected as a starting point of the conceptual model because it provides an overview of the full consumption process. It is useful for both researching the acceptance of access-based consumption as well as divestment in ownership-based consumption. Also, it provides an analysis framework of behaviour and determinants by focusing on the satisfaction of the user through the building blocks of the user's needs, wants, and expectations.

However, as mentioned in section 2.2., the CDP model has been the subject of critique in literature. In the light of the selection criteria mentioned in sub-section 2.2.1, the limitations of the CDP model are considered and take-aways are formulated for the further development of the conceptual model (in section 2.5).

Descriptive model

The model is a simplification of the phenomena that is in reality not as linear. Building up on rational choice theory, the CDP focuses on the individual and considers human action to be predictable – meaning that individuals can be controlled by tweaking the right collection of determinants, incentives and disincentives. As the problem of getting users to return their devices is complex, the factors influencing behaviour are not causal.

The situation is currently even more complex than at the creation of the model in the 60's due to technological developments and concerns for CE. The 2006 version of the model takes the impact of internet at its infancy into account. However, the internet has become exponentially important in the decision process of users with

its increasing mobility and spread in the past decades. In addition, the effervescence of social media ensures that users communicate more, with more people and even faster than ever before. Social media influencers and online product reviews for instance considerably changed the landscape of marketing.

Although acknowledged by the CDP model creators (i.e., “the human mind is decidedly nonlinear” (Blackwell et al., 2006, p.48)), the stage-gate set up of the model still creates the illusion of linearity.

Take-aways

As a result, the CDP model will be used as a descriptive model (versus a predictive model) to map out the concepts around the user behaviour and as a base to interpret them to find possible design interventions. The model will be utilized considering iterative processes and acknowledging that boundaries of the building blocks are more porous than clear-cut. For example, users can change the decision made at the 'pre-purchase evaluation of alternatives' stage when discovering a better alternative at the store during the 'purchase' stage.

Active organism

By simplifying the situation, the model represents an incomplete overview of variables influencing the decision process. Blackwell et al. (2006) however acknowledge the impact of norms (p.206, p.429), rituals (p.206, p.429), complexity and habits (p.89), time (pp.87-88), framing (pp.641-645), emotions and mood (p.40, p.84, p.95, p.206, p.222, p.375) in their 2006 Consumer Behavior book. Also, as illustrated earlier by the considerable amount of theories and models conceptualising behaviour, the concepts and relationships between them are debated in science. Furthermore, the decision process at the core of the model in itself provides an interesting framework to analyse both the acceptance of access-based consumption and the participation in responsible divestment in ownership-based consumption. Therefore, it may be valuable to concentrate on this decision process.

The decision process is influenced by an increased number of concepts and relationships, which means that individuals cannot be considered as machines but as active organisms influenced by previous experiences and external factors (Bray, 2008). The CDP model follows the structure of the Stimulus-Organism-Response model developed by Hebb (Cziko, 2000) depicted in Figure 15.

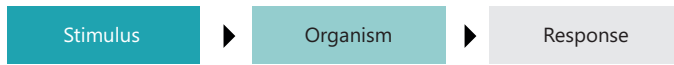


Figure 15. Stimulus-Organism-Response model (Cziko, 2000)

In the Stimulus-Organism-Response model, stimulus is an input external to the organism defined as “the intervening processes and structures consist[ing] of perceptual, physiological, feeling, and thinking activities” (Bagozzi, 1986, p.46 quoted by Chang et al., 2011) occurring within the user. The response is the decisions of the user and their outcomes (Chang et al., 2011). In the cases researched in this dissertation, the response is either that the user accepts access-based consumption or returns a device after use in ownership-based consumption.

Take-aways

Within the active organism, the decision process could be kept central to the conceptual model. All influences on this process could be visualised as one block of variables including for instance habits, information process and attitudes. As a result, a direction is provided on how to design interventions (i.e., one of the selection criteria).

Correcting the current focus on traditional purchase

The aforementioned conceptualisation of the decision process provides guidance to uncover needs, wants and expectations of users, and generates insights for the envisioned research on both access-based consumption and divestment in ownership-based consumption. Nevertheless, the authors of the CDP model principally focused on purchase and use in the context of traditional ownership-based consumption when developing the decision process model.

Therefore, an imbalance can be found between the purchase phase and the divestment phase. Even though the model mentions divestment, purchase is constantly emphasized in the Consumer Behavior book, whereas divestment is not considered as thoroughly. “Historically, the study of consumer behavior focused on buyer behavior, or “why people buy.” More recently, researchers and practitioners have focused on consumption analysis, which refers to why and how people use products in addition to why and how they buy” [without original emphasize] (Blackwell et al., 2006, p.4). The next step for the CDP model will be undertaken in this dissertation by now focusing on the divestment phase. Indeed, circular economy has only recently gained traction. As a result, in contrast to previous decades,

companies currently do not only want users to purchase their product or service, but also want them to bring back any product after use. It is now time to restore the balance between the attention to the purchase phase, use phase and that for the divestment phase. The divestment stage of the decision process will thus need to be altered through this research.

On top of this, the authors neglected access-based consumption during the model's development. The CDP model's decision process is well-thought through for traditional ownership-based consumption. Although services are mentioned, the design of access-based consumption does not seem to be considered thoroughly by Blackwell et al (2006). The model however offers some leads on how to approach the development of access-based consumption solutions based on the needs, wants and expectations of users throughout the stages of the decision process.

Take-aways

When creating the conceptual model, the lack of consideration of divestment and access-based consumption during the development of the decision process stages needs to be addressed.

Familiarity for designers

The last criterium to consider is the familiarity that design practitioners and researchers have with the concepts and relationships figuring in the model. Most of the stages of the decision process are intuitive for designers (i.e., similar to the ones during the user-centred development of products or services) and for providers with a marketing or economics background.

As mentioned in the introduction chapter of this dissertation, the term 'consumer' has been deliberately avoided as it holds the negative connotation that people 'eat up' the product over time, and thus diminish its utility and quality over time. The term 'user' is therefore preferred as it does not imply any devaluation. Despite its limitations, the term 'consumption' is used as the overarching concept regarding purchasing, using and divesting products and services.

Take-aways

The stages of the decision process are intuitive to design practitioners and researchers, however to avoid confusion the 'consumption stage' of the CDP model will be renamed the 'use stage' in the conceptual model.

2.5 The conceptual model used in this dissertation

In this dissertation, a conceptual model is defined as a simplified representation of the phenomena studied so as to create an understanding it. The conceptual model used in this dissertation is meant to be suitable when both studying the acceptance of access-based consumption (i.e., alternative mode of consumption where the legal ownership of a product remains in the hands of the service provider) as well as studying divestment (i.e., the last phase of the consumption process) in ownership-based consumption.

The CDP model provides a basis to analyse why and how users decide and behave throughout the consumption process. The take-aways mentioned in section 2.4 result in the conceptual model of Figure 16.

Several adaptations have been made to the CDP model to fit this research's scope and research objectives. These changes are stipulated as follows:

- The CDP model represents “a roadmap of consumers' minds that marketers and managers can use to help guide product mix, communication, and sales strategies” (Blackwell et al., 2006, p.70). The conceptual model in Figure 16 is however meant as a map of users' minds and behaviour that design researchers and practitioners can use to help guide the creation of design interventions (i.e., the stimuli on the left of the conceptual model) when considering the acceptance of access-based consumption and divestment in ownership-based consumption.
- In contrast to the CDP model, this conceptual model is solely to be used as an descriptive model and is used considering iterative processes. The arrows do not represent causality but reflect the influence on another concept, and the dotted lines emphasize the iterative nature of the process. The stages are only representative once the divestment phase is undergone.
- Similarly as with the CDP model though, the author of this dissertation is aware that the situation is not linear. The stages of the decision process and activities that users go through during the consumption cycle are considered porous. This porousness is exacerbated by the increased number of connections between users and their communication opportunities brought by the internet.
- The structure of the CDP model is simplified in various ways. The stimulus/organism/response structure of the model is visually made more apparent

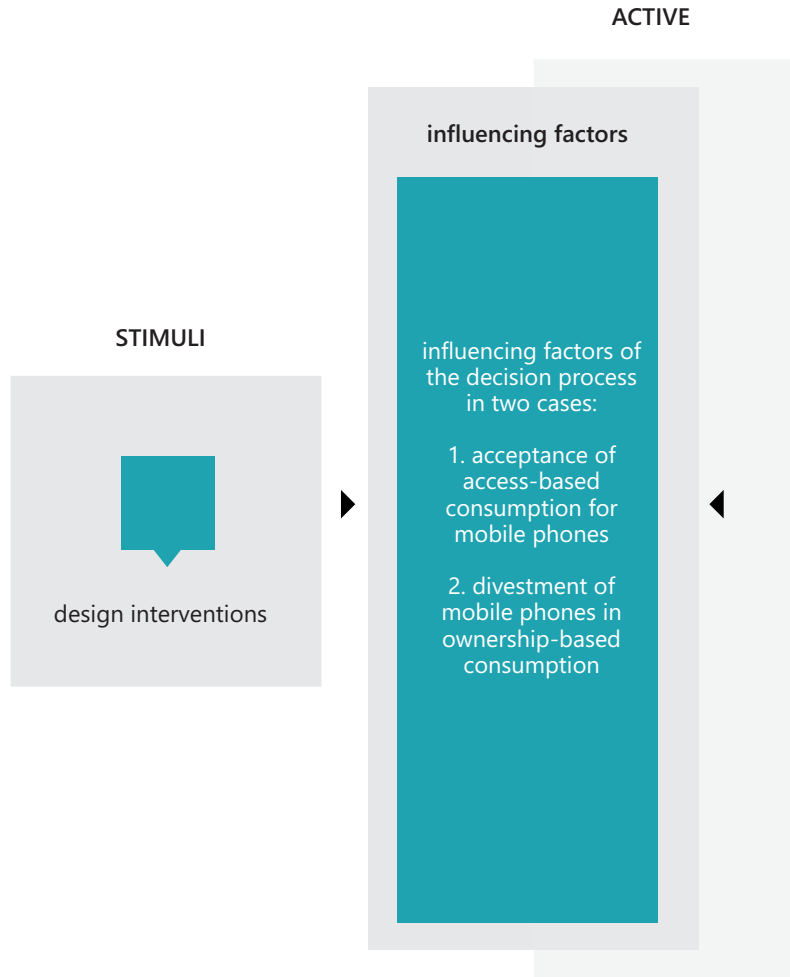
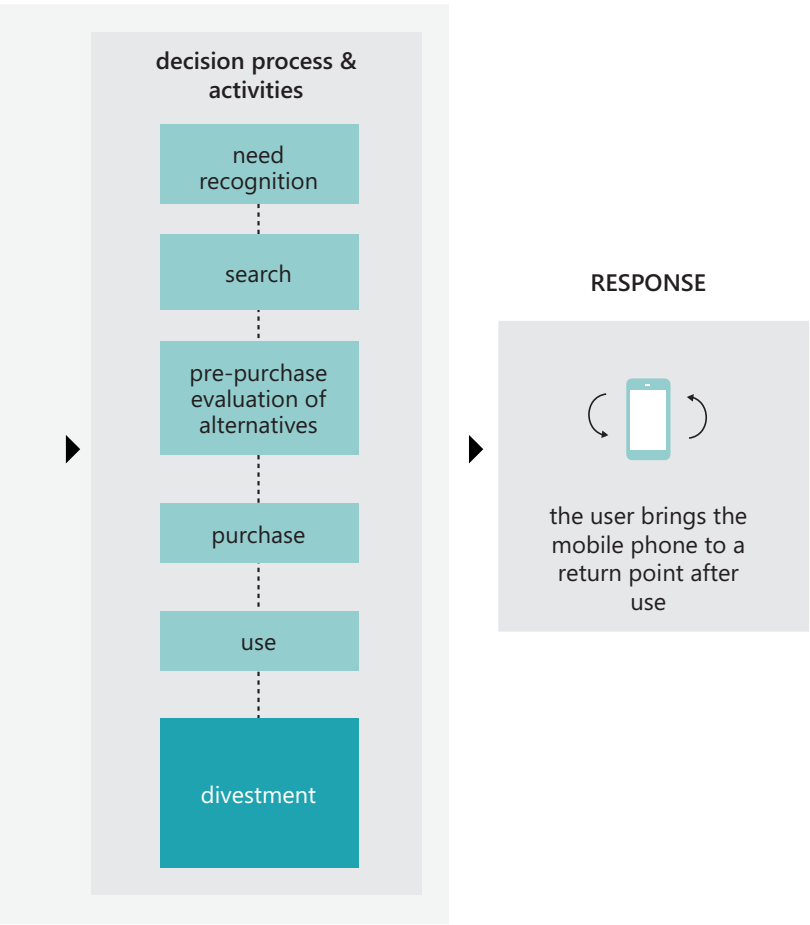


Figure 16. Conceptual model used for this research based on the CDP model by Blackwell et al. (2006). The dark blue highlights represent the points of contribution of this research.

INDIVIDUAL ORGANISM



- Legend
- influences
 - ... iterative process

to foster understanding. The emphasis is put on the decision process by having it at the core of the conceptual model. The output blocks of dissatisfaction and satisfaction from the CDP model are here incorporated in the response block to recentre the attention on why and how users accept access-based consumption or return their devices in ownership-based consumption (vs the original aim of the CDP to uncover why and how users buy and use products). The information processing building block (i.e., including the internal and external search of knowledge processes) is integrated in the active individual organism one. The influencing factors are not categorized like Blackwell et al. did in order to avoid the restriction to upcoming data collection and interpretation.

- The CDP model implicitly considered activities throughout the decision process. At the search stage for instance, the user retrieves knowledge from her/his memory, collects information from external sources (Blackwell et al., 2006). To make these activities more explicit, the decision process block was renamed 'decision process and activities'.
- Several changes are made in the definition of the stages of the decision process of CDP.
- The names of the first four stages remain unchanged. The definition of the pre-purchase evaluation of alternatives stage was extended to include that the decision is made at this stage to actually purchase something to fulfil a need. At the purchase stage, the activity of purchasing the product of service is included in the definition.
- The 'consumption' stage in the CDP model is renamed to 'use' stage to better suit the language of design practitioners and researchers.
- The last phase of the consumption cycle, namely the divestment phase, combines the last two stages of the CDP model (i.e., post-consumption evaluation stage and divestment stage) and is meant to be further developed in this dissertation.

To clarify the conceptual model, the building blocks of the stimuli (2.5.1), active individual organism (2.5.2) and response (2.5.3) are defined in the upcoming sub-sections.

2.5.1 Stimuli

Like in the CDP model, stimuli are considered the input of the conceptual model. Similarly to the definition in the CDP model, stimulus can be marketer-dominated or non-marketer-dominated.

To translate these stimuli to the language of designers, stimuli have been linked to 'design interventions' that trigger, guide and maintain (Lilley, 2009) the envisioned change of response behaviour. The studies in this dissertation were developed to explore these design interventions to increase the return of mobile phones after use.

2.5.2 Active individual organism

The organism stands for what happens in the active mind of individual users.

Influencing factors

The internal and external variables influencing the decision process of the CDP model were combined into the block of influencing factors. These include various processes and concepts such as information processing, social norms, emotions and habits. The block is partially inside of the 'active individual organism' block as well as outside to visually represent both internal and external factors. Through the studies in this dissertation, the factors influencing the acceptance of access-based consumption are explored per stage of the decision process. Other studies in this dissertation focus on uncovering the factors influencing the divestment phase in order to stimulate users to voluntarily bring their mobile phones to return points after use in ownership-based consumption.

Decision process and activities

The decision process and activities are categorized in three phases of the consumption cycle: (1) the purchase phase, (2) the use phase, and (3) the divestment phase.

Purchase phase

- Need recognition stage: "an individual senses a difference between what he or she perceives to be the ideal versus the actual state of affairs" (Blackwell et al., 2006, p.71).
- Search stage: "receptivity of information that solves problems or needs, rather than a search for specific products" (Blackwell et al., 2006, p.72). It can be either performed passively by being more receptive, or actively by engaging in pro-active behaviour.
- Pre-purchase evaluation of alternatives stage: the alternatives to fulfil the need are then assessed. Users not only evaluate what to purchase but also where to purchase it. At the end of this stage, users make the decision to

actually purchase something,

- Purchase stage: users (1) select where to purchase the product or service, (2) make an (online or offline) in-store decision on what to finally purchase, and (3) act upon this decision by purchasing the product or service.

Use phase

- Use stage: after purchase, the user gets to utilise the product or service. The stages within the use phase are very different depending on the product or service and will thus be bundled into one stage in order to be generalizable. Nevertheless, its visual compactness should not be mistaken to represent a lack of attention required on this phase.

Divestment phase

- ‘To be defined’ stages. According to the CDP model, it should at least include an evaluation of the purchase product or service (i.e., comparing expectations to the perceived performance) and the physical action of users dispensing with the product after use. To transition towards a circular economy, divestment needs to be considered more thoroughly. The divestment phase of the CDP model is meant to support designers to study users “by examining how [they] proceed through the decision model (adapted for a particular product or service)- and ask questions” (Blackwell et al., 2006).

2.5.3 Response

The envisioned response is that individuals change their behaviour by returning their mobile phones at return points after use as a result of the decision process.

It is however also valuable to understand why users have another response.

2.6 Conclusion

This chapter defined the conceptual framework of this dissertation's research. It provided the reader with:

- **The scope of the research.** Key concepts used in the research, such as the *decision process* and *behaviour*, were described by delineating what is within the scope of this research and what lies out of scope. It goes beyond the brief overview made in the introduction chapter by guiding the reader through the core considerations made when looking at the envisioned behaviour change illustrated in Figure 5.
- **The approach to change current behaviour to the envisioned behaviour.** The chapter took a dive into the field of social sciences to make the main objective of this dissertation researchable. In doing so, it created a trail clarifying where the research is situated and how it can connect to other research. The choice was made to concentrate on the user perspective as agent (versus that of governments or companies) with a focus on behaviour at an individual level (versus at a collective level). The Consumer Decision Process (CDP) model by Blackwell et al. (2006) was selected as the basis of the conceptual model to organize the research findings.
- **The conceptual model.** The conceptual model resulting from this approach organizes the concepts, relationship and actors deemed relevant for this research. With this model, the main objective of this dissertation has become researchable. It enabled the author of this dissertation to understand the phenomena, to design studies to generate data and to guide the analysis of this data. It also helps the reader to grasp the narrative of this dissertation and gives potential successors the opportunity to build on this research.

CHAPTER 3

Research Design

3. Research Design

3.1 Introduction

Link to previous chapter

The conceptual model developed in Chapter 2 enables the author of the dissertation to organize new found knowledge. To generate this knowledge, the research design needs to be clarified.

Objective of this chapter

Design asks to navigate the uncertainty of phenomena in order to let new insights emerge and innovate to change the current situation (van Boeijen & Daalhuizen, 2010). Uncertainty is both internal (i.e., state of knowledge of the designer) and external (i.e., unpredictable or unknown situation)) to designers (Daalhuizen, 2014; Kahneman & Tversky, 1981). A design practitioner and researcher ought to “make sense of an uncertain situation that initially makes no sense” (Schön, 1983, p.40). What can be known of the phenomena of the acceptance of access-based consumption and the return of devices in ownership-based consumption? How can knowledge about these phenomena actually be acquired? What is ‘the world’ to be considered around these phenomena to research them?

To answer these questions, this chapter offers a glimpse of the mind of the author of this dissertation (as illustrated in Figure 17). Existing knowledge and the studied phenomena serve as input for the processing in the inquirer’s mind and will result in new knowledge reported in this dissertation.

Outline of this chapter

The tour takes you through a reflection on research paradigms (3.2) starting with ontology (3.2.1) and epistemology (3.2.2), and leading to the selection of constructivism as the research paradigm core to this dissertation (3.2.3). Constructivism’s worldview is then summarized in the context of the phenomena studied in this research (3.2.4).

Next, the tour moves on to the implications of the application of constructivism (3.3) on the appropriate type of reasoning (i.e., inductive) (3.3.1) and type of research (i.e., qualitative) (3.3.2) to adopt. This chapter then clarifies how constructivism influenced the conceptual model developed in the Chapter 2 (3.3.3).

Finally, the methodological choices to answer the research questions are described (3.4).

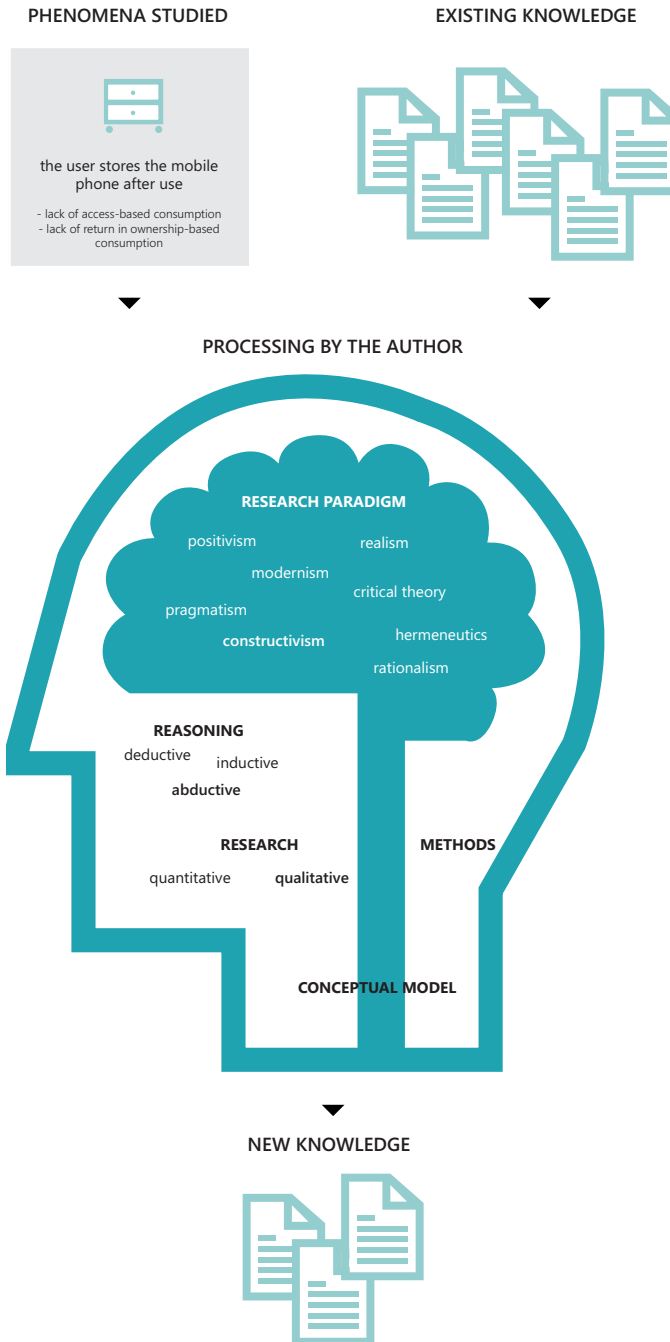


Figure 17. The author's processing of the phenomena studied in this dissertation into the new knowledge resulting from this research

3.2 Research paradigms

By naming a research paradigm and defining its characteristics, the assumptions of the author of this dissertation are spelled out for the reader to understand how she is conducting research and what she considers valid (Coghlan & Brannick, 2005). A research paradigm is a "set of interrelated assumptions about the social world which provides a philosophical and conceptual framework for the organized study of that world" (Filstead, 1979, p.34). Researchers want to produce valid knowledge, and this validity is based on the research community's agreement on this set of assumptions (Kanellis and Papadopoulos, 2009).

Based on ontological (3.2.1) and epistemological aspects (3.2.2), a research paradigm is selected (3.2.3) and described further (3.2.4) to define the worldview adopted in this dissertation.

3.2.1 Ontology

Ontology is the study of being (Crotty, 1989) and questions what 'the world' actually is. Research paradigms envision reality to be objective (i.e., independent of the inquirer, time and place) or subjective (i.e., dependent of the inquirer, time and place) (van Gigch, 2002). For instance, according to positivism, there is an objective reality understandable through governing rules, and therefore not influenced by our senses nor the inquirer's (Scotland, 2012). This research paradigm is considered to yield causal links between entities, to come to predictions and control phenomena (Ponterotto, 2005). In contrast, constructivism challenges the existence of this objectivity as "objectivity is the delusion that observations could be made without an observer" (von Foerster 1978, epigraph, cited by van Gigch, 2002b). Constructivism supposes that reality is subjective and created by social and contextual understanding (Alvesson & Skoldberg, 2009).

The research in this dissertation focuses on users' behaviour when it comes to accepting the access-based consumption of mobile phones or their return in ownership-based consumption. The thoughts, emotions and decisions triggered by the stimuli of design interventions and leading to this behaviour are dependent on the existence of human intervention (van Gigch, 2002). They would "not exist or be the way they are if they are not known, perceived or at least conceived by one or more conscious beings" (Bell, 1992 cited by van Gigch, 2002). In contrast to machines, users are complex beings who do not always act rationally. Hence, it can be argued that reality is subjective and is constructed by individuals and collectives.

3.2.2 Epistemology

Epistemology answers what can actually be known about this world by delineating “how knowledge can be created, acquired and communicated” (Scotland, 2012, p.9).

It helps define what the criteria are for knowledge to be recognized as knowledge rather than opinions, and thus distinguishing scientific from non-scientific knowledge (Blaikie, 2007).

As the world studied in this dissertation is ontologically considered subjective, the study is also epistemologically subjective (van Gigch, 2002). Indeed, the aforementioned thoughts, emotions and decisions come into being because the user thinks, feels and decides. These are on top of this only observable if articulated by that person. This articulation in research is often prompted by an inquirer who will therefore per definition influence the knowledge extracted from the study.

3.2.3 Selecting a research paradigm

According to the reflections in 3.2.1 and 3.2.2, the fitting research paradigm is ontologically and epistemologically subjective. The selection of the research paradigm is based on the comprehensive overview of key research paradigms by Guba and Lincoln (1994) cited 19.744 times (according to Google Scholar accessed on 18/06/19). The overview includes positivism, postpositivism, critical theory and constructivism. This requirement for ontological and epistemological subjectivity eliminates positivism and postpositivism as fitting research paradigms for this research. The choice must thus be made between critical theory and constructivism.

Critical theory

Ontologically, critical theory considers that a virtual reality is shaped by cultural, economic, ethnic, gender, political and social factors in a historical context (Guba and Lincoln, 1994). Epistemologically, “what can be known is inextricably intertwined with the interaction between a particular investigator and a particular object or group” (Guba and Lincoln, 1994, p.26).

Critical theory is meant to confront the status quo (Ponterotto, 2005) and transform “the social, political, cultural, economic, ethnic, and gender structures that constrain and exploit humankind” (Guba and Lincoln, 1994, p.211). In this type of research, the inquirer is both instigator and facilitator. In contrast to constructivism, critical theory focuses on power relations and the emancipation of oppressed groups (Ponterotto, 2005). Critical theory could shed light on the prejudices users have on the alternative ways of consumption including the access of mobile phones and their

return after use in consumption-based consumption. Nevertheless, the aim of this research is not aligned with the activist motives of critical theory.

Constructivism

Ontologically, according to constructivism, reality is constructed in people's mind and not externally imposed (Ponterotto, 2005). Constructivists consider realities to be "multiple, intangible mental constructions, socially and experientially based, local and specific in nature [...] and dependent for their form and content on the individual persons or groups holding the constructions" (Guba and Lincoln, 1994, p.111). As design interventions are experienced by the users, they influence the way users construct their reality.

Epistemologically, constructivism sees knowledge as the result of the interaction between the inquirer and the respondent (Guba and Lincoln, 1994). Constructivism is meant to understand and reconstruct people's conceptualisations. Here, the inquirer is seen as both participant and facilitator (Guba and Lincoln, 1994). The modern foundation of constructivism was amongst other formulated by economist Herbert Simon (van Gigch, 2002), who is considered one of the founders of design research. Within social sciences, sciences such as 'decision sciences', 'sciences of cognition', 'system sciences' and 'design sciences' have integrated constructivism to some extent (van Gigch, 2002b). Constructivism has been used explicitly as a basis for previous research on user behaviour and how to change it (for example by Pettersen, 2013 and Garnelo-Gomez, 2017). Mobile phone ownership, access and return systems can all be seen as social constructs with different meanings per individual and collective. As this present research is particularly interested in how users 'make sense' of these concepts, constructivism seems appropriate as a research paradigm for this research.

3.2.4 Worldview according to constructivism

In summary, for the purpose of this research, the world around the phenomena of the acceptance of access-based consumption and the return of devices in ownership-based consumption is considered a subjective reality. The reality of design interventions is indeed a social construct created in the minds of users and collectives of users through shared interaction. It evolves over time through "acts of cognition, such as representation, imagination, understanding, intuition and so on" (van Gigch, 2002b, p.554). For example, the access of mobile phones does not have a universal or objective psychological meaning, but is interpreted differently depending on the beholder and their social context rather

than dictated by objective factors. For this research, different users will thus need to be studied to understand the conceptualisation of access-based consumption.

The constructs cannot be observed objectively by means of for example an MRI of ones' brain mapping the thoughts occurring in ones' mind. Instead, an inquirer is needed to extract these thoughts, for instance verbally (e.g. through an interview) or in writing (e.g. through an exercise book as part of a sensitising kit). Per definition, the inquirer thus influences the object of the study and is also herself influenced by it (Guba & Lincoln, 1994). As most situations are unique and uncertain, the inquirer constructs the reality. By trying to make sense of the situation, she shapes the conversation with the situation through the framing of the problem, its scoping, the order of research and the intent of the research (Schön, 1983, p.165).

Note that in terms of limitations, constructivism cannot result in full generalizations, adaptable to any situation. Also, as the inquirer is an inherent part of the research, the knowledge can unintentionally be tainted by biases. Limitations linked to the research design are further developed in the section 7.4.

3.3 Methodological implications

The selection of constructivism as research paradigm has methodological implications for what type of reasoning to adopt to generate new knowledge on the phenomena studied (3.2.1) and the type of research to implement (3.2.2). Methodology refers the “why, what, from where, when and how data is collected and analyzed” (Scotland, 2012, p.9).

3.3.1 Reasoning

Traditionally, deductive reasoning employed in physical sciences has been considered the way to conduct scientific, rigorous and valid research (van Gigch, 2002b). It focuses on verifying hypotheses by means of empirical research (Mason, 2002) based on universal rules. However, by choosing constructivism as research paradigm, inductive or abductive reasoning should be adopted in this research.

In contrast to deductive reasoning, inductive reasoning starts with the empirical research, identifies patterns and comes to theories based on propositions (not to be mistaken with hypotheses) (Mason, 2002). It is thus more exploratory than deductive reasoning as it allows “research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies.” (Thomas, 2003, p.2).

In the second half of the 20th century, constructivism came to challenge the notion that social sciences were “less ‘scientific’, ‘rigorous’ or ‘valid’ than the physical sciences” (van Gigch, 2002b, p.554). Inductive reasoning indeed still complies with the scientific requirement by being guided by “statistical links between causes and effects” and the “logical relationship between premises and conclusions” (van Gigch, 2002b, p.553). In order to judge the quality and credibility of the research, one should (1) acknowledge subjectivity by discussing it and by recognizing biases, (2) trustworthiness and authenticity, (3) interdependence, (4) triangulation, (5) reflexivity, (6) particularity, (7) enhance and deepen understanding, (8) contribute to a dialogue, (9) extrapolate and transfer knowledge, and (10) those sharing their perspective should consider the findings credible and accurate (Patton, 2015).

Abductive reasoning resembles inductive reasoning. However, it goes further by looking for patterns of innovative abduction. Designers “prepare and plan for a task or project while maintaining a certain flexibility to adapt to the circumstances at hand” (Daalhuizen, 2014, p.24) and thus follow an iterative process. “In a good process of design, this conversation with the situation is reflective. In answer to

the situation's back-talk, the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves." (Schön, 1983, p.79). As this type of reasoning lies closer to the reality of designing, the author employed abductive reasoning throughout this research.

3.3.2 Qualitative research

Constructivism is a strong foundation for qualitative research (Ponterotto, 2005; Stake, 1995). As argued by Ponterotto (2005), constructivism implies that meaning "must be brought to the surface through deep reflection" (p.129). Through qualitative research, a phenomenon is explored using multiple lenses (Baxter & Jack, 2008). In contrast to quantitative research (i.e., concerned with numerical data mostly interpreted through the prism of objective reality), qualitative research deals with "nonnumerical information and their phenomenological interpretation, which inextricably tie in with human senses and subjectivity." (Leung, 2015, p.324).

Qualitative research fits this research as the inquirer is exploring the phenomena of acceptance of access-based consumption and the return of devices in ownership-based consumption from a rather new perspective (i.e., that of users). The constructs around the current situation need to be uncovered and opportunities for the creation of design interventions need to be revealed. It thus requires rich data with open-ended inquiries for the users to fill in without being guided through options pre-selected by the inquirer.

In order to extract the subjective reality of users on these phenomena, various qualitative methods¹ can be used. Figure 18 from Sanders and Stappers (2012) visualizes the relationships between what people say, do and make, with the level of knowledge and methods along an axis of surface and deep insight.

Sanders and Stappers distinguish four levels of knowledge: (1) explicit (which can be verbally heard or read), (2) observable (which can be seen), (3) tacit (which cannot be verbally communicated), and (4) latent (which refers to thoughts and ideas of users on what has not yet been experienced, yet could have an opinion on it based on past experiences). Market research mostly focuses on the top of the

⁸ Although often used interchangeably, note the difference between a method, a technique and a tool. Their differences can be clarified with an analogy to cooking (as done by van der Togt, 2017): here, the method stands for the crème brûlée recipe (i.e., to achieve the goal of the study), the technique stands for actions like caramelizing, and the tool stands for the torch required to caramelize the sugar on top of the crème brûlée.

iceberg with what is said through questionnaires, group sessions and interviews (Sanders & Stappers, 2012). However, a deeper level of understanding can be attained through the generative study of experiences, combining various methods at multiple levels (Sanders & Stappers, 2012). Users can be observed (or report self-observation) in their activities (Sanders & Stappers, 2012) using eyetracking, shadowing or fly-on-the-wall observation for example (Martin & Hanington, 2018). At the deepest level, users can be brought to create in order to express their thoughts and emotions (Sanders & Stappers, 2012) through for instance bodystorming, collages, or toolkits (Martin and Hanington, 2018).

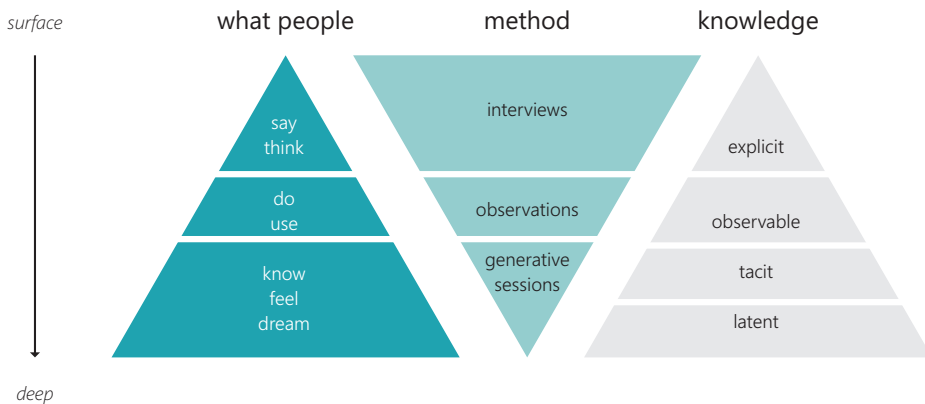


Figure 18. Methods to study what people say, do and make help access different levels of knowledge (reproduction of Sanders and Stappers, 2012, p.67)

The specific methods, techniques and tools utilized to collect data on the two main studies of this dissertation are described in detail in the following chapters attending to the distinct studies.

3.3.3 Implications for the conceptual model

Although Chapter 2 on the conceptual model appears before this research design chapter, the thinking reported in this present chapter was also used when developing the conceptual model. It was positioned after Chapter 2 in this dissertation to foster readability. So as to save the reader from having to go back and forth through the dissertation, the conceptual model is visualised again in Figure 19.

Familiarity

The phenomena central to this study are part of complex systems of

individuals, groups, companies, governments, information technologies etc. “[...] [I]nquirers can sometimes figure out how to solve unique problems or make sense of puzzling phenomena by modelling the unfamiliar on the familiar” (Schön, 1983, p.186). The conceptual model was therefore built on what was familiar to design practitioners and researchers. As a result, known models were used as a foundation for this conceptual model. This procedure enables the inquirer to not start from scratch, but rather to get a grip on as much of the uncertainty of the situation by enabling to order knowledge. Also, as familiarity is fostered, terminology utilised in the foundation of the conceptual model (i.e., the CDP model) was altered to better suit the language of design practitioners and researchers.

Subjectivity & Constructivism

The conceptual model is not meant to be restrictive, hence the inclusion of a blackbox for influencing factors for example. It enables the inquirer to find patterns in the data collected and organize the knowledge. Rather than aiming for a predictive model, the conceptual model is meant to enable the analysis of the phenomena and build insight to design a solution to change the user behaviour. The development of the conceptual model was shaped by constructivism as it assumes that each situation is unique and uncertain, and that behaviour cannot be predicted. Certainty can never be obtained according to this research paradigm. The objective of this research is not to uncover cause and effects as, according to constructivism principles, these cannot be uncovered due to lack of universal truth. The objective is rather to improve the understanding of the user perspective of the phenomena of the acceptance of access-based consumption and return of devices in ownership-based consumption.

Abductive reasoning

Following an abductive reasoning in the previous chapter, no hypotheses can be formulated to change their user behaviour based on the literature review of behaviour and users. This research requires the revelation of new information and ideas. The conclusions of the research would otherwise already be contained in the premises of the hypotheses and would not yield new creative thinking. Nevertheless, the data analysis does not have to start from scratch. The reviewed literature brings potential patterns in data forward and can guide the organization of knowledge.

The data interpretation follows an iterative process by shaping and reshaping the found patterns emerging from the data. This processing is built on discursive insight, proceeding by reasoning following constructivism principles and knowledge of the context of the users and the phenomena.

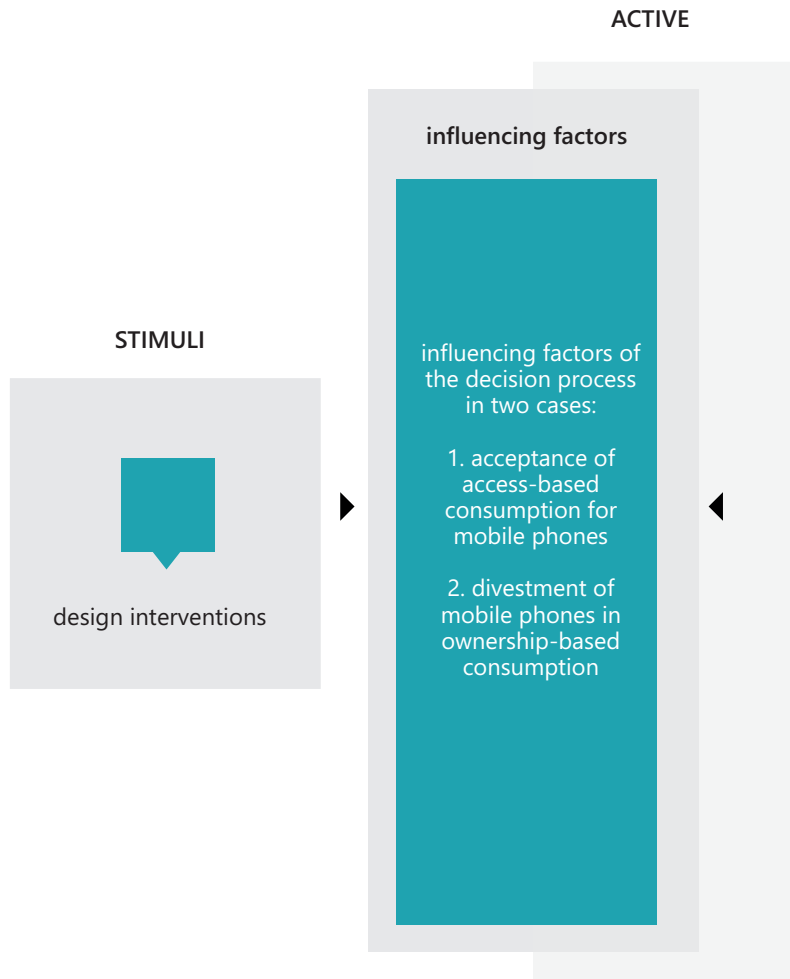
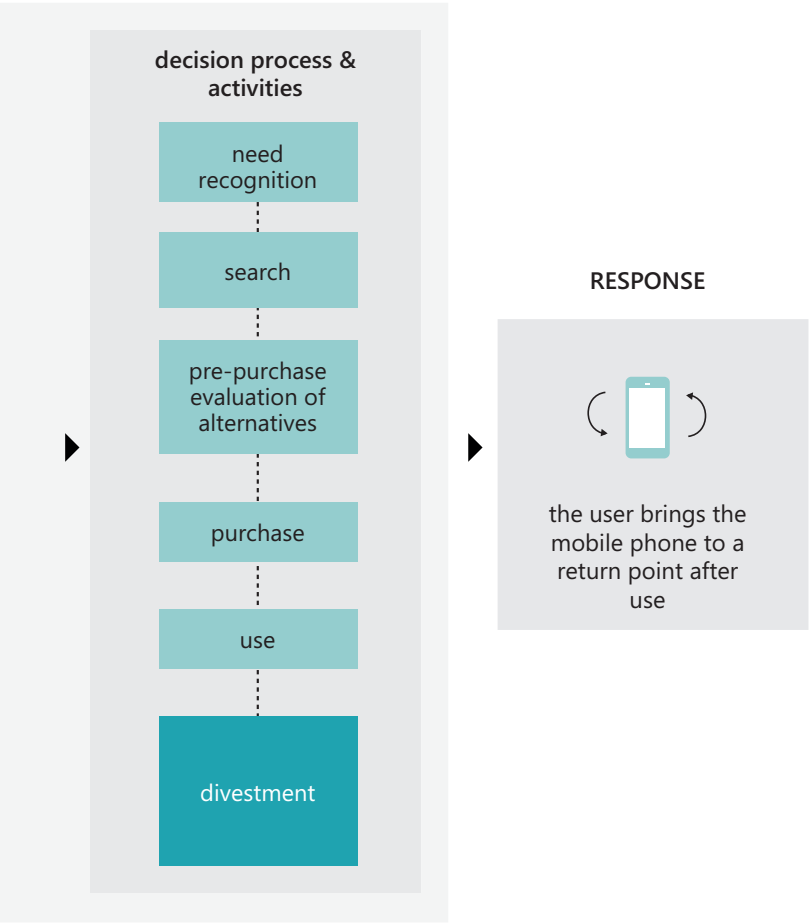


Figure 19. Conceptual model used for this research (based on the CDP model by Blackwell et al., 2006)

INDIVIDUAL ORGANISM



- Legend
- influences
 - ... iterative process

3.4 Methodological choices

The choices of the research paradigm, type of reasoning, type of research and conceptual model led to the following set up to answer Research Questions 2 & 3.

The remainder of this dissertation is divided in two parts: the first on the acceptance of access-based consumption and the second on the voluntary return of phones in ownership-based consumption.

Both start with systematic literature reviews to further create a conceptual foundation.

For the first part of the dissertation, in-depth semi-structured interviews were conducted with non-adopters and adopters of access services for cars and for smartphones. Qualitative research fits this research as the inquirer is exploring the phenomenon from the rather original perspective of users. The semi-structured interview guides enabled the collection of rich data with open-ended inquiries for the users to complete. Following constructivism, this method enables to discover how users interpret the current design interventions of the car and smartphone access services and to identify opportunities for new design interventions to improve the acceptance of access-based consumption of smartphones.

For the second part of the dissertation, a Research through Design (RtD) approach is followed using design practice (i.e., design projects with professionals and students) to generate divestment knowledge for design practitioners and researchers (Herriott, 2019). The iterative process of RtD is aligned with abductive reasoning as designers constantly reflect and adapt their design process (Bender & Blessing, 2004; Schön, 1983). Here again, following constructivism, these methods enable to uncover what happens in users' minds during divestment. Also, qualitative research fits this dissertation due to the explorative nature of the research.

Chapters 4 and 6 include published papers reporting the findings of the studies on the acceptance of access-based consumption and the voluntary return of devices in ownership-based consumption. As a result, the afore-mentioned methods are more thoroughly explained in the Methods sections of these papers.

3.5 Conclusion

After describing the conceptual framework in Chapter 2, this chapter provided a deeper look into the inquirer's mind to precise the research design. Fitting the objectives and scope of this research as well as being compatible with each other, the following aspects form the foundation of this research.

- **The research paradigm.** In this dissertation, reality is considered to be subjective and constructed by individuals and collectives. The research is thus guided by the research paradigm of constructivism.
- **The type of reasoning.** To remain close to the design process, abductive reasoning is employed throughout this dissertation. The interpretation of emerging data is iteratively shaped and reshaped to find patterns.
- **The type of research.** Following the selection of constructivism, the defined phenomena and research questions, qualitative research best fits the purpose of this dissertation. Rich nonnumerical information is therefore gathered from various users to better understand their interpretation of the situation and access knowledge from users and designers at various levels.
- **Methodological choices.** The research design choices led to conduct systematic literature reviews to provide guidance in the identification of patterns in the emerging data, to conduct interviews of (potential) users of access-based services, and to adopt a Research through Design approach to gather latent knowledge from designers on how to design for divestment.
- **The conceptual model.** The model presented in Chapter 2 was developed following the research design choices defined in this chapter.

CHAPTER 4

The acceptance of access-based consumption for devices

4. The acceptance of access-based consumption for mobile phones

4.1 Introduction

Link to previous chapter

As explained in Chapter 3, the dissertation is split in two main parts. This first part is concerned with the acceptance of access-based consumption. In access-based consumption, the legal ownership of a product remains in the hands of the service provider, who sells the right of use of a physical product for a limited period of time (Malone et al., 2006) (e.g., through lease or pay-per-use).

Objective of this chapter

This chapter answers a part of:

RQ1A: What conceptual model could be used to understand the interaction between users, mobile phones and providers for the acceptance of access-based consumption?

and

RQ2: What design interventions could enable users to accept accessing mobile phones instead of owning them?

The conceptual framework developed in Chapter 2 and illustrated in Figure 20 is used as a starting point for this research.

The research reported in Chapter 4 explores the factors influencing the decision process and activities around the user acceptance of access-based consumption. These factors are then transposed into potential design interventions affecting the user response of bringing back their mobile phones at the end of the use cycle. The objective at the end of this chapter is to fill in the blue blocks in Figure 20.

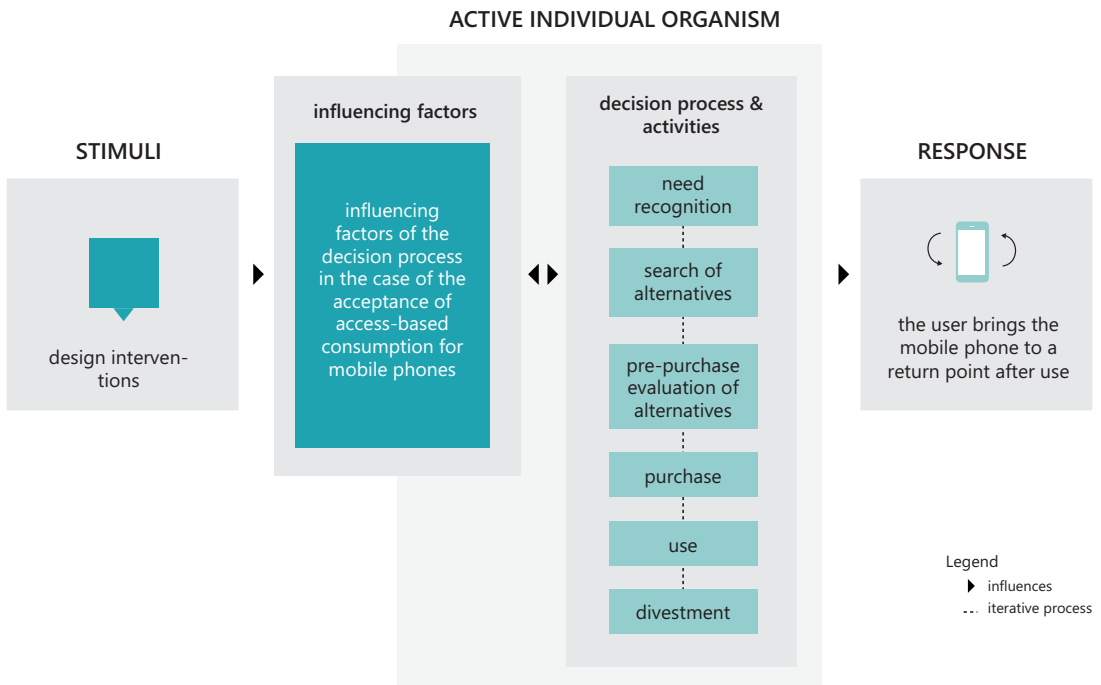


Figure 20. Conceptual model at the core of this research (based the CDP model by Blackwell et al., 2006). The blue highlights represent the points of contribution of this chapter

Outline of this chapter

In order to respond to the RQs and complete the conceptual model, section 4.2 reports an empirical study exploring the factors influencing users' rejection of access-based services for smartphones. The findings are compared with the case of car access services, which are socially better accepted, to identify potential areas for improvement (i.e., design interventions). Section 4.2 is composed of the author's peer-reviewed paper 'Does Access Trump Ownership? Exploring Consumer Acceptance of Access-Based Consumption in the Case of Smartphones' published in *Sustainability* in 2018.

Then, section 4.3 explores how a transition can be made from the classic sales model of mobile phones towards access-based consumption. Section 4.3 is composed of the author's peer-reviewed conference paper 'The (il)logic of ownership – Exploring alternative commercial offers for mobile devices' for the Electronics Goes Green conference held in Berlin on the 7th-9th September 2016.

4.2 'Does Access Trump Ownership? Exploring Consumer Acceptance of Access-Based Consumption in the Case of Smartphones'

This section is composed of the author's peer-reviewed paper 'Does Access Trump Ownership? Exploring Consumer Acceptance of Access-Based Consumption in the Case of Smartphones'. It was published on the 22nd of June 2018 in Sustainability. Since then, the thinking of the inquirer has evolved. For instance, the term 'user' is now preferred over the term 'consumer' as to avoid the negative connotation that people diminish its utility and quality. The conceptual model is now represented with a dotted line to emphasize the iterative nature of the process. Also, several concepts would now be renamed such as "end of the use cycle" instead of "end-of-use" and "business model" instead of "model". Although the original content of the paper has been left unchanged, the layout and the referencing system of the Sustainability paper have been adapted to that of the dissertation. The pronoun 'we' was employed to refer to the authors of the paper: Flora Poppelaars (author of this dissertation), prof.dr. Conny Bakker and prof.dr. Jo van Engelen (her supervisory team).

4.2.1 Introduction

A circular economy (CE) provides a counter weight to our current linear 'take–make–dispose' way of consuming. A CE is "one that is restorative by design, and which aims to keep products, components and materials at their highest utility and value, at all times" (Webster, 2015, p. 16). To allow resources to loop back into the CE, products need to be returned so that their embedded economic value can be reclaimed through reuse, refurbishment, remanufacturing, harvesting of modules and components, and/or the effective recycling of materials (Balkenende et al., 2017; Ellen MacArthur Foundation, 2013). In the existing situation of "sell more/sell faster" (Bakker, den Hollander, et al., 2014, p. 10) where products are owned by their users, the path of unused products depends on the voluntary decision made by the consumer and thus products may or may not be collected at the end-of-use. The concept of accessing instead of owning however offers the certainty of getting back products at the end-of-use (Stahel, 2010). In such an access model (Bakker, den Hollander, et al., 2014) (or use-oriented model (Tukker, 2004)), the legal ownership of a product remains in the hands of the service provider, who sells the right of use of a physical product for a limited period of time (Malone et al., 2006) (e.g., through lease or pay-per-use). This model therefore can contribute to the transition towards a CE by ensuring the return of products and their resource management throughout multiple lifetimes.

One of the challenges of access-based consumption is its acceptance in consumer markets (Annarelli et al., 2016; Vezzoli et al., 2015; Wallaschkowski et al., 2016). Empirical studies on consumer acceptance of access models are scarce (Wallaschkowski et al., 2016) and by and large focused on what happens before the purchase of such a service. These studies rarely consider the thinking process during the use of the service. Empirical studies on consumer acceptance of access models considering the thinking process before and after purchase are specifically rare for the case of smartphones.

The objectives of this study are to explore (1) why access services for smartphones are currently regularly rejected in the consumer market; (2) what can be learned from access services for cars that are more socially accepted; and (3) what may be recommendations for the development of access services for smartphones to ensure customers durably adopt and accept them in the consumer market. By providing an understanding of factors influencing consumer rejection or acceptance of these access services, (future) smartphone service providers could better inform services' design to increase the adoption and acceptance of their access model, and, as a result, contribute to a transition towards a circular economy.

Insights on consumer adoption and acceptance of smartphone access services are generated based on interviews on consumer experiences of existing services. The factors prompting the consumers to buy into smartphone access models and accept them after use (or not) were explored. We interviewed five adopters who purchased and experienced (a) a smartphone lease service by a Dutch telecom provider or (b) a smartphone upgrade service by a second telecom provider, and four non-adopters who did not purchase these services. The more mature and widely accepted car access services (Bardhi & Eckhardt, 2012) were also examined to explore successful factors for the adoption and acceptance of these access-based services. We interviewed six adopters who purchased and three non-adopters who did not purchase the service of (c) a car lease or (d) a pay-per-use car service. The scope of this study is restricted to for-profit business-to-consumer (B2C) access models (as opposed to non-profit, peer-to-peer or business-to-business models) in Western Europe.

This paper is divided in six sections. In Section 2, a conceptual model of consumer behavior is proposed to identify factors in relevant empirical studies of the consumer acceptance on access-based consumption found in literature. Section 3 reports the methodological aspects of the two series of interviews conducted. The factors along the stages of the conceptual model resulting from these interviews are described in Section 4. In Section 5, the implications of these findings on the three objectives of this study and the findings' limitations are discussed.

4.2.2 Consumer Acceptance of Access Models in Literature

Access models differ from traditional transactional models in that the relational exchange is ongoing. Where the relation in a transactional model is mostly centered on the transfer of ownership of a product at a single interaction point, in an access model we see a continuing exchange, throughout the service, up until the point that the product is returned to the service provider. In our literature review, we therefore want to distinguish between the consumer decision process until the point of purchase of a service, and the consumer decision process after purchase (during use). The question driving the literature review is to what extent the literature has empirically explored the consumer adoption and acceptance process of access services.

Adoption and Acceptance Consumer Behavior Model

In order to explore adoption and acceptance of access models in literature, a conceptual model of consumer behavior is first presented based on well-established models in literature. Schiffman and Kanuk defined consumer behavior as “the behavior that consumers display in searching for, purchasing, using, evaluating, and disposing of products and services that they expect will satisfy their needs” (Schiffman & Kanuk, 2007, p. 3). Then, using this model, knowledge gaps are uncovered in empirical studies on the acceptance of B2C access models.

The Consumer Decision Model (Roger D. Blackwell, Paul W. Miniard, 2001), also known as the Engel–Blackwell–Miniard (EBM) model, is one of the most widely cited analytical models and allows us to map and explore the relational exchange throughout the length of the service (from need recognition through to divestment). It is an analytical model because it attempts to provide a framework of the key elements that are claimed to explain the behavior of consumers. The EBM model is a combination of the input, information process, decision process and variables influencing the decision process. The seven core stages of the decision process of the EBM model are thus used as the backbone of our conceptual model (i.e., (1) need recognition, (2) search, (3) pre-purchase alternative evaluation, (4) purchase, (5) consumption, (6) post-purchase alternative evaluation, and (7) divestment), visualized in the dark grey blocks in Figure 21. These stages are deemed “representative for utilitarian, high involvement products like mobile phones” (van Weelden et al., 2016, p. 745). The assumptions underlying the conceptual model are that the thinking process undergone by consumers is linear and that consumers behave rationally.

As visualized by black frames in Figure 21, we made a distinction between the adoption phase and the acceptance phase. This distinction was based on Meijkamp's (2000) model distinguishing the adoption decision with respect to car sharing (which according to his categorization includes "informal arrangements", "neighborhood systems", "short-term systems", "subscription systems", "vouchers systems", and "closed systems"), and the service quality perception after usage (Meijkamp, 2000). For the purpose of this study, we define the term 'adoption' as the psychological action of the consumer of selecting a certain service and making it possible for her/him to use the proposed service. The term 'acceptance' is used to describe the psychological action of credence in a service (including the product at its core). The nuance between adoption and acceptance is that adoption is based on expectations of potential users, and acceptance happens after purchasing the service when the customer actually experiences the service. As a result, the adoption phase goes from the need recognition until the adoption, and the acceptance phase starts after purchasing the service until its divestment. Consumers can reject the service on three different occasions in the model during the adoption phase and once during the acceptance phase. As an analogy, an organ can be transplanted (adopted) but it is not automatically accepted by the receiving body (accepted).

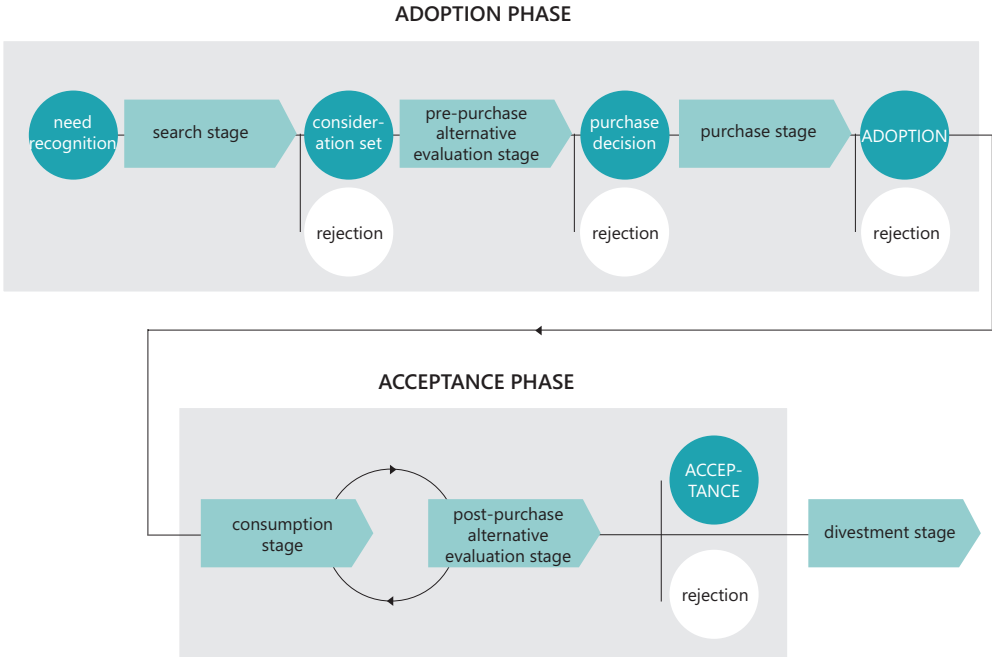


Figure 21. Conceptual model of adoption and acceptance consumer behavior used in this study (adapted from (Roger D. Blackwell, Paul W. Miniard, 2001), (Meijkamp, 2000), and (van Weelden et al., 2016)). Blocks represent the core stages of the process and circles represent the main outcomes of a stage.

We furthermore adopted the approach of van Weelden, Mugge, & Bakker (van Weelden et al., 2016) to put emphasis on the specific outcomes of each of the stages in the consumer decision model by adding circles that depict the moments where a consumer can either continue with, or reject, the purchase and consumption process. This addition of the stage outcomes is due to our interest in the experiences of both consumers who actually used the service and consumers who identified the need for a smartphone or car but rejected the access-based service before using it.

Literature Review of Empirical Studies on Access-Based Consumption

Using the Web of Science and Google Scholar databases, our literature review focused on publications covering empirical studies of consumer behavior for B2C access-based consumption in peer-reviewed journal papers, doctoral theses, and master theses published since the year 2000. The initial review used a combination of the following search terms: "access-based consumption", "non-ownership", "product service system", "access", "performance", "collaborative consumption", "empirical", "rent*", "leas*", "consumer behavior", and used snowballing to capture additional literature. The selection of publications was made considering their relevance to the scope of our study restricted to for-profit B2C access models and thus excluded for instance publications on non-profit, peer-to-peer, product pooling and sharing, or B2B models.

- **Results of Literature Review**

The final overview of 22 studies fitting the scope of the literature review is given in Table 2. The table indicates whether the literature reviewed the adoption or the acceptance phase (with reference to Figure 21) and the kind of product-service studied.

- **Discussion**

The studies considered a variety of products at the core of the service, ranging from transportation to clothing. The majority of the studies identified in the literature address only the adoption phase. They studied the expectations of participants before using the service and did not include the experience of adopters actually using the service (the acceptance phase in Figure 21). It is also clear that, with the exception of Salters (2014), none of the studies address access services for mobile phones in a B2C context.

The majority of the studies furthermore examined hypothetical cases, and not existing services. Therefore, the findings may not be as reliable as when considering the full picture of existing services.

Publication	Phase Studied	Item at the Core of the Service
(Armstrong et al., 2015)	Adoption	Clothing
(Bardhi & Eckhardt, 2012)	Acceptance	Car (Zipcar)
(Christoph Kai Baumeister, 2014)	Adoption	Various
(Catulli, 2012a)	Adoption and acceptance	Car (City Car Club and Street Car) & nursery equipment
(Catulli et al., 2014)	Adoption	Nursery equipment
(Catulli et al., 2013)	Adoption	Nursery equipment
(Gullstrand Edbring et al., 2015)	Adoption	Furniture
(Hanssen & Fjærtøft, 2017)	Adoption	Car
(Kärkkäinen, 2013)	Acceptance	Luxury accessories
(Lamberton & Rose, 2012)	Adoption	Car, bike & phone provider plans
(Lang & Joyner Armstrong, 2018)	Adoption	Clothing
(Lawson et al., 2016)	Adoption	Various
(Lidenhammar, 2015)	Adoption	Furniture
(Limsupanark et al., 2017)	Adoption	Car
(Meijkamp, 2000)	Adoption	Car
(Rexfelt & Hiort af Ornäs, 2009)	Adoption	Various
(Salters, 2014)	Adoption	Phones
(Schaefers, 2013)	Adoption and acceptance	Car
(Schaefers et al., 2016)	Acceptance	Car
(Sowik et al., 2016)	Acceptance	Car
(Trocchia & Beatty, 2003)	Adoption	Car
(Trocchia et al., 2006)	Adoption	Car

Table 2. Overview of selected empirical studies on the adoption and acceptance of access services within the scope of this study.

A content analysis of the selected studies showed common patterns in their findings. These patterns can be categorized into three overarching themes: (A) the importance of trust, (B) unburdening, and (C) habits and necessity.

The first overarching theme concerns the importance of trust. As the results of services are not tangible like the product at its core, the consumers must trust the concept of access-based consumption, the service provider and the community. However, consumers experience a lack of awareness (Gullstrand Edbring et al., 2015)

and have difficulty understanding the access models (Rexfelt & Hiort af Ornäs, 2009; Salters, 2014). Rexfelt & Hiort af Ornäs (2009) and Catulli et al. (2014) show the impact of positive experiences that peers had on the adoption of services. Access models for cars have gained popularity because they increasingly represent an economically savvy, thrifty, and flexible form of consumption, making adopters feel smarter than owners (Catulli et al., 2013, 2014; Schiffman & Kanuk, 2007). In addition, the reputation of the company has been found to play a role in the adoption of access models for cars, nursery equipment, and miscellaneous items, specifically triggered by the power of (high end) brands (Catulli, 2012b; Catulli et al., 2014; Meijkamp, 2000; Rexfelt & Hiort af Ornäs, 2009). In contrast, the early rejection of the service can be provoked by the lack of trust in these types of models due to the perceived availability risk (Christoph K. Baumeister, 2014; Lamberton & Rose, 2012) or lack of trust in the service providers (Armstrong et al., 2015; Rexfelt & Hiort af Ornäs, 2009; Salters, 2014).

The second overarching theme relates to avoiding the 'burdens' linked to ownership. The perceived burdens of ownership (e.g., social, psychological, time, financial, and performance risks of ownership) reduce the willingness of ownership and stimulate the willingness to use of access-based consumption (Limsupanark et al., 2017; Schaefers et al., 2016). Interestingly, access services were found to foster a sense of community before the adoption phase (Hanssen & Fjørtoft, 2017). The augmented ease, convenience and flexibility are highly appreciated by adopters (found by all studies except (Catulli et al., 2013, 2014; Lidenhammar, 2015; Lawson et al., 2016; Schaefers et al., 2016; Sowik et al., 2016)). As highlighted by (Gullstrand Edbring et al., 2015), (Lawson et al., 2016) and (Salters, 2014), having a low commitment provides the opportunity to try alternatives and while maintaining the possibility of reversing the decision seems an attractive way to bypass post-purchase dissonance. Conversely, the access agreement conveys limitations, inflexibility and inconvenience (Christoph K. Baumeister, 2014; Catulli et al., 2013, 2014; Kärkkäinen, 2013; Salters, 2014). Customer have to be careful with the product involved (Christoph K. Baumeister, 2014; Kärkkäinen, 2013) (although inconclusive according to (Lidenhammar, 2015)). Furthermore, low costs/financial commitment were perceived as beneficial (Christoph K. Baumeister, 2014; Catulli et al., 2013, 2014; Gullstrand Edbring et al., 2015; Lidenhammar, 2015; Kärkkäinen, 2013; Lawson et al., 2016; Meijkamp, 2000; Rexfelt & Hiort af Ornäs, 2009; Schaefers et al., 2016; Sowik et al., 2016). Note that (Armstrong et al., 2015) and (Lidenhammar, 2015) found that a one-time fee is preferred.

The third overarching theme touches upon habit and necessity. Engrained habits (Lidenhammar, 2015; Lang & Joyner Armstrong, 2018; Meijkamp, 2000) and

the feeling that these types of models are not meant for the consumer are in the way of the adoption of a specific access model (Lidenhammar, 2015; Meijkamp, 2000; Rexfelt & Hiort af Ornäs, 2009). There is still a desire to own (Gullstrand Edbring et al., 2015; Lang & Joyner Armstrong, 2018; Lawson et al., 2016; Meijkamp, 2000). The social stigma of 'not owning' is also a barrier to the adoption of access models (Christoph K. Baumeister, 2014; Catulli, 2012b; Kärkkäinen, 2013). Moreover, during use, adopters can be disengaged and not attached to the service, product nor service provider (Bardhi & Eckhardt, 2012; Christoph K. Baumeister, 2014; Sowik et al., 2016). The need for sustainable benefits are mentioned in previous empirical studies (Bardhi & Eckhardt, 2012; Christoph K. Baumeister, 2014; Catulli et al., 2013; Gullstrand Edbring et al., 2015; Meijkamp, 2000; Salters, 2014; Sowik et al., 2016) (even though car rental services for example are not considered environmental-friendly (Hanssen & Fjørtoft, 2017)).

4.2.3 Empirical Study: Materials and Methods

Introduction: Cars and Smartphones

To better understand why smartphone access services are generally rejected, lessons from more successful access services are needed. Access models for cars are one of the most mature access services on the market (Bardhi & Eckhardt, 2012) and, as seen in the overview in Table 2, most empirical studies on access services focus on cars. Cars and smartphones share a comparable relationship with consumers as they are both considerable expenses, have a utilitarian function in consumers' daily lives and often are considered as extensions of their users' identity. As a result, car consumers are expected to also be involved in an extensive thought-process throughout the adoption and acceptance phases, making the conceptual model in Figure 21 representative for cars too.

Data Collection

Due to the explorative nature of the research, qualitative methods were used, with in-depth semi-structured interviews with non-adopters and adopters of access services for cars and for smartphones. Eight interview guides were designed based on (Siniscalco & Auriat, 2005) depending on one of the four different services studied (Car2go, BMW, KPN, and Vodafone) and one of the two types of interviewees (a) participants who purchased and used the service (referred to as 'adopters'), or (b) participants who neither purchased nor used the service (referred to as 'non-adopters'). For the non-adopters' interview guides, questions were developed to go through the search, pre-purchase alternative evaluation and purchase stages

with the participants (including e.g., prior experience with alternative forms of consumption and the participant's expectations of the service). The first part of the interview guides for adopters followed similar steps. The second part of the adopters' guides covered the purchase, consumption, post-purchase alternative evaluation and potential divestment stages to explore how participants experienced the service (including e.g., benefits and drawbacks at every stage). Within the time constraints of the study, the distribution of the 18 participants was as indicated in Table 3.

Car		Phone	
Non-adopters	Adopters	Non-adopters	Adopters
car2go n=2 BMW n=1	car2go n=3 BMW n=3	KPN n=2 Vodafone n=2	KPN n=3 Vodafone n=2

Table 3. Distribution of the participants in the study.

This distribution was made based on the fact that both non-adopters and adopters go through the same decision making process but adopt, accept or reject the service at different points of this process. Eight women and 10 men who were between the age of 24 and 63 participated in the study. The intention was to have a diverse group of potential customers and actual customers to explore various rich experiences.

High prestige brands were selected for each concept to contribute to the reliability of this research. After consideration of well-known access models in the Netherlands, the cases of car2go (a pay-per-use service with electric Smarts in Amsterdam) (car2go Nederland B.V., 2018) and BMW Lease (leasing a BMW car through the manufacturer or another service provider) were selected for cars. KPN Lease (lease programs for smartphones by Dutch telecom provider KPN and affiliates in 2012–2014; the telecom provider has a number of affiliate telecom providers were the same lease program was launched. For readability, we will categorize them all under the name of their parent company—KPN) (Bencom B.V., n.d.) and Vodafone New Phone Every Year (an upgrade program by telecom provider Vodafone preceding Vodafone NEXT and enabling the customer to exchange her/his phone for the newest phone on the market after one year for a monthly fee) (Vodafone, n.d.) were chosen for mobile phones. The participants were found in the authors' network or online on open forums dedicated to the specific services. With the participants' consent, the conversations were recorded when possible and transcribed. Online posts from the participants to the service provider were also used as data.

Data Analysis

The data collected was compiled in codes, defined as “consistent phrases, expressions, or ideas that were common among research participants” (Turner, 2010, p. 759). A code name included the stage of the model where the factor occurred and was counted only once per interviewee. The KJ method was used to cluster the identified codes in themes (Scupin, 1997). Neither codes nor themes were pre-defined, as the intention of an explorative study is to uncover themes and patterns unknown in advance. To avoid researcher’s biases and test inter-coder reliability, two non-participating researchers coded a transcript and eliminated or altered redundancies and ambiguous themes (Turner, 2010).

238 codes identified in the 18 interviews were grouped into 17 themes along the adoption and acceptance process. The 17 themes identified in the interviews are as listed in Table 4.

These themes can be interpreted positively (for instance, the convenience getting something new every year) or negatively (for example, the inconvenience of the unavailability of a car in the proximity).

4.2.4 Results

Results: Adoption Phase

Figure 22 shows a summary of positive and negative themes that were most mentioned during the various stages of the adoption phase, for both the car access services (indicated with a car symbol) and the mobile phone access services (indicated with a phone symbol).

We will treat the themes identified in the interviews following the overarching themes of importance of trust, unburdening, and habits and necessity found in the results of the empirical studies. Themes mentioned more than twice are summarized in Table 5.

Themes Related to the Importance of Trust
1. Awareness and familiarity with access-based consumption in general or the service in particular (i.e., acquaintance with access-based consumption or the service)
2. Understanding of the service
3. Reliability of and trust in the service (i.e., responsibility for liabilities and consistency of good quality, ability and performance of the service)
4. Relationship with the service provider (i.e., connection and communication between the (potential) customer and the service provider)
5. Image of the service provider (i.e., general impression of the service provider)
Themes Related to Unburdening
6. Financial aspects of the service (i.e., features of the service relating to finance including price, costs, expenses, payment method and payment scheme)
7. Ease and convenience of the service (i.e., being able to proceed with something without difficulty; e.g., repair process, availability or no need to end the contract)
8. Commitment and flexibility of the service (i.e., level of engagement required for the user to access the offer, and, the adaptability of the service to circumstances & the ability offered to the user to be flexible in life)
9. Confirmation or excess of the expectations formulated before purchase of the service
10. Value from consumption (i.e., importance, worth, or usefulness the interviewee retrieves from the act of consuming)
Themes Related to Habits and Necessity
11. Product characteristics at the core of the service (i.e., the car or phone)
12. Affinity and necessity (i.e., affection and the perceived need of the interviewee towards products and alternative services in general)
13. Sustainability (i.e., aspects relating to expected/perceived care in the design of the service when it comes to people, planet, and profit)
14. Similar use of the product than before
15. Product, service or brand attachment
16. Market (i.e., the arena in which commercial dealings are conducted, and existence or not of alternative products or services)
17. Image of access-based consumption (i.e., general impression of alternative ownership models enabling the temporal use of a product)

Table 4. Overview of the themes identified in the interviews.



Figure 22. Summary of the themes throughout the stages of the adoption phase for the access services studied for cars (indicated with a car symbol) and phones (indicated with a phone symbol). Positive themes are listed at the top and negative themes are listed at the bottom of the figure.

Overarching Themes	Themes (+ Positive, - Negative)	Occurrence		Quotes
		Car n=9	Phone n=9	
(A) Importance of trust	+ familiarity	16	22	"He said 'oh maybe I can lease a car2go from here'. So he started the app and then I immediately got information on how it worked."
	+ reliability and trust in the service	18	13	"It's a party that I have trusted for years."
	+ relationship with the service provider	4	11	"[. . .] and there wasn't actually a catch because it is clear on the site."
	+ positive image of the service provider	3	10	"BMW is qualitatively in a higher segment."
	- trust issues in the service	5	6	"Too good to be true."
	- unaware/unfamiliar	4	6	"Never heard of Lease devices."
	- (partly) misunderstood	1	4	"Maybe it takes longer before the phone is yours."
(B) Unburdening	+ financial aspects of the service	7	11	"Two year all inclusive."
	+ ease and convenience of the service	12	3	"[. . .] at the moment something goes wrong with the product or there is damage, you get a repair or a replacement device."
	+ low commitment with the service	5	4	"If you want out then you'll just get your money back."
	- financial aspects of the service	6	1	"In return it has its costs, as if you are paying back a loan, with every month a certain amount of money."
(C) Habits and necessity	+ product characteristics	8	10	"I believe I caved because of the phone that came with it. I found the Samsung very beautiful, it spoke to me a lot."
	+ necessity	2	3	"It's like 'oh I have to have a new phone', 'oh I have to cut my hair', an intangible need to then have something new."
	+ sustainability	2	2	"I liked electric driving and not one on fossil fuel."
	- lack of necessity or affinity	3	0	"I'm old-school. I'm in the culture of owning."
	- unsustainability	0	2	"I also find it very wasteful."

Table 5. Themes throughout the adoption phase of access models for cars and phones, including their occurrence and example quotes.

- **Importance of Trust**

Reliability of and trust in the service was mentioned 31 times, by both car and smartphone interviewees, particularly by car adopters (18 times). The relationship and communication with the service provider was often valued by interviewees in the case of phones (11 times vs. 4 for cars). Clarity was prized: "And what I very much liked is that the site Vodafone site was very 'Jip and Janneke' [Dutch expression, meaning very easy to understand] and there wasn't actually a catch because it is clear on the site". However, phone services were also (partly) misunderstood (four times vs. one time for cars).

Several interviewees of the phone services had a positive image of the two telecom providers and their relationship (mentioned 10 times for phones, and 3 for cars), although some also mistrusted the service (e.g., "too good to be true"). Familiarity with access models was specifically relevant to the adoption of phone services (22 times). This was mentioned 16 times by car service interviewees. The contrary was also true: unfamiliarity with the service often lead to its early rejection.

- **Unburdening**

The perceived ease and convenience of car access-based services is mentioned 12 times, 3 times for phones (e.g., "I expected it to be a kind of counterpart of an insurance for your phone so at the moment something goes wrong with the product or there is damage, you get a repair or a replacement device."). The low commitment threshold of the engagement with the service was considered beneficial in the adoption phase (four times for phones, five times for cars) ("I wanted [the car] very badly, it was insane, so somebody had to tell me that if I made the wrong decision that they could reverse it"). The financial flexibility of Vodafone New Phone Every Year was appreciated by an interviewee. The financial aspects (i.e., costs and regularity of payments) of the services are found interesting by car and phone interviewees (mentioned 7 times for cars, 11 for phones). Nevertheless, services were at times considered too expensive or the monthly payment construction was not appreciated, especially for cars (six times for cars vs. one time for phones).

- **Habits and Necessity**

The product characteristics are found essential to the adoption of the services (8 occurrences for cars, 10 for phones): "I believe I caved because of the phone that came with it". New (fun) embedded technology is esteemed for both products. The search for a new solution emerged from a subjective need to have a product for BMW Lease (two times), KPN Lease and Vodafone NPEY (three times in total) and was even compared to the habit of cutting your hair regularly.

Also, some interviewees of car services had no interest in a new product or access services whatsoever. Sustainable aspects of the access models were positive factors for both products (mentioned twice). Nevertheless, the unsustainability of services was considered a barrier to the adoption of Vodafone NPEY for two interviewees esteeming the one-year swap opportunity to be wasteful: “you’re not going to force yourself to buy a new phone again every year”.

Results: Acceptance Phase

This sub-section only treats the answers of the interviewees who actually acquired the car or phone service. Themes mentioned more than twice are summarized in Table 6. Figure 23 shows a summary of the themes throughout the stages of the customer decision process during the acceptance phase.

- **Importance of Trust**

Reliability and trust in the service was here again fore mostly mentioned by car interviewees (nine occurrences for cars vs. two for phones). However, interviewees for both the car and phone services (nine occurrences for cars, five for phones) experienced drawbacks in use with respect to reliability and trust in the service (all drawbacks mentioned for cars come from car2go respondents). This included adopters experiencing (digital) technical issues, heterogenic service quality, damages, and safety risks; warranty not according to expectations, or service offered later or in a different way than expected. Next to the perceived availability risk, some were troubled with the experienced heterogenic service quality, damages and safety risks, warranty was not according to expectations, or the service was offered later or in a different way than expected. One interviewee was particularly annoyed and finally did not accept the service, saying, “I want to get rid of it, I don’t trust them anymore”.

Good customer service, guidance throughout the processes of maintenance and repair, and clear communication were esteemed by both car and phone access service adopters (three in total): “you call them up and they’ll make sure to calm you down a little. Yes I find it very relaxed.” Nevertheless, concerns were raised regarding bad customer service, inconvenient physical contact points, and uncertainty as to how to contact the service provider (three times for cars, one for phones). In the case of KPN Lease, interviewees explained to be expecting a similar service as for car lease (i.e., including repairs and maintenance). As a result, these interviewees felt particularly let down by the service provider when it appeared that repair costs were not included and that the adopter had to pay out of pocket for a needed repair. The lack of homogeneity in the message communicated by the customer service experienced by interviewees did not contribute to making this clearer to adopters on forehand.

Overarching Themes	Themes (+ Positive, - Negative)	Occurrence		Quotes
		Car n=6	Phone n=5	
(A) Importance of trust	+ reliability and trust in the service	9	2	<i>"The company has the responsibility over the product so it has to be sound."</i>
	+ relationship with the service provider	2	1	<i>"You call them up and they'll make sure to calm you down a little."</i>
	- unreliability and distrust in the service	9	5	<i>"I want to get rid of it, I don't trust them anymore."</i>
	- bad relationship with the service provider	3	1	<i>"I've been [trying to solve the problem] for four months"</i>
(B) Unburdening	+ ease and convenience	7	2	<i>"You get something new on the market every year."</i>
	+ financial aspects	2	4	<i>"It's not very cheap but yeah it includes parking costs etc., so finally it's wel-priced."</i>
	+ confirmation or excess of expectations	4	1	<i>"Normally, I would not [renew], but they offered such a good service."</i>
	+ feeling of joy and happiness	3	0	<i>"Well I'm still in the phase where I just also use it for fun."</i>
	+ low commitment and flexibility	3	0	<i>"You only pay when you need it."</i>
	- financial aspects	4	5	<i>"When returning iPhone 6 to get the new iPhone 6S with similar specifications, I said 'what?! A down payment? I've been paying 10 euros every month to buy this new phone!'"</i>
	- inconvenience	5	1	<i>"Sometimes it feels like poverty when the car is not there."</i>
	- inflexibility	3	1	<i>"And then I got it back for a rude awakening."</i>
(C) Habits and necessity	+ similar use than before	2	3	<i>"That's what I did with my previous phones."</i>
	- not attached to the product, service or brand	3	0	<i>"I am not materialist, I have no affection towards a product."</i>

Table 6. Themes throughout the acceptance phase including their occurrence and example quotes.

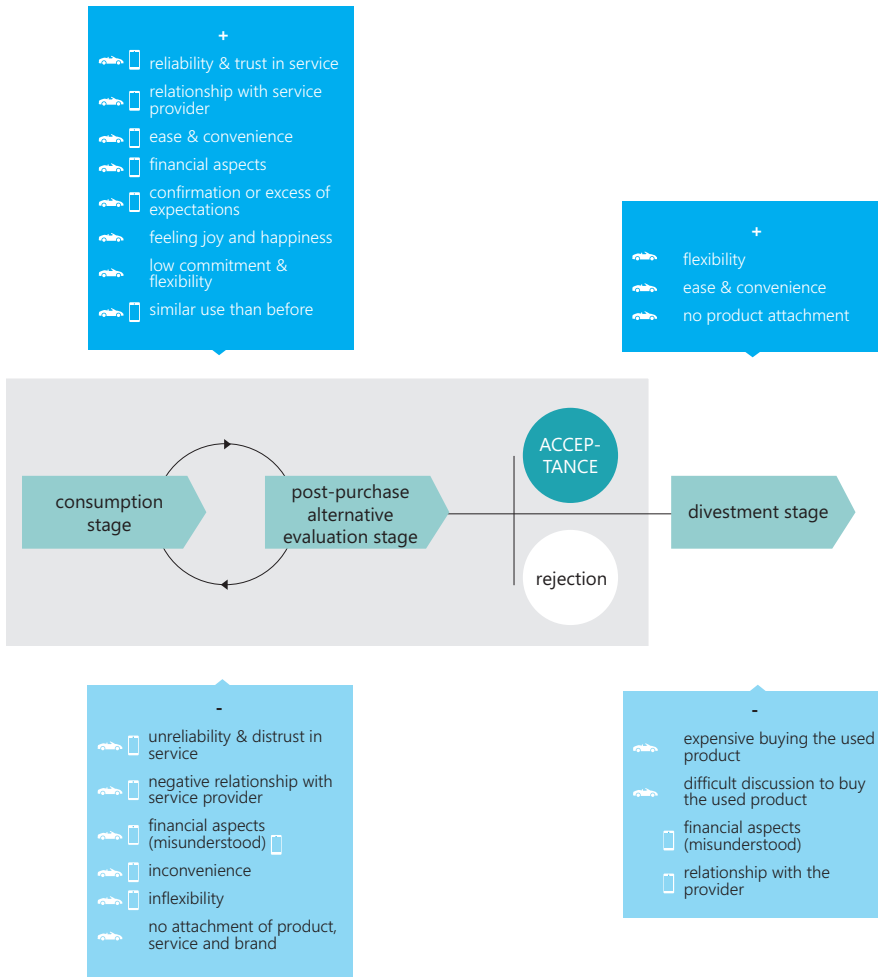


Figure 23. Summary of the themes throughout the stages of the acceptance phase for the access services studied for cars (indicated with a car symbol) and phones (indicated with a phone symbol). Positive themes are listed at the top and negative themes are listed at the bottom of the figure.

- **Unburdening**

Expectations on ease and convenience are confirmed for car adopters (mentioned seven times, two times for phones). On the other hand, car pay-per-use adopters were inconvenienced due to product unavailability or the limited working area of car2go (five times). As one interviewee explained, use patterns are in their majority similar across the car2go adopters. Also, a couple of smartphone adopters were very unhappy with the replacement device they received when their product

was sent off for repair ("You get a replacement device so old (Android 2.3.6.) on which you can't even log into your Google account.").

Financial aspects were seen as positive during the use (two occurrences for cars, four for phones). The financial aspects were even more often mentioned negatively (four for cars, five for phones). This was for example due to the fact that the expenses were more important in use than expected before purchase. The monthly cost construction was also evaluated as unhandy.

The confirmation or excess of expectations is a strong driver to accept the service (four occurrences for cars, one for phones): "Normally I would not [renew], but they offered such a good service."

A feeling of joy and happiness when using the service was mentioned three times by car service adopters. For one pay-per-use interviewee the line between recreational and functional use was even blurred.

The expected low commitment level and flexibility were indeed experienced but only for car access services (three occurrences). Some interviewees valued the fact that there was no need to end the contract: "you only pay when you need it". However, some car and phone access services adopters (three times for cars, one for phones) found that their freedom was restricted during the use of the service. Several adopters were not even aware of these limitations.

- **Habits and Necessity**

When asked how the participants used the product accessed in comparison to a previously owned product, similar use than before (often because of habits) was mentioned two times for cars and three for phones: "If you wouldn't have this option, then you could in a matter of speaking resell it then you try to be as careful with as possible", "Yes I always had a cover on my phone".

The lack of attachment to the product, service or brand, was mentioned three times for cars (e.g., "I am not materialist, I have no affection towards a product."). One interviewee even explained he used the product excessively (compared to the use of an owned similar product) as the car was not his.

4.2.5 Discussion

This study explores the reasons why access-based smartphone services were rejected by interviewed consumers and is one of the very few to address this subject. There are indeed hardly any studies that address access-based consumption in the case of smartphones and most studies on consumer acceptance of access models focus on the adoption phase. This study is unique for its focus on both the adoption and acceptance phase of access-based smartphone services. The findings are

compared with car access services, which are better accepted in society, in order to identify potential areas for improvement for smartphone access services.

This explorative study is based on 18 in-depth interviews and is thus impossible to generalize. However, it provides first insights and a few emerging patterns that may be worth exploring further in more detail.

Which Factors Led to the Rejection of Smartphone Access Services during the Adoption Phase?

The adoption phase describes the thinking process that consumers go through before purchasing the service based on their expectations of it only. We have identified five factors in the results of our interviews that most often seem to lead to the rejection of smartphone access services in the adoption phase.

- **Lack of awareness and familiarity with smartphone access services.** There are not many of these services on the consumer market. In fact, the overall diversity of product categories offered through access-based consumption is limited, with the exception of a few products like cars. Car access services are relatively wide-spread and familiar (car lease is for instance common in a business context) and B2C services are quite visible in the streets (e.g., car2go has recognizable colors and logos on their cars). According to Rexfelt & Hiort af Ornäs, consumers facing an unfamiliar kind of business offer are tending to “see it in the light of earlier experiences” (Rexfelt & Hiort af Ornäs, 2009, p. 689). We did indeed notice during our interviews that participants compared phone access services to car access services. Participants for instance compared KPN Lease with car lease and expected similar terms and conditions (which was not the case). We also found service providers themselves struggling with the newness of the services. In the case of Vodafone NPEY, participants reported that the service provider did not inform prospective adopters of this access-based option. Unfamiliarity with these services may have a negative influence on consumer understanding, trust, and risk perception. Literature (Catulli et al., 2014; Rexfelt & Hiort af Ornäs, 2009) confirms the importance of familiarity of the consumer with access services.
- **Poor image of the service provider.** Simple and to-the-point language, for instance on the website, was appreciated and trusted by some interviewees. However, with others, this raised suspicions (“too good to be true”), especially if the participant had had a prior direct or indirect negative

experience with the service provider.

- **Financial aspects.** In the same fashion as previous literature (Christoph K. Baumeister, 2014; Catulli et al., 2013, 2014; Gullstrand Edbring et al., 2015; *Hopping on the Service Bandwagon Towards a Circular Economy Consumer Acceptance of Product-Service Systems for Home Furniture*, 2015; Kärkkäinen, 2013; Lawson et al., 2016; Meijkamp, 2000; Rexfelt & Hiort af Ornäs, 2009; Schaefer et al., 2016; Sowik et al., 2016), the financial aspects like costs and financial commitment were often mentioned by our interviewees. Some participants felt the costs were unfairly high because they compared the access services with second-hand products (as it was used by other consumers), considered them a sacrifice of freedom of choice (e.g., limited hardware options), or saw them as an increase of future uncertainty/risks (e.g., unavailability of phone before getting a replacement phone in case of repairs). Particularly for phones, not owning the device at the end of use is a considerable barrier as it is seen as an investment and therefore source of income at the end of consumption.
- **Wanting to own.** Similarly to (Meijkamp, 2000), even though the smartphone access service would relieve the burdens of ownership, the perceived need to own new products appeared to be a force of habit. For some participants the perceived need to own new products was very strong, mostly on emotional or financial grounds. Other interviewees, however, argued that the fast new technology cycles were a reason not to own a smartphone and thus a positive motivation for an access model.
- **Sustainability concerns.** A couple of interviewees wanted the service to make sense environmentally speaking, which according to them was not the case for the upgrade program. On one hand, smartphone adopters have been used to changing their device to a newer one after each end of the telecom provider contract (one or two years) as a habit. On the other hand, the sustainability of a service promoting the consumption of a new smartphone every single year was questioned.

Which Factors Led to Rejection of Smartphone Access Services during the Acceptance Phase?

The acceptance phase was defined as the thinking process that consumers go through after purchasing the service based on their actual experience using it.

Three factors were identified in the results of our interviews that frequently seem to stimulate the rejection of smartphone access services in the acceptance phase. The participants show strong adverse reactions when a discrepancy between their expectations and reality occurs.

- **Misunderstanding of the access service.** Some interviewees (especially loyal clients) tended to intrinsically trust the service provider and thus assumed the service was sound. In some cases, the access-based service was misunderstood, leading to participants having the 'wrong' expectations of the service. For example, a consumer was so excited to get a new device that he rushed into the purchase of the service in the store even though he had just heard about it for the first time and without reading the fine print, assuming that the trusted party had good intentions. Also, as mentioned earlier, interviewees said that they expected a similar service as for car lease (i.e., including repairs and maintenance).
- **Stranglehold of the service provider.** Accompanying the misunderstanding of the service, some adopters were unpleasantly surprised by the fact that they had to pay a certain amount out of pocket for repairs before the insurance would pay any expenses. What made it even worse, was that they were forced to repair the device as fines were assigned depending on the state of the returned device at the end of use. The lack of freedom and unforeseen additional costs were disliked greatly.
- **Perceived subpar service by the service provider.** One particular event stood out for all the phone leasers: the break of a device. Drawbacks mentioned by the adopters were the inadequate replacement phone, the rough awakening from being relieved thinking the repair of the lease phone is covered to discovering unanticipated costs, and the recovery process of reprogramming everything back to the original state by the adopter. For two leasers, this resulted in the rejection of the service altogether. Two interviewees felt they were not getting value for their money (i.e., paying for a certain level of service but not receiving it consistently). One interviewee was particularly disappointed in the inconsistent communication from the service provider, especially when a technical error occurred with his contract. Interestingly, one of the three leasers still had a positive experience of the repair process due to the fact that the broken display (along with other unexpected components) were fixed by the

repairer, the repair status could be followed online, and the repair service was perceived as easy, skilled, and convenient (i.e., a third-party repairer from KPN came to the leaser's office).

How to Increase the Chances of Successful Adoption and Acceptance of Smartphone Access Services Based on the Car Access Services Interviews?

Based on lessons learned from car access services, there seem to be opportunities to increase the chance of success of smartphone access models through:

- **Lowering expected risks and uncertainties.** Cars can be test-driven before getting the lease contract. Car2go can be trialed, as the registration to the service is non-committal and the member is only charged when actually using the service. These open-ended trials can instigate curiosity and seem to provide a "nothing to lose" feeling, as well as avoiding the possibility of post-purchase dissonance. The car lease service also diminished the consumer uncertainties by, for example, providing an estimate of the residual value of the car at the end-of-use, enabling the prospected leaser to have an overview of the expenses and investment throughout the life of the product.
- **Financial aspects.** The additional cost premium of the car access services seemed self-explanatory by being all-inclusive and providing an excellent service (linked to the good provider image).
- **Providing all-inclusive services.** Expectations on ease and convenience are confirmed for car adopters (also mentioned in literature (Bardhi & Eckhardt, 2012; Catulli, 2012b; Kärkkäinen, 2013; Schaefers, 2013)). The all-inclusive aspect of the services is appreciated as it takes considerable hassles away (e.g., thinking of refilling the parking meter is unnecessary for the pay-per-use service, thinking about maintenance is taken away by regular check-ups by the lease service provider). In the case of cars, the pay-per-use service is considered a luxurious offer if the usual mode of consumption preferred is not/less convenient. If the car is unavailable, it is a momentary disappointment. However, other mobility alternatives exist to go from A to B (e.g., public transportation or bike). The existence of immediate realistic alternatives makes this unavailability less upsetting than the unavailability of a smartphone. These types of alternative products are not possible

for smartphones that need to be constantly available. Access services for smartphones should therefore enable the constant access to a technically similar device as the one in current use.

- **Carefree value out of consumption.** The perceived need to own new products appeared to be a force of habit. When talking about their consumer behavior, the interviewees seemed to often operate from a gut feeling (e.g., “f*cking chic car [. . .] there are some things you don’t need to think about”). This not only happened during the adoption phase, but was also observed during the acceptance phase where car services would instigate happiness and joy through the use of the “fun” electric Smart enabling the access to a special product. Trust in the service provider and service seem essential here. As a result, the consumer behavior process seems rather emotional in contrary to the rational utilitarian decision-making process we were expecting.
- **Giving access to well-known brands and exclusive products.** Interestingly, the materialistic tendency of one of the interviewees was soothed as the car lease was the only way for him to use a specific car model (mirroring a recommendation from (Lang & Joyner Armstrong, 2018)).
- **Increasing the level of maturity and market penetration of smartphone access services.** The familiar and mature car access market are used as a reference for smartphone consumers when it comes to access services. The offer of a wider range of phone access services would increase awareness and familiarity with such business propositions.

Recommendations to Improve the Adoption and Acceptance of Smartphone Access Services

Based on the above, we provide a number of recommendations that are worth exploring in more detail when designing access-based services for smartphones to increase the adoption and acceptance of smartphone access services.

- **Clear and homogeneous communication throughout the service lifecycle.** Smartphone service providers should be aware that consumers tend to compare the service to other access services they are familiar with, and they should adjust their communication to meet these expectations. Marketing and customer services should instigate trust through care and clearly

yet shortly communicate the rights and responsibilities of the adopters, especially regarding repair, replacement devices, and end-of-use. This communication is particularly essential before the purchase of the service to reduce the chance for the formulation of 'wrong' expectations. Being sustainable may not be the most effective argument to promote access-based services, however an unsustainable service may be a barrier for adoption.

- **Excellent service experience to take over the burdens of ownership and retrieve the value in consumption.** Access services should be all-inclusive to minimize the perceived risks and uncertainties and have transparent costs. The price premium would be more acceptable if the services would focus on high-end brands of smartphones and provide an excellent experience throughout the stages of the adoption and acceptance phase through exclusivity and uniqueness. The residual value of the product at the end-of-use could be fixed from the start in case the adopter wants to purchase it at the end of the contract or wants to calculate the value of the investment over time. As smartphones are continuously used throughout the day and are sometimes considered as an extension of the self, customers want to be connected without interruptions (contrary to the trip-based use of cars). The 'make or break' moment of the repair experience should therefore be outstandingly designed in order to create a seamless use experience. The irrationality of consumers could also be leveraged by incorporating unique and fun elements (i.e., tangible and intangible) of the access to the product as the central value of consumption. Other negative factors, such as the perceived risk of availability, decreasing durability, or lack of novelty during use, could be balanced out by a dynamically adapted value proposition over time (den Hollander, 2018) that addresses soft factors such as cost decrease, extra attention, check-ups, software updates, etc. Services could be as flexible as possible to increase the consumers' feeling of being safe and in control. Low commitment without repercussions could be stimulated by offering trial periods to avoid post-purchase dissonance.
- **New normal: social and business logic shift.** We argue that a business logic shift by companies, as well as a logic shift by society in general, is needed to distance ourselves from ownership to use or value as the central concept of consumption (through access-based consumption) (Poppelaars et al.,

n.d.). As a result of the shift, the amount of access services will increase, the uptake will be larger and the chance of familiarity in the family/friend network of non-adopters will thus increase. Also, the invisibility of the use of the service on the accessed product could be remediated through exclusive phone design (e.g., select color or accessory only available for access service adopters). Appropriate marketing and communication are essential to increase the awareness of these services by automatically mentioning this option when adopters are inquiring about new purchase or extension of the contract with the service provider or manufacturer.

Limitations and Further Research

This study has its limitations and opportunities for further research.

It is impossible to avoid that the human nature of the subjects and researchers influences the accuracy of the findings of interviews. The authors are also aware that the nuance between expectations (before acquisition) and perceptions (after acquisition) can be mixed over time in interviewees' head. The interview guides were designed to avoid as much confusion as possible. Nevertheless, we acknowledge the impact on the validity of the results.

The results of this study are based on 18 semi-structured interviews on four different services. Therefore, the findings are not generalizable. This study can serve as a foundation for further research on this subject to realize practical applications.

The diversity of backgrounds and lifestyles of the sample could be expanded in future studies, where segmentation could also be further researched. 'Generation Y' may, for instance, be an important group to leverage, as it would be more inclined to adopt and accept access-based consumption (Godelnik, 2017).

Privacy issues were not mentioned in our interviews in the case of mobile phones. It may be valuable to research this further as these issues were found in the empirical study on phones by (Salters, 2014).

Furthermore, the power of (brand) community was found in literature (Bardhi & Eckhardt, 2012; Christoph K. Baumeister, 2014; Hanssen & Fjørtoft, 2017) but was not reflected in our interviews. Being part of something provides a sense of fulfilment and joy to some adopters (which was lacking in the case of phones), and could be used in the design of the service and interaction with the service provider and other adopters. Also, this study only considered access services provided by telecom providers. It would be valuable to research how the access services provided by smartphone manufacturers are experienced by consumers (e.g., Apple or Samsung Upgrade Program).

The factors found for the adoption and acceptance of smartphone and car

access services often coincide. However, the final result of the behavior in general seems biased against smartphone access services. The emotions of our interviewees seem to play an interesting role in this process. We wonder whether—instead of using a linear/rational decision-making approach to consumer behavior (like we did as a starting point of this study)—another approach to consumer behavior (taking these irrational considerations into account) would be enriching for the study of the adoption and acceptance of access-based consumption in further research?

4.2.6 Conclusions

Mobile phones have been well-spread since the 1990s, however, in the consumer market, the devices have mostly been owned. Access services for smartphones are therefore new to consumers overall, but also new to most service providers. Experiments with access services for smartphones have been attempted in the early 2010s in the Netherlands. This paper explored the first lessons learned on access-based consumption for smartphones based on a small basis of non-adopters and adopters and compared the findings with car access services to identify areas for improvement.

The rejection of smartphone access services during the adoption phase (based on expectations) seem to happen as a result of participants being unaware and unfamiliar with these services, having a poor image of the service provider, feeling they are not compensated properly for their sacrifice, having sustainability concerns, and still remaining in the habit of owning things. The acceptance of smartphone access services (based on experiences) is hindered by the misunderstanding of the access service, the perceived stranglehold of the service provider and the perceived subpar service by the service provider. The car access service interviews demonstrated the need for service providers to prompt trust by lowering expected risks and uncertainties, to take over risks and hassles of ownership with an all-inclusive service, and to leverage consumers' gut feeling (vs rational decision-making). Based on these insights, the adoption and acceptance of access services for smartphones could be improved through clear and homogeneous communication, an excellent experience taking over the hurdles of ownership while keeping enjoyments (especially with carefree repair process), and a social and business logic shift.

Additional research is needed to validate the findings of this exploration on a larger scale, and investigate the aspects of privacy, brand community, and brand/product attachment further.

Does access trump ownership (Gansky, 2010)? Not yet. Nevertheless, this paper contributes to the field of access-based consumption by providing insights on

why smartphone access services are not as successful as they could potentially be. To enable a transition towards a circular economy, lessons have been drawn from the case of car access services and some recommendations were made to start tipping the scale.

4.3 The (il)logic of ownership - Exploring alternative commercial offers for mobile devices

This section is composed of the author's peer-reviewed conference paper 'The (il)logic of ownership – Exploring alternative commercial offers for mobile devices' for the Electronics Goes Green conference held in Berlin on the 7th-9th September 2016. Here again, the thinking of the inquirer has evolved. For example, a user perspective was selected in this dissertation whereas this paper was mostly written from a company perspective where 'users' become 'customers'. At this point in the research, the term 'alternative commercial offers' was employed to refer to business models other than the 'classic sales business model'. Later in the research, this differentiation evolved into 'access-based consumption' (i.e. these alternative commercial offers) versus 'ownership-based consumption' (i.e., the classic sales business model). Similarly as with the previous paper, the original content of the paper has been left unchanged, only the layout and the referencing system have been adapted to fit the dissertation's. The pronoun 'we' was employed to refer to the authors of the paper: Flora Poppelaars (author of this dissertation), prof.dr. Conny Bakker and prof.dr. Jo van Engelen (her supervisory team).

4.3.1 Introduction

Mobile devices like laptops, tablets and phones have become an integral part of modern everyday life. The classic concept of owning products however engenders considerable losses throughout the value chain (Ellen MacArthur Foundation, 2013). As the world's middle classes with 'high quality' living standards are expanding (Ellen MacArthur Foundation, 2013), the use of these devices is expected to continuously grow in the coming years. The current linear 'take-make-dispose' model will thus give rise to a significant increase in the amount of e-waste. This in sum causes an intensification of global competition for certain resources (especially of critical raw materials), which is translated into volatile costly prices, supply risk and additional pressure on the environment (Peck et al., 2015). Customers dispose of products because these suffer from "absolute obsolescence" (product failure) and "relative obsolescence" (psychological, technological or economic obsolescence) (Cooper, 2004). Due to, but not limited to, evolving trends (Ellen MacArthur Foundation, 2013), fast developments in technology (Saphores et al., 2006) and (for the case of phones and tablets) the fixed duration of provider subscription contracts, the lifespan of electronic products is decreasing, which worsens the resource losses (Bakker, Wang, et al., 2014).

A *circular economy* (CE) provides a counter weight to the throughput of products. It entails “an economy that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times” (Ellen MacArthur Foundation, 2016, p. 18). A CE is geared at decoupling economic growth from the consumption of finite resources (Ellen MacArthur Foundation, 2016). In order to transition to a circular economy, one of the approaches for manufacturers is to capture the embedded value in their products through reuse, refurbishment, remanufacturing and/or recycling (Ellen MacArthur Foundation, 2016). These processes require that used products be returned to manufacturers, service providers and/or third parties to regain ownership over the embedded value of the end-of-use products and process them.

In the existing situation, the path of unused devices depends on the voluntary decision made by the customer. Various collection initiatives from governments and businesses (including for example municipal collection points, trade-in, mail-back or buy-back services) are in place to enable and motivate the customer to return their devices (Ongondo & Williams, 2011). Yet customers are reluctant to give back their belongings at the end of life/use resulting in relatively low collection rates (Tanskanen, 2012). This can be explained by amongst others a lack of awareness or convenience of the collection points (Tanskanen, 2012). Customers also tend to keep these small products in ‘hibernation’ stored away (as spare) or forgotten in drawers and attics (Ongondo & Williams, 2011; Tanskanen, 2012). Consequently, the embedded (physical and emotional) value of the product decreases during that period of time, making it even less interesting to dispose of responsibly. Without customer participation in prolonging and closing loops, the prospect of designing products and systems for a CE seems poor for businesses. Two issues need to be addressed in order to transition towards a CE: (1) the loop needs to be closed by ensuring that specific manufacturers get back their devices from their customers, and (2) unused devices should be prevented from going into hibernation so as to capture the devices at their highest value. As the aforementioned return logistics initiatives have been rather unsuccessful, it seems customers do not respond well to the current approaches. Perhaps looking at the acquisition phase might provide a valuable answer instead of focusing on end-of-pipe collection solutions.

Customer product ownership through a ‘classic sales offer’ – where the ownership of a product is transferred at the point of purchase from retailer to customer in one single transaction – has been the dominant form of consumption of electronic consumer devices. Here, the customer has the power/mastery over

a product, holding it as property (Merriam Webster, n.d.). Offers providing an alternative (such as sharing or leasing) may have the potential to enable companies to regain their volumes and to cycle them further in a circular system (Ellen MacArthur Foundation, 2013). As opposed to the traditional customer product ownership, in these alternative offers, the user of the actual product is not the owner (or, not the sole owner in the case of sharing).

We take the perspective of focusing, for now, on options that do not transfer product ownership at the start of the consumption cycle. This paper will focus on commercial offers for private customers (as opposed to free offers or business-to-business offers), delivering an alternative to the classic sales offer for mobile devices through for example leasing and pay-per-use schemes. The business remains the owner of the product while enabling a customer to enjoy the perks and functionality of the device. To get access to the product or service, the customer pays a certain amount per interaction/use/month/etc in exchange.

Literature on alternative commercial offers is relatively underdeveloped compared to literature on more traditional sales offers. This is particularly true in the case of mobile devices in contrast to better established examples in for instance the fields of transportation and spaces. As research on the topic is scattered across disciplines and fields, the studies are multiform and used terminology and taxonomy varies considerably. This paper attempts to conceptualise the opportunities of commercial offers providing a different logic by aligning the terminology and taxonomy related to these commercial alternative offers.

The paper will first explore what the place of ownership is in the status quo for mobile devices (in part 2). By studying past and current alternative commercial offers for mobile phones, it also proposes taxonomy of these offers tailored for these devices (part 3). It finally (part 4) suggests how a change in logic could solve the issues of closing the loop and preventing value hibernation.

4.3.2 Ownership logic when providing a mobile device

Ownership has taken various shapes in the current landscape of mobile device offers. Most offers including the 'classic sales offer', equipment instalment plans (EIP) and provider subscriptions, facilitate the dominant customer product ownership paradigm. These are challenged by commercial alternatives in which companies remain the owner of the devices.

For 'classic sales offer', the retailer sells a device to a customer thus transferring product ownership through a single transaction at the point of sale. According to institutional economist John T. Commons, "transactions are, not the 'exchange of commodities', but the alienation and acquisition, between individuals, of the rights of property and liberty created by society, which must therefore be negotiated between the parties concerned before labour can produce, or consumers can consume, or commodities be physically exchanged" (Commons, 1931, p. 4). It allows the owner to use, control, manage, and enjoy the good owned (Schwab, 2007) (cited by (Moeller & Wittkowski, 2010)). The burden of, for example, maintenance or storage must also be borne (Berry & Maricle, 1973) (cited by (Moeller & Wittkowski, 2010)).

An equipment instalment plan is a payment option enabling customers to purchase a device through monthly payments. This will transfer the ownership of the product from the retailer to the customer once all the instalments have been paid. Customers have to be 'qualified' to apply and must enter a financing agreement of at least one year.

Through provider subscription, customers can get a device (in this case most commonly a smartphone) by committing to make a continuous monthly payment with a specific provider for one or two years. Here the customers pay for only the service provided, meaning the possibility to call, text and use data (but this does officially not include the phone). In return, the provider subsidizes the customer's device making it either free for the customer or affordable at a discounted price. The product ownership is transferred from the provider to the customer at the end of the contract (when all the monthly payments have been issued or when a fee is paid by the customer to terminate the contract earlier).

Alternative commercial offers have existed for decades (Durgee & O'Connor, 1995) and are lately gaining momentum (Moeller & Wittkowski, 2010) with the rise of companies such as Zipcar and Uber. Both enterprises enable customers to transport themselves from A to B without the need of owning a vehicle. Customers have only recently grown more comfortable with adopting these alternative offers. Although commercial alternative offers used to be reserved to a small category of products (e.g. music, car, books), the range of goods available for private customers through these alternatives to classic sales offers has expanded to inter alia luxury goods, power tools and electronic appliances.

Alternative commercial offers for mobile devices are nevertheless at an early,

exploratory stage. In the past years, a few companies are trying / have attempted to bypass the status quo of collection systems by changing the way they offer mobile devices. Leasing a phone is certainly not a new concept. Indeed, throughout the 20th century, Bell System used to lease their telephones instead of selling them to customers (Porticus Center, n.d.).

4.3.3 Alternative commercial offers

To make the opportunities more tangible for industry, the overview of alternative commercial offers for mobile devices should be transparent. The terms, definitions and classifications of commercial offers different from classic sales are not used uniformly in literature and need to be aligned.

Categorizations in literature

An overview of the categorization made in literature of alternative commercial offers is compiled in Table 7. We discern three overall categories: (1) the business owns the product, the customer gets to use it; (2) the business owns the product, the customer gets its resulting performance; and (3) hybrid between the business being the product owner to the customer being the product owner during the use phase.

Bakker, den Hollander, et al. (2014), Judd (1964), Lawson (2011), and Tukker (2004) explore categories (1) and (2) when looking into 'business model archetypes', 'marketed services', 'non ownership' alternatives, and types of 'product-service systems' (respectively). Van den Bos (2012) characterise offers fitting in category (1) and (3).

1. The first outlined category is called differently across literature: 'use-oriented' by Tukker (2004), 'flexible non-ownership', 'access model' by Bakker et al. (2014), and 'rented goods service' by Judd (1964). Tukker describes two types of offers that fit within our scope: 'product lease', and 'product sharing/renting'. Van den Bos (2012) lists offers that fit into this similar category, namely: 'rental' and leasing (including 'financial leasing' and 'operational leasing').

2. The definitions of 'result-oriented' (Tukker, 2004), 'performance model' (Bakker, den Hollander, et al., 2014) and 'non goods service' (Judd, 1964) fit in the second category. Here again, Tukker specifies the types of offers within this category being 'outsourcing', 'pay per service unit' and 'functional result'.

3. Van den Bos (2012) and Lawson (2011) offers that can fit in the third category of offers with the concepts of 'financial leasing' ('rent-own') and 'lease purchase', and 'contractual non-ownership'.

	1. The business owns the product, the customer gets to use it	2. The business owns the product, the customer gets its resulting performance	3. Hybrid between the business being the product owner and the customer being the owner during use phase
Bakker et al. (2014)	Access Model: provides product access rather than ownership	Performance Model: provides the product's performance rather than the product itself	
van den Bos (2012)	Leasing: contracts the user to pay provider (owner) for the use of an asset. > Operational leasing: a portion of the economic ownership (insurance and maintenance) is for the lessor. The user cannot have the option of purchasing the product.	Renting	> Financial leasing: even though the provider maintains the legal product ownership, the insurance and maintenance responsibilities are for the user. The user can have the option to purchase the product (comparable to rent-to-own) > Lease purchase: product ownership is transferred to the lessee.
Judd (1964)	Rented goods service: "The right to possess and use a product"	Non goods service: "No product elements but rather an experience or what might be termed experiential possession"	
Lawson (2011)	Contractual non-ownership: the provider has the ownership rights and responsibilities but offers the customer access of the product for a determined period of time with transferring the responsibility for maintenance and storage Flexible non-ownership: idem, without the responsibility transfer for maintenance and storage		
Tukker (2004)	Use-oriented: product ownership is with the provider		Result-oriented: all about the result of an asset, without "pre-determined product involved"
	Product lease: exclusive use of an asset without ownership transfer Product sharing/renting: non exclusive use of an asset without product ownership transfer	Out-sourcing: the owner of an asset is a third party that provides a product related service Pay per service unit: the customer pays for the output of an asset depending on the use level Functional result: the service provider supplies a specific result	

Table 7. Categorization of alternative commercial offers (other than classic sales offers) in literature

Key concepts

Alternative offers come with, amongst others, a different payment construction,

company/customer relationship, customer experience and customer relationship to the product (Durgee & O'Connor, 1995; Lawson, 2011). In order to grasp the nuances between the categories of offers and classify them, key concepts of 'consumption', 'transaction', 'ownership' and 'residual value' need to be clarified.

For the purpose of this paper, 'consumption' is used to define the process from the moment the 'consumer' acquires a tangible product to the moment of end-of-use and disposal of the good. Etymologically, the term consumption evolved from meaning 'wasting of the body by disease' in the late 14th century to 'using up of material' in the 16th century (Dictionary.com, n.d.). In the case of mobile devices, the value of the product does not have to decrease solely due to wear and tear but can also happen because of the diminishing worth of technologies over time (i.e. without even actually using the product). Per its current definition, the use of goods (even durable ones) is destructive and deteriorates its value over time from the moment of acquisition to the end-of use. Customers not only consume the material, but also the meaning of the tangible product.

'Transaction' is an imperative for consumption; a good or service is acquired through a transaction between the provider and the customer. In the classic sales offer, the transaction happens at the point of sale. For a classic sale of a tablet, the financial transaction takes place for example at a store at a single point in time. Customers tend to evaluate only the transactional costs at this point of sale (i.e. the price of the sale), sometimes preferring cheaper costs at the acquisition instead of more economical options on a longer term (Ellen MacArthur Foundation, 2014). In the eyes of the owner, ownership rights have been acquired at once by one monetary exchange.

Little to no future expenditures are expected during use or disposal. For alternative commercial offers, transactions over time can facilitate alternative ownership relationships while providing the same possibility to consume a product. When for example leasing a device, a monetary transaction happens every month to use the smartphone.

In our context, the term 'ownership' is used when a customer, company or third party holds a product as its property (Merriam Webster, n.d.). Etzioni observes that this is a "dual creation, part attitude part object, part in the mind, part 'real'" (Etzioni, 1991, p. 466). Note the distinction between legal ownership ('real') and psychological ownership ('in the mind') (Demyttenaere et al., 2016; Pierce et al., 2002). Although a user can enjoy the use of a product as if it is her/his own when

it comes to extracting the meaning of the product, it does not always mean she/he legally owns it – and vice versa. We will solely consider legal ownership in this paper. Whether in the classic sales offer or in the aforementioned alternative commercial offers, one party always owns the product, the customer, or the provider. Considering leasing again, the customer may enjoy psychological ownership over the mobile phone although Sprint remains the legal owner of the device. For a classic sale, the (legal and psychological) ownership is transferred from the provider to the customer.

The 'residual value' of a product is its worth at the end of use/ownership when a further transaction can take place. This phase is neither the end of the life cycle of the product nor that of the embedded materials. Even though the value of a purchased smartphone decreases over time by, amongst others, capturing or consuming the product's value, it can be sold as a second hand product to a new user. The customer usually gets fined when the product is returned damaged, as the company's investment depreciated more than wear during normal use. The residual value is not only financial but also moral. Indeed, the potential of recycled resources in a resource scarce world and consequently the avoided negative environmental impact that is facilitated by the return of a device need to be accounted for.

Summary of categories of commercial offers for mobile devices

Clustering the categories from literature in Table 7 and considering the described key concepts, Table 8 compiles categories of offers relevant for mobile devices: (1) classic sales (described in part 2), (2) access, (3) performance and (4) hybrids.

Access offers (2) combine Bakker et al.'s 'access model', a portion of 'leasing' offers by van den Bos, Judd's 'rented goods service', 'contractual and flexible non-ownership' by Lawson, and the 'useoriented' offers by Tukker. These offers enable the customer to have surrogate product ownership (to a certain extent). This entails that the provider keeps the ownership rights and responsibilities while offering the customer temporary access of a product. The model is based on a contractual agreement that requires payments over time, penalties for breaking the contract and requirements to maintain (and potentially secure) the value of the accessed product. This is done when full-time ownership of the product is unaffordable and/or unnecessary (Bakker, den Hollander, et al., 2014). The lawn mower you would like to use occasionally but cannot store on a long term can be accessed through Home Depot for the time required. The expensive Chanel bag you would love to have in

your hands but cannot afford can be 'borrowed' from Avelle (bagborroworsteal.com). Access offers are product dependent and are thus in a more direct competition with buying a mobile device, including the device in provider subscriptions. Several telecom providers and third parties offer/have offered customers the opportunity to get to use a device for one or two years through offers such as Sprint Lease, O2 Lease, Tmobile Jump! and KPN Lease. The customers pay a monthly fee to access a specific product for a predefined period of time. At the end of the contract, the customers can sometimes be offered to pay off the residual value of the product in order to own it instead of returning it to the company (thus becoming a hybrid offer if this option is used).

Performance offers (3) combine the 'performance model' by Bakker et al., 'non goods service' by Judd, and 'result-oriented' offers from Tukker. They entail that the provider retains the ownership rights and responsibilities, however the customer gets temporary access of a good and does not need to be a surrogate owner when it comes to maintenance, storage and divestiture (Lawson, 2011). In this scenario, the customer is enjoying the functionality of the product independently of its embodiment: it is all about the performance/result of the product. For customers who are interested in light (as opposed to interested in luminaires) Philips, for instance, offers the possibility to pay per lux (Bakker, den Hollander, et al., 2014). Another way to offer the performance of a product would be to enable people to use the functionalities. Fitting in this category, specialized companies (i.e. Rentoid, Explora, Triptel or Zilok) offer the possibility to be reachable and call for one day to a couple of months. Here again the product is returned after the specified period of time.

In a fourth category, hybrid offers combine customer product ownership and company product ownership throughout the use phase of the devices. It is based on van den Bos' 'financial leasing' and 'lease purchase'. We include EIP, provider subscription and upgrade plans in this category of offers. In an upgrade plan, the customer pays a monthly fee on top of their monthly plan to have the right to break her/his contract open to get a newer device after a certain time. The product has to be handed back to get the newer device, but the customer is also allowed to pay off the remaining value of the product to own it (cancelling out the right to upgrade to a newer device). Interestingly, for this type of offers, both telecom providers (such as Vodafone's New Phone Every Year, AT&T Next, T-mobile Jump! On Demand, or Verizon Edge) and original equipment manufacturers (Apple, Samsung) are using these constructions. These formulas are especially catching on in the past years.

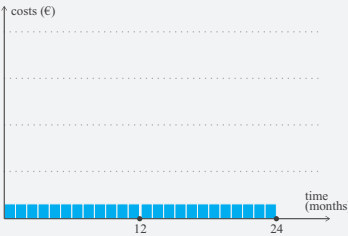
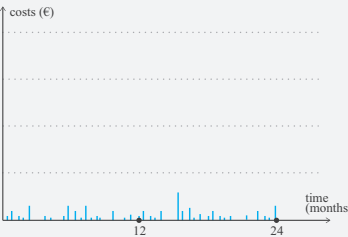
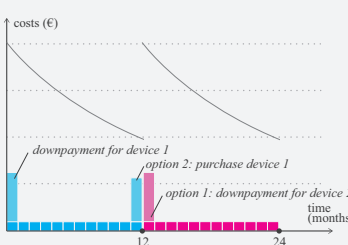
	Product ownership	Example of transactions and residual value (when applicable) during the consumption	Examples for mobile devices
1. Classic sales: Selling the transfer of product ownership at once	The ownership of the product is transferred at point of sale from retailer to customer	 The graph shows a single high initial cost (blue bar) at month 0. A curve labeled 'residual value (if working)' starts at the top and decreases over time. A small yellow bar labeled 'maintenance' is shown at month 12. The x-axis is 'time (months)' with markers at 12 and 24. The y-axis is 'costs (€)'.	Sales at a retailstore (online or offline)
2. Access: Selling the use of a product to the customer	The provider remains the owner of the product, while the customer can temporarily be a surrogate owner	 The graph shows a series of regular, low-cost payments (blue bars) over time. The x-axis is 'time (months)' with markers at 12 and 24. The y-axis is 'costs (€)'.	Sprint Lease, O2, T-mobile Jump!, and KPN Lease
3. Performance: Selling the result of what an asset produces without pre-determining the product used	The provider remains the owner of the product	 The graph shows irregular, variable-cost payments (blue bars) over time. The x-axis is 'time (months)' with markers at 12 and 24. The y-axis is 'costs (€)'.	Rentoid, Explora, Triptel and Zilok
4. Hybrids: Combination of 1 and 3 or 4	Combination of the aforementioned categories	 The graph shows a combination of costs: a high initial cost (blue bar) at month 0, regular payments (blue bars) over time, and a final purchase option (pink bar) at month 12. The x-axis is 'time (months)' with markers at 12 and 24. The y-axis is 'costs (€)'.	Equipment Instalment Plan; provider subscription; and Upgrade Programmes such as Vodafone's New Phone Every Year, AT&T Next, Tmobile Jump! On Demand, Sprint iPhone/Galaxy forever; or Verizon Edge

Table 8. Summary of commercial offers for customers from a business perspective for mobile devices

4.3.4 Changing the logic

None of the studied alternatives seem to be a convincing commercial success. Note the leasing plans provided in the Netherlands by KPN, Telfort and Hi in the

early 2010's were cancelled within a couple of years. The diversity of upgrade plans has expanded and evolved in the past years though yet captures a relatively small share of private users. The alternative commercial offers for mobile devices are however rather young initiatives, which have to prove themselves. These are interesting developments that nonetheless have failed so far to entice the majority of mobile phone users.

Reasons behind this seemingly indifference from the consumer market need further investigation. We speculate this disinterest might inter alia be explained by the fact that both businesses and customers tend to be stuck in the same logic of ownership where growth can only be achieved if the number of products consumed (material output) increases. As a result, in light of the way people talk to each other, society is prejudiced to view these alternatives with continuous payments as amongst others a risky endeavour as well as a 'poor man's choice'. In this paradigm, from a customer psychology perspective, the preconception of preferring owning over using a product without a transfer of ownership from company to customer is perpetuated. This can nevertheless change if the logic changes.

According to Rachel Botsman and Roo Rogers, "collaborative consumption is not a niche trend, and it's not a reactionary blip to the recession. It's a socioeconomic groundswell that will transform the way companies think about their value propositions— and the way people fulfill their needs." (Botsman & Rogers, n.d., p. 1).

In order to enable products and resources to be maintained at their highest value, businesses need to re-evaluate their logic. Business logic (or 'enterprise logic') can be defined as "the overall logic shaping a firm's strategy, structure, and management processes into an effective whole" (Miles et al., 1997) (cited by (Nijs, 2014)). As advocated by Nijs (2014), it is time to evolve away from the industrial exchange logic of value creation (i.e. manufacturers create value whilst customers destroy it) towards a new logic of co-creation (i.e. all stakeholders contribute to value creation).

For this to succeed with the support of existing enabling technologies, enterprises need to alter their behaviour (Zuboff & Maxmin, 2002) (cited by (Nijs, 2014)). In this way, "the collective [can] function in a more complex environment" (Nijs, 2014, p. 94).

In the past half-decade, the mainstream examples of Uber or Airbnb have

had a major transformational impact by opening customers and companies' eyes on new conceptualisations of enjoying the use or performance of a product. Similar innovative offers could be introduced in the mobile device market, making a shift in the logic of ownership emerge from both the customer market as the business world. One could for example think of new access constructions co-creating value with customers and businesses that reduce perceived financial risks, or exploit the gap in long-term performance offers.

4.3.5 Conclusions

Alternative commercial offers enable companies to remain the owner of their products throughout the product's life cycle. This would ease the closing of their material loops and secure a steady stream of products at a relatively high value, in contrast to attempting to regain product ownership at the end of pipe from the customer's hands.

Building upon the different categories of alternative commercial offers described in literature, an overview of taxonomy of these offers was proposed for the case of mobile devices. The main categories have been clustered into: access offers, performance offers and hybrid offers. The first focuses on the use of a product, the second on the result of the use of a nonpredetermined product, and the latter combines aspects from classic sales offers with access and performance.

The conceptual framework⁹ drafted in this paper has the potential to contribute as a good foundation to try out the exposed alternative offers and change perceptions of the market by changing the business logic. Shifting the logic from product ownership as its central concept to use or value as its central concept is a promising opportunity to solve the issues of closing the loop and preventing value hibernation.

9 This term in the paper does not refer to the one used in this dissertation

4.4 Conclusion

Chapter 4 focused on answering

RQ1A: What conceptual model could be used to understand the interaction between users, mobile phones and providers for the acceptance of access-based consumption?;

and

RQ2: What design interventions could enable users to accept accessing mobile phones instead of owning them?

- **The CDP as starting point.** The first study in this chapter showed that the classic CDP model adapted with several stipulations made earlier in this dissertation (see Section 2.5) serves as an acceptable starting point for this research to explore the context of consumption central to this dissertation.
- **Enriching the conceptual model.** The chapter contributed to the user acceptance of access-based consumption by providing a better understanding of factors influencing the thinking process of users. The findings coming from the exploration of early access services attempts for smartphones from the first paper (4.2) are summarized in Figure 24.
 - **Influencing factors.** Influencing factors were divided into two categories: the ones negatively influencing the adoption phase of the smartphone access service (including the 4 first stages of the decision process and activities) based on the interviewees expectations, and the ones negatively influencing the acceptance phase of the service (foremostly focusing on the use stage of the decision process) based on users' experience. Factors negatively influencing the adoption phase were the lack of awareness and unfamiliarity with these services, the poor image of the service provider, the feeling to not be compensated properly for the sacrifice of not owning, remaining in the logic of owning things, and having sustainability concerns. Factors negatively influencing the acceptance phase were the misunderstanding of the access service, the perceived stranglehold of the service provider and the perceived subpar service by the service provider (especially when it came to a repair experience).

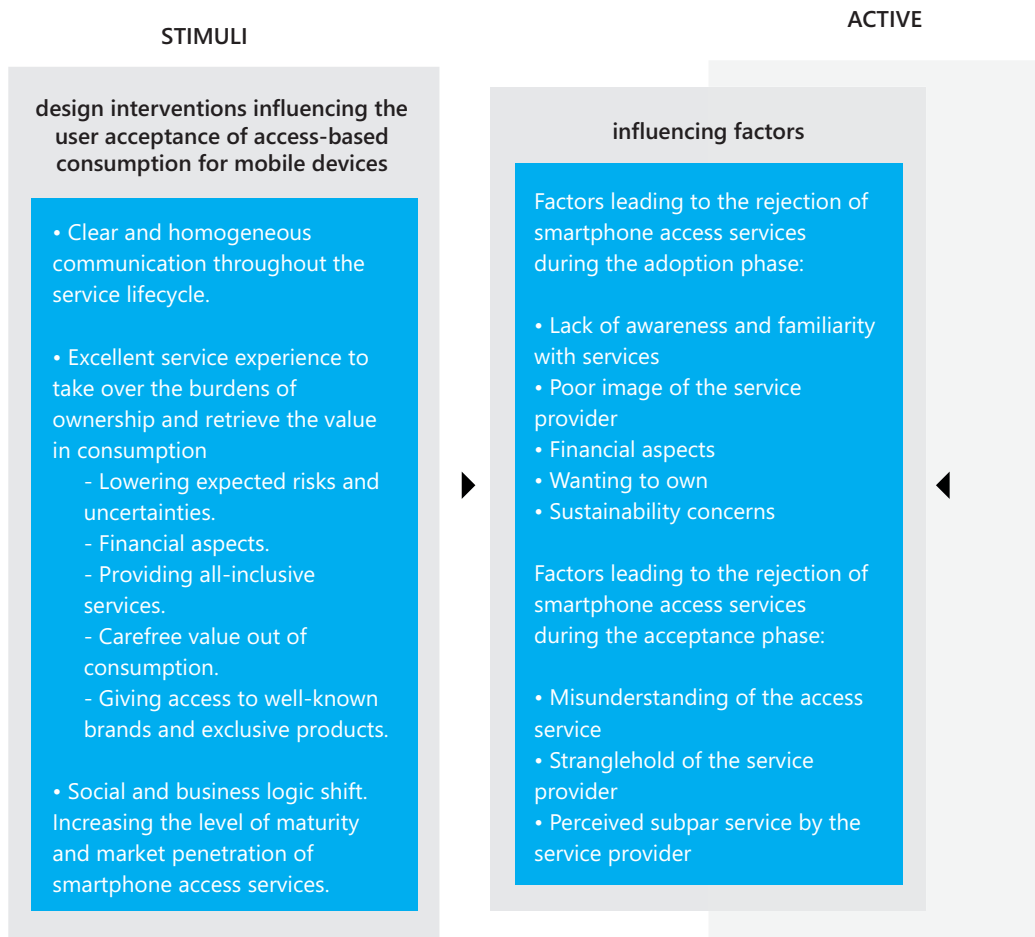
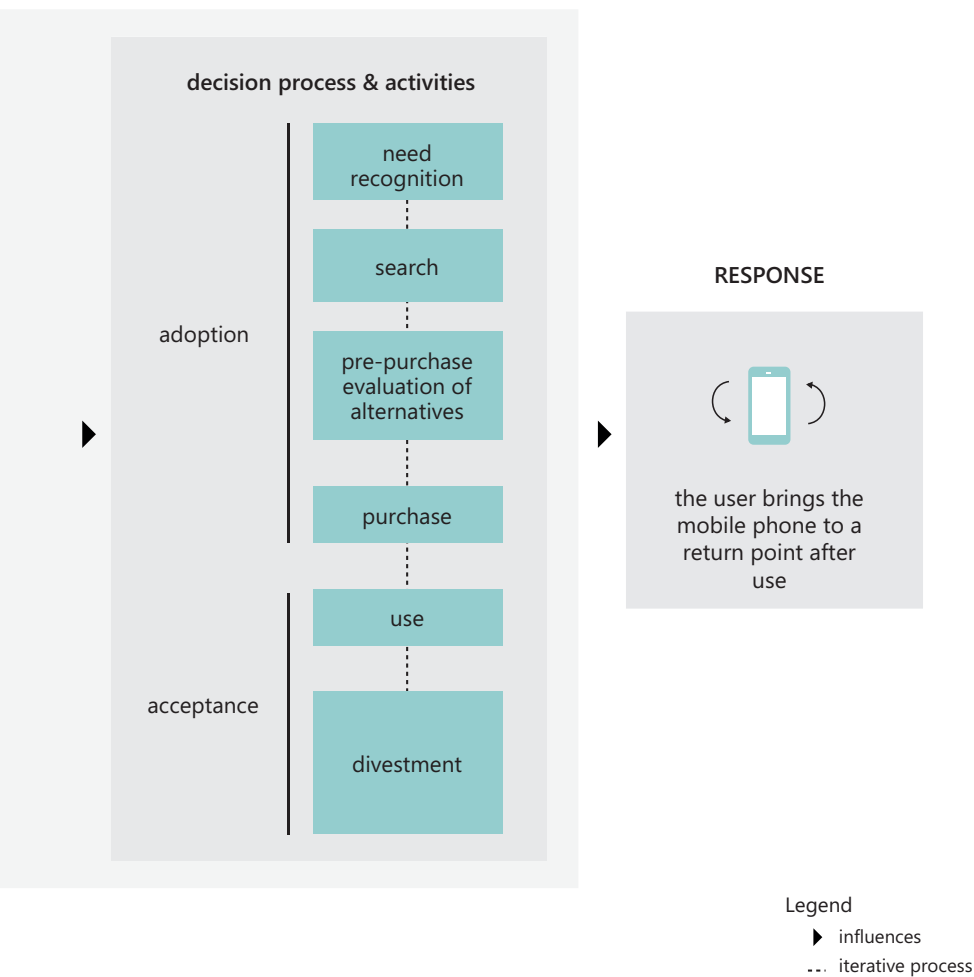


Figure 24. Conceptual model including the findings of Chapter 4 in the dark blue blocks

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- **Design interventions.** Based on insights from interviewees of more widely accepted car access services, design interventions were identified to improve the acceptance of access-based consumption for mobile phones. These design interventions count: clear and homogeneous communication to avoid misunderstand of these unfamiliar services, an excellent experience taking over the hurdles of ownership while keeping enjoyments (by lowering expected risks and uncertainties, interesting and clear financial aspects, receiving carefree value out of consumption, and getting access to well-known brands and exclusive products), and a social and business logic shift.
 - **Reflecting on the factors and design interventions.** This chapter's findings show that the problem is complex and compound. Rich insights were collected through interviews with a relatively small number of participants and resulted in a variety of factors influencing the acceptance of access-based consumption. Note that the identified factors are interdependent and not as clear-cut as they seem. The enriched conceptual model however provides further understanding of how they are linked to describe the phenomenon.
- **Needed logic shift.** In the second paper (4.4), an overview of the taxonomy employed in literature on these types of business models was provided to identify the categories of commercial offers for mobile phones. Therefore, insights are provided for companies to develop potential services including the design interventions mentioned in Figure 24. A logic shift is also essential for users to accept access-based consumption. While the logic currently focuses on (both psychologically and legally) *owning* a phone, the logic can be shifted towards the *use* of the device. The use of the device, or at least its function and what it represents, is attained by the user through access, performance and hybrid business models. Companies could co-create value with their users with these models and implement the insights from the first study to soften the habit of owning and stimulate the acceptance of access-based consumption. With the quick acceptance of Uber and Airbnb, services could leverage this wave to shift the users' logic by offering *communication* instead of focusing on the hardware side of mobile phones. Ubiquitous data access and making a device anonymous yet instantly personified by the transfer of content for instance might make this evolution possible (Bohn, 2004).

CHAPTER 5

The divestment of devices in ownership- based consumption: Literature

5. Divestment in ownership-based consumption: Literature

5.1 Introduction

Link to previous chapter

The return of a device can be contractual or voluntary. Chapter 5 studied the former through the exploration of the acceptance of access-based consumption. The coming two chapters consider the latter.

Gap

The power of access is that accessed products are contractually returned at the end of the use cycle. Therefore, in this case, the return is an integral part of the consumption process by incorporating return in the purchase agreement with users. As a result, users are mentally prepared for the fate of the product at the end of the contract and the service provider guides them towards reverse logistics channels.

Unfortunately, this mechanism is not in place when users own their products. The fate of owned products deemed obsolete is complex and often only thought of by users at the end of the use cycle. A clear imbalance can be seen between the extensive care for purchase decisions versus that for the divestment decisions.

This discrepancy is not only observable in a user context, but also in the fields of design and CE. However, the divestment phase is as important and complex as the purchase phase (Lucas, 2002).

Relevance

In 1977, Jacoby, Berning and Dietvorst argued that the study of divestment “merits the status of a major research focus within consumer behavior” (Jacoby et al., 1977, p.22). Since then, multiple calls for research have been made (Glover, 2012; Hanson, 1980; Lastovicka & Fernandez, 2005; Roster, 2001; Selvfors et al., 2019).

Studying divestment is relevant for its considerable economic impact, its marketing implications because of repeat purchases, effects on resource scarcity, and its potential to explore user attitudes and expectations (Jacoby, 1978). By excluding divestment from the user journey, companies seem “to prevent the consumer from questioning the consequences of consumption”, but also remove user’s ability to

deal with their waste sensibly (Macleod, 2017, p.23).

Concepts of divestment are increasingly researched in consumer behaviour literature as can be illustrated by the dedicated special issue 'Unpacking Disposal' in the Journal of Consumer Behaviour in 2009 visibly positioning this topic as "a fundamental consumer activity" (Cherrier, 2009, p.327). Yet, it remains remarkable how little attention consumer behaviour researchers, design researchers and marketing researchers have for divestment, especially when compared to the purchase and use of products.

Objective of this chapter

The objective of this chapter is to provide a better understanding of divestment in ownership-based consumption for design researchers and practitioners based on a literature review. The envisioned result is the conceptualisation of divestment in a comprehensive way for designers and explore effective factors to influence users to divest products. This chapter will thus answer a part of

RQ1B: What conceptual model could be used to understand the interaction between users, mobile phones and providers for the return of devices in ownership-based consumption?

and

RQ3: What design interventions could influence users to divest their mobile phones and voluntarily return them? In other words, how can users say goodbye to their products in ownership-based consumption?

Chapter 5 also uses Chapter 2's conceptual model as a starting point, as visualised in Figure 25.

This chapter focuses on the case of ownership-based consumption and specifically on how a transition can be made where the return of products after use is evident for users. To attain this objective, the discrepancy between the care for the purchase phase versus the divestment phase of the consumption cycle needs to be remediated. As a result, the last stage of the decision process & activities block (which is emphasized in blue) requires further research. This literature study therefore sheds light on the decision process and activities during divestment, and also explores the factors influencing these (i.e., blue block on the left). By gaining a detailed understanding of the divestment process and of the factors influencing it,

design interventions can be developed to influence the users to bring their owned mobile phones to return points after use.

The following research sub-questions guide the literature review.
What are the stages of the divestment processes?

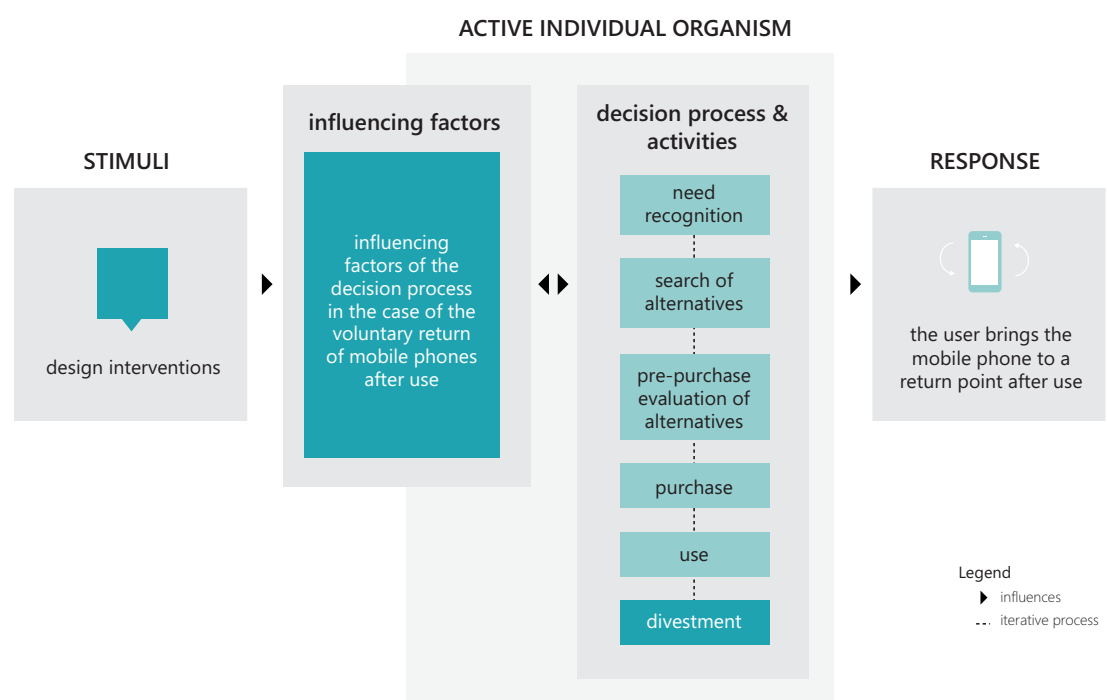


Figure 25. Conceptual model at the core of this research (based on the CDP model by Blackwell et al., 2006). The blue highlights represent the points of contribution of this chapter.

What are factors influencing the divestment processes in the case of voluntary return of owned products after use?

Scope

The review does not focus on the divestment of consumables but on the divestment of products which involve a rich decision process. The case of mobile phones is used as a backdrop of the research in the context of user ownership. Also, this study is limited to ownership-based consumption.

Outline of this chapter¹⁰

First, the terminology choices around the concept of divestment are explained in 5.1.1.

The physical and mental processes during the divestment phase are then reviewed in design literature (5.2). This section reports both findings from general design literature (5.2.1) and circular design literature (5.2.2). As design literature lacks depth on the concept of divestment, the inquiry is complemented by a review of social sciences literature identifying take-aways for a divestment model (5.3). This literature review results in the development of a model of the decision process and activities of divestment to enrich the conceptual model (5.4). Then, the factors influencing this model are explored in literature (5.5). Finally, conclusions are drawn and remaining gaps are stated (5.6).

5.1.1 Terminology choices

The last phase of the consumption cycle¹¹ has been named differently depending on the context and eye of the beholder with for instance the terms 'disposing of', 'throwing away', 'separating from', 'getting rid of', 'relinquishing', 'letting go', 'scrapping', 'discontinuing' or 'abandoning'. In this sub-section, a brief overview is given of the terms used to designate the end of the consumption cycle from a user perspective in the fields of design, CE and other social sciences where the subject is treated.

Design

The field of design uses various names to refer to the last phase of consumption.

The term 'disposal' is usually employed to define the phase after the use of a product. It defines the physical side of what happens with a tangible product when the user is done with it.

However, some design practitioners and researchers introduced the psychological and emotional process in dealing with the finality of a product. As

¹⁰ Note that the documentation is not chronological, but rather built to enhance readability. The thinking process was not linear and was continuously iterated during the research through the design process.

¹¹ As mentioned in Chapter 1, note that in this dissertation, the term 'consumption' refers to the greater concept of the combination of (1) purchasing, (2) using and (3) divesting products and services. Although it holds the same connotation of eating away resources as the term 'consumer', the choice was made to keep this denomination as the term 'use' is too closely related to the action of using a product or service whereas 'consumption' is currently employed in a higher and more general level. The author is however inviting a reflection on the term 'consumption'.

argued by designer Joe Macleod, users should be guided during the end of the user-product relationship via 'off-boarding' designed by the product or service developer (Macleod, 2017). Off-boarding can be seen as the inverse process of on-boarding, which is put in place to welcome the user to their new product or service. The author also introduces the concept of a 'closure experience', representing the experience that the user goes through to close this consumption cycle. Also, the term 'detachment' is used as antonym of attachment (i.e., the emotional bond a user has with his/her product) (Mugge, 2007; Selvfors et al., 2019).

Circular Economy

In the field of CE, the end of the consumption process has been referred to in various ways.

The EMF's butterfly model mentions 'collection' as the requirement for further cycling. The model builds amongst others on the Cradle-to-Cradle principle of 'Waste is food', and aims at replacing "the 'end-of-life' concept with restoration" (Ellen MacArthur Foundation, 2011, p.7). Although no distinction was made between 'end-of-life' and 'End-of-Use' (EoU), EoU stands for the current end of a use cycle without leaving out the possibility of a next use "where the customer may give the product back to manufacturer, keep it, pass it on or dispose of it otherwise" (Wastling et al., 2018, p.4).

In his PhD dissertation, Marcel den Hollander argues that, in a CE, products should be as identical as possible to its original state (Den Hollander, 2018). He defines various concepts around 'product integrity' originating from Stahel's Inertia Principle (Stahel, 2010). "Product use cycle is the duration of the period that starts at the moment a product is released for use after manufacture or recovery and ends at the moment a product becomes obsolete." (Den Hollander et al., 2017, p.519). A product is considered obsolete when its user finds it no longer useful or significant (Den Hollander, 2018). This definition takes into account that the state of obsolescence is reversible through recovery (i.e., "any operation with the primary aim of reversing obsolescence" (Den Hollander et al., 2017, p.519)). As advanced by Den Hollander, products can have multiple use cycles, however they only have a single lifetime. A product lifetime is defined as "the duration of the period that starts at the moment a product is released for use after manufacture and ends at the moment a product becomes obsolete beyond recovery at product level" (Den Hollander et al., 2017, p.519) (i.e., when recovery would require permanently destroying product integrity, for example through recycling).

As one of the first to do so in design for CE, Selvfors et al. (2019) consider the consumption cycle from a user perspective and refer to the last phase of the cycle as

'riddance' (Selvefors et al., 2019).

Other literature in Social Sciences

Literature from other fields in social sciences is also not aligned when it comes to the denomination of the last phase of consumption.

As detailed in previous chapters, the CDP model conceptualizes this last phase as two stages of the decision process. The 'post-purchase alternative evaluation' stage is when the user reflects on whether expectations are met and needs are fulfilled. It is followed by the 'divestment' stage representing the way the users physically distance themselves from the packaging and/or product after use. A distinction is made between the decision of stopping the use of the product to prefer an alternative (i.e., post-purchase alternative evaluation) and the action of removing the product from one's sight (i.e., divestment).

Other terms used to define the last phase of the consumption cycle are 'disposal' (e.g. Cherrier, 2009), 'disposition' (e.g. Hanson, 1980; Jacoby, 1978; Lastovicka & Fernandez, 2005; Roster, 2001), and 'divestment' (e.g. Glover, 2012; Gregson et al., 2013).

This distinction between the physical and the mental part of the end of the consumption process is also made by other researchers in social sciences. The physical part is referred to as 'disposition' (e.g. Hall & Zhao, 2016; Jacoby et al., 1977; Roster, 2001) and 'disposal' (e.g., Cruz-Cárdenas & Arévalo-Chávez, 2018; Ekerdt, 2009; Walker, 2006). The psychological part is indicated by terms like 'detachment' (e.g. Mai & Conti, 2007; Savas, 2004) and 'dispossession' (e.g. Ekerdt, 2009; Hall & Zhao, 2016; Roster, 2001).

Choice in this dissertation

The choice of terminology employed in this dissertation is based on the terminology used in the literature reviewed. The parallel adopted in this dissertation between the product perspective, use perspective and marketing perspective is based on Selvefors et al.'s (2019) take on opportunities for circularity by using two different points of departure (i.e., people's consumption processes and product life-cycle). The perspective on divestment in this dissertation is illustrated in Figure 26.

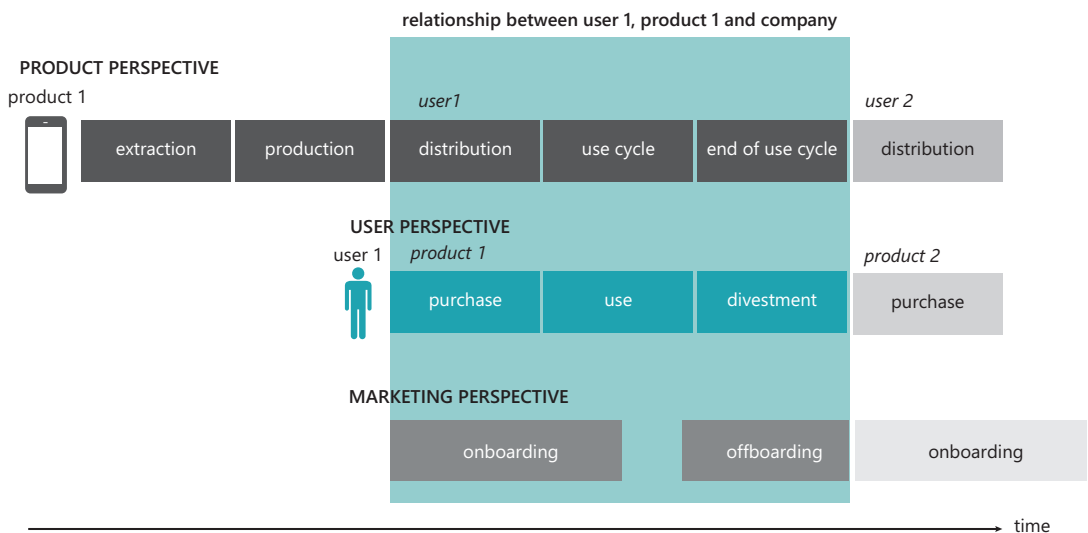


Figure 26. The user perspective, product perspective and marketing perspective on the relationship between product/service, user and company (the parallel employed is building upon Selvefors et al.'s (2019))

As the user is at the centre of this dissertation, a user perspective (i.e., the people aspect of design) is adopted when considering the consumption cycle. The terms used in this dissertation are visualised in Table 9.

The term 'disposal' is often used in various contexts, however it is negatively connoted and often implies the lack of residual economic value left in the product dispensed with. In the context of a CE, it thus would seem to solely refer to products at the end of the product lifetime, destined for recycling or linear disposal methods such as landfill. Following and Hall & Zhao (2016), Jacoby et al. (1977), and Roster (2001), the term 'disposition' will be used for the process of physical separation between the user and the product. The verb 'dispense with' is used to refer to the final act of disposition (vs 'dispose of' for disposal). This term includes the physical preparation for the final act.

As counterpart of attachment and similarly to Mugge (2007), Savas (2004) and Mai & Conti (2007), 'detachment' will be used to refer to the mental process of the separation of the relationship between the user and the product.

Following Gregson et al. (2013) and Glover (2012), and expanding the meaning of the divestment stage of the CDP model to also include psychological and emotional aspects, 'divestment' will be used to refer to the final phase of the consumption process and the combination of the physical and mental separation processes. As a result, the phases of the consumption cycle are thus 'purchase', 'use'

and 'divestment'.

Divestment	
overarching term referring to the final phase of the consumption process after the purchase and the use phases	
Disposition physical separation of the product, the visible part of divestment	Detachment mental and emotional separation of the product, the invisible part of divestment

Table 9. Terms used in this dissertation for the user perspective of the last phase of the consumption process

The relationship between the various processes is illustrated below.

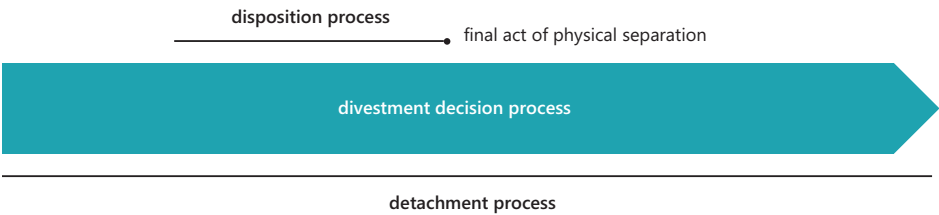


Figure 27. Relationship between the decision process during divestment, the disposition process occurring during divestment and the detachment process occurring during divestment.

From a product perspective (i.e., technology aspect of design), with an eye on the product recovery making a product ready for a next use cycle (Den Hollander, 2018; Bakker et al., 2018), the term 'end of the use cycle' will be used to characterise the state of the product when a user is done using it and does not intend to use it in the future. The denomination of the state of the product at the centre of the relationship with the user depends on the beholder but the further use of the product is possible. It just states the fact that the current use cycle has come to an end for whatever reason and that the product could potentially be recovered.

From a marketing perspective (i.e., business aspect of design), the term 'off-boarding' will be used to refer to the strategy employed by marketers to guide users to enable to say goodbye to his/her product at the end of the product use cycle.

5.2 Divestment processes in design literature

As previously illustrated, divestment has been conceptualised differently as “[d]ifferent disciplines typically focus on different portions of this behavioral process.” (Jacoby et al., 1977, p.22). In this section, literature is reviewed on divestment in the fields of design in general, then circular design more specifically, and finally expanding to other social sciences in order to take the first step to respond to the research sub-question: What are the stages of the divestment processes?

5.2.1 General design literature

Product innovation processes models at the core of design research from the past 50 years are first studied. As a rule, these models strongly focus on the purchase and the use phases, but lack attention for the divestment phase (Balkenende & Bakker, 2018). As a result, design researchers and practitioners are not educated to consider divestment as an integral part of product development (i.e., research and development process from need for a solution to conception and release) and product design (i.e., technical aspects of the solution). Therefore, divestment is not structurally taken into account in product management (i.e., marketing and organisational aspects). It may thus not be addressed beyond environmental legal compliance (Balkenende & Bakker, 2018).

To remedy the oversight of divestment in product innovation processes models, Balkenende & Bakker (2018) proposed the addition of the recovery stage after the use stage as well as feedback loops to the Product Innovation Process model by Roozenburg & Eekels (1995). The adapted model is illustrated in Figure 28.

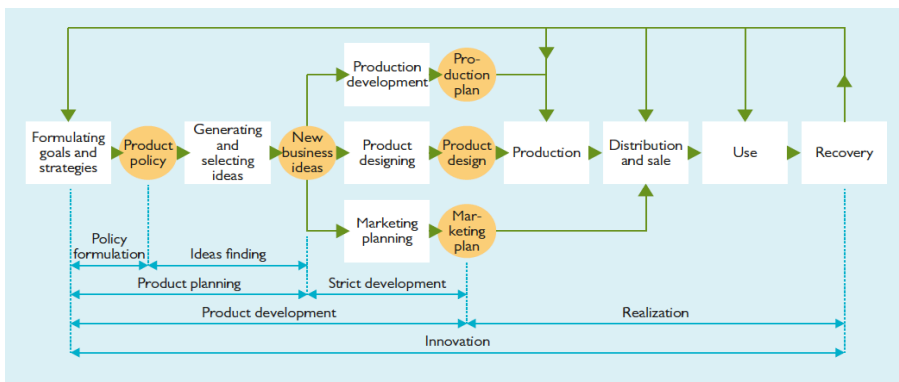


Figure 28. *The Product Innovation Process model originally from Roozenburg and Eekels (1995) adapted by Bakker in (Balkenende & Bakker, 2018)*

The Product Innovation Process model by Roozenburg and Eekels (1995) is structured around the product lifecycle stages of production, distribution and sale, and finally use, while also visualising the prior design steps required to realize these lifecycle stages. Although focusing on the product perspective, the model conveniently regroups product design, product development and (partially) product management.

Preceding the product lifecycle stages, the process of product design starts with new business ideas and results in its production. Pahl and Beitz described the steps needed during the clarification of the task, conceptual design, embodiment design and detail design stages of their model to come to a solution (Pahl et al., 2007). Cross's four stage design process model (2000) is a simplified version going from exploration, to generation, evaluation and finally communication of the design for its manufacture.

Zooming out, product design is actually a part of product development which includes strategic aspects through for example product planning and marketing planning. This effort perpetuates Archer's attempt to combine engineering and commercial components in the context of a company's strategy in his Innovation Process (Archer, 1971 in Buijs, 2003). Buijs and Valkenburg further builds on these processes in 2000 by visualizing the process cyclically, thus emphasizing the feedback loop inherent to the process.

Zooming out even further to the whole process illustrated, product management was considered through the inclusion of product planning and the marketing plan. However, more can be learned from marketing and organizational aspects of the company and its activities. Product management is at a systems level, influencing not only the product but also the service and system around it. Also, the relationship between the user, product and company is constant in the case of mobile phone with for instance software updates and repair.

Conclusion

To address the omission of divestment and the lack of attention for product management, design research would thus benefit from learning more on a strategic level to make divestment an integral part of design in order to guide users through divestment and enable the recovery of products (Balkenende & Bakker, 2018). By looking further into strategic/product management/marketing literature, the user perspective and marketing perspective could be taken additionally into account instead of merely focusing on the product perspective.

5.2.2 Circular design literature

The absence of divestment in formative models from design literature could be explained by the fact that the sense of emergency for action to mitigate climate change has only recently grown more mainstream in society. In the early 2010's, the CE concept emerged and researchers, consultancies and organisations have since developed various design approaches to enable designers to design for a circular economy. "Circular product design: Elevates design to a systems level (1), Strives to maintain product integrity (2), is about cycling at a different pace (3), explores new relationships and experiences with products (4) and is driven by different business models (5)" (Bakker et al., 2014). This sub-section provides an overview of design processes for circular products and services in a CE for design researchers and practitioners based on a systematic literature review.

Method

The main objective of this literature review is to answer the first sub-question: What is the current divestment process according to [circular design] literature? How can designers design for divestment to ensure users bring back their mobile phones at the end of use? The scope is kept at product design and publications with a distinct design process to design for a circular economy. The systematic review process is visualised in Figure 29.

In the Web of Science and Scopus databases, the search {"circular economy" AND "circular design" OR "circular product design" OR "design for a circular economy" OR "design for circular economy"} performed on the 18th of July 2019 yielded respectively 37 and 40 search results without any restrictions, 34 and 39 when only keeping articles, conference proceedings and book chapters. The combination of the two sets of results and the exclusion of repetitions provided a set of 47 publications. These publications were assessed based on their titles, which further reduced the results to 37 publications. After reading their abstracts searching for publications providing a systems perspective of a circular design process (vs loose design strategies), 27 results were left. Of these remaining publications, 15 results were considered relevant after content analysis. Through snowballing (Wohlin, 2014), 5 publications were added to the set for a final total of 20 publications. Note that the set-up and practice of the empirical studies reported in Chapter 6 have been done in 2018, meaning that the publications from 2019 could not be taken into account. The results of the literature review however include these publications for the sake of completeness.

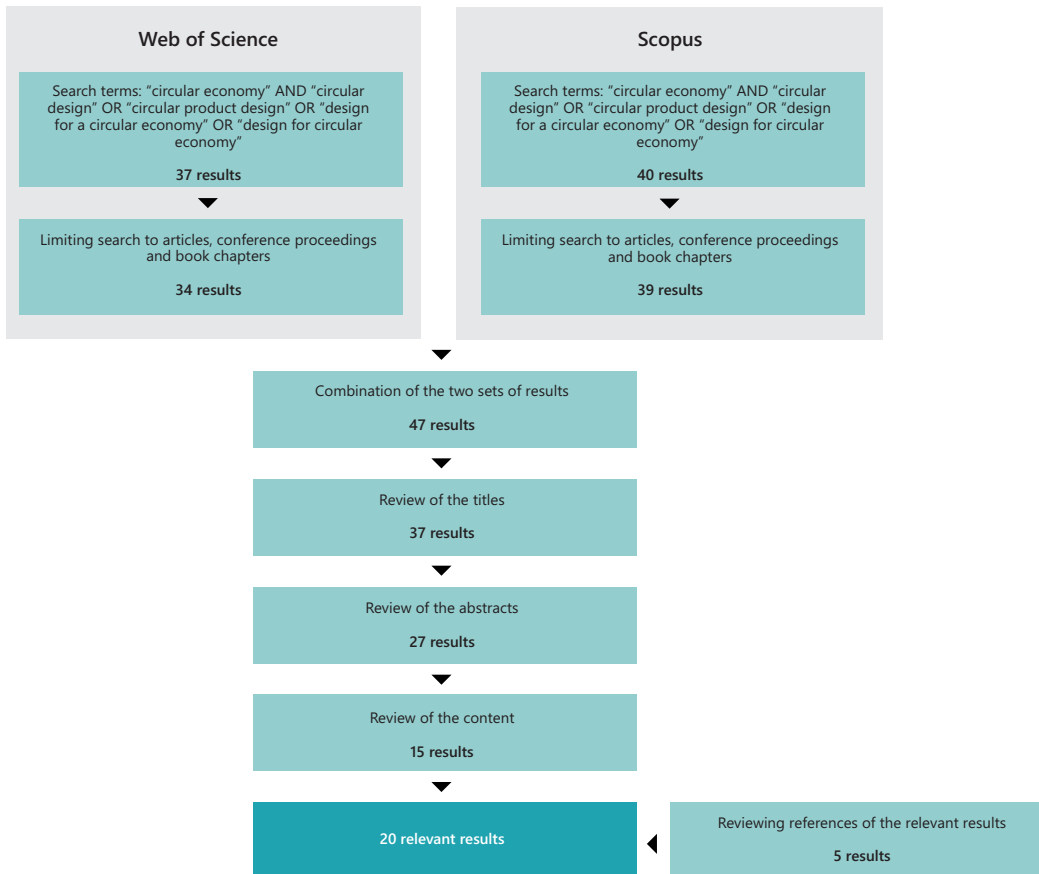


Figure 29. Flow diagram of the systematic review of divestment in circular design literature

Circular design approaches in literature

The 20 publications found through the systematic literature review (Table 10) were further investigated to uncover to what extent divestment is taken into account in circular design literature and how designers could design for divestment.

Title	Authors	Year	Source
Product Design And Business Model Strategies For A Circular Economy	Bocken et al.	2016	Journal Of Industrial And Production Engineering
A Conceptual Framework For Circular Design	Moreno et al.	2016	Sustainability
Design For Circular Behaviour: Considering Users In A Circular Economy	Wastling et al.	2018	Sustainability
Circular Product Design. A Multiple Loops Life Cycle Design Approach For The Circular Economy	Mestre & Cooper	2017	Design Journal
A Circular Economy Toolkit As An Alternative To Improve The Application Of Pss Methodologies	Reigado et al.	2017	Proceedings of the 9th CIRP Industrial Product/Service-Systems Conference
Consumer Intervention Mappinga Tool For Designing Future Product Strategies Within Circular Product Service Systems	Sinclair et al.	2018	Sustainability
Taxonomy Of Design Strategies For A Circular Design Tool	Moreno et al.	2017	Proceedings of Product Lifetimes And The Environment
Identifying Design Guidelines To Meet The Circular Economy Principles: A Case Study On Electric And Electronic Equipment	Bovea et al.	2018	Journal Of Environmental Management
Use To Use - A User Perspective On Product Circularity	Selvefors et al.	2019	Journal Of Cleaner Production
Collaborative Circular Design. Incorporating Life Cycle Thinking Into An Interdisciplinary Design Process	Goldsworthy, Kate; Ellams, Dawn	2019	Design Journal
The Circular Pathfinder: Development And Evaluation Of A Practice-Based Tool For Selecting Circular Design Strategies	Van Dam, S. S.; Bakker, C. A.; De Pauw, I; Van Der Grinten, B.	2017	Product Lifetimes And The Environment (Plate)
Designing Product-Service Systems To Close Resource Loops: Circular Design Guidelines	Van Der Laan And Aurisicchio	2019	Proceedings of CIRP
Product Design For A Circular Economy: Functional Recovery On Focus	Pozo Arcos, B., Balkenende, A.R., Bakker, C.A., Sundin, E.	2018	Proceedings Of International Design Conference
Circular Design Futures	R. Earley	2017	Design Journal
Sustainable Furniture That Grow With End Users	Bosch, T., Verploegen, K., Grösser, S.N., Van Rhijn, G.	2017	Dynamics Of Long-Life Assets: From Technology Adaptation To Upgrading The Business Model

Title	Authors	Year	Source
Design For Managing Obsolescence	Marcel Den Hollander	2018	Ph.D. Thesis
Carative Factors To Guide Design Development Process For Object-Owner Detachment In Enabling An Object's Longevity	Choi, Y., Stevens, J., Brass, C.,	2017	Proceedings of Product Lifetimes And The Environment 2017
A Product Design Framework For A Circular Economy	Van Der Berg, M.R., Bakker, C.	2015	Proceedings of Product Lifetimes And The Environment 2015
Multiple Generation Life-Cycles For Product Sustainability: The Way Forward	Go, T., Wahab, D.A., Hishamuddin, H.,	2015	Journal Of Cleaner Production
Sustainable Users And The World Of Objects Design And Consumerism	Anne Marchand	2000	Eternally Yours: Time In Design

Table 10. The set of publications resulting from the circular design approaches literature review

The majority of the publications (15 on 20) did not consider the user perspective during divestment and mainly focused on the technical side of CE (van der Berg & Bakker, 2015; Bosch et al., 2017; Bovea & Pérez-Belis, 2018; Goldsworthy & Ellams, 2019; Kane et al., 2018; Mestre & Cooper, 2017; Moreno et al., 2017; Pozo Arcos et al., 2018) and on the business side of CE (Bocken et al., 2016; van Dam et al., 2017; Go et al., 2015; den Hollander, 2018; IDEO & EMF, 2017 cited by Reigado et al., 2017; Moreno et al., 2016; Sinclair et al., 2018). The circular design strategies listed for instance influence the materials selected or the logistics of the product collection. Three publications mentioned the user in the context of circular consumption in general but did not go into details in terms of how to design for divestment from a user perspective (Goldsworthy & Ellams, 2019; IDEO & EMF, 2017; Moreno et al., 2017).

The remaining five publications did consider the user perspective at the end of the use cycle at more length.

Rebecca Earley touched upon the subject of the use perspective with the recommendation to leverage design for behaviour and mindset change as one of the directions to follow for models and tools for circular design futures (Earley, 2017). The paper however does not go further in detail on the divestment process and the user's perspective.

Although not considering circular design processes in general, Choi, Stevens and Brass provided an interesting research avenue for this dissertation's research by exploring the divestment of products and the relationship with caring for them

(Choi et al., 2017). They designed a toolkit to enable designers to find solutions for the divestment of products through carative factors. Using the cards, their workshop participants generated ideas like penalty policies if thrown away and pick up services (Choi et al., 2017). The paper does not provide insights on the divestment process itself but offers inspiration for relevant design interventions in the context of care to enable divestment.

Selvefors, Rexfelt, Renström and Strömberg propose to reframe the circular narrative by emphasizing the user perspective in circular consumption processes (Selvefors et al., 2019). Instead of the product life-cycle as point of departure, the team from Chalmers University of Technology (Sweden) modelled the consumption cycle from the user perspective in three phases: (1) obtainment, (2) use and (3) riddance as illustrated in Figure 30.

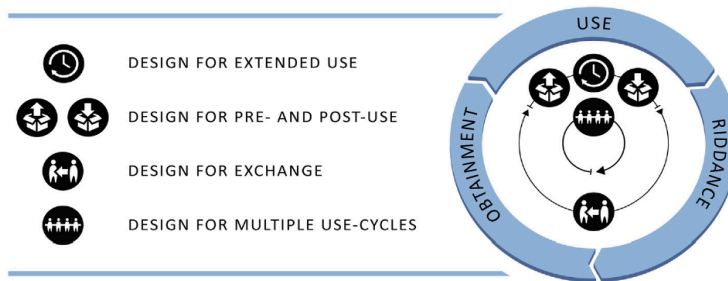


Figure 30. Consumption cycle from a user perspective by Selvefors et al. (2019)

The end of their use phase (i.e., “post-use sub-phase”) plus the riddance phase align with this research’s concept of divestment by considering both the physical and mental processes of getting a product out of the user’s hand.

Next to this interesting reframing of circular issues, the team provides design strategies that are relevant for divestment including design for post-use, design for exchange and design for multiple use-cycles. For design for post-use, the researchers propose that users have to acknowledge the circular divestment path for their products after use by designing for detachment for example by discouraging storage and encouraging user reflection on the need for the product (Selvefors et al., 2019). For design for exchange, the transfer of the product from one user to another could be facilitated through design with for instance easy disassembly and reassembly or providing services that eliminate barriers for users (Selvefors et al., 2019). For design for multiple use-cycles, physical and psychological contamination of products could be removed (e.g. reframing the use traces or deleting personal

information) (Selvefors et al., 2019). As acknowledged by the team, this publication focused on a general understanding of circular consumption and therefore a deeper understanding is needed on amongst other divestment. To this end, they recommended the reuse of traditional methods such as user journeys for user studies in this new perspective and context (Selvefors et al., 2019). This call for research is in line with the objectives of this dissertation’s study.

Wastling et al. went in depth in user behaviour and developed a model of Circular Behaviour (Figure 31) keeping the user at its core (Wastling et al., 2018). The model is divided according to the type of consumption of ‘user ownership’ and ‘provider ownership’ (called ‘ownership-based consumption’ and ‘access-based consumption’ respectively in this dissertation) and the consumption phases use and end-of-use. The model of Circular Behaviour is meant to provide guidance for circular designers with an overview of desired behaviours serving the adoption and acceptance of circular business models such as product attachment and avoiding damaging behaviours. The model is complemented with a series of interventions helping designers to encourage the behaviours, namely incentivisation, training, trust, education, persuasion, enablement and environmental restructuring (Wastling et al., 2018). These interventions could all be relevant for the psychological and physical processes of divestment.

PHASE:	USE	END OF USE
User ownership (product orientated)	Establishing relationship	Prolong replacement
	Product care	Return product
	Repair	Sell (via third party)
	Engage with product life extension services	Enable reuse
	Product attachment/ownership	Correct disposal/ recycling
Provider Ownership (use/performance orientated)	Adhere to contractual obligations	
	Product care	Fast circulation of goods
	Engage with product life extension services	Reducing operating costs
	Provide information	
	Avoid Product misuse	
	Avoid Damaging behaviours	

Figure 31. Model of circular behaviour: an outline of desired behaviours for circular business models by Wastling et al. (2018)

Also, Wastling et al. developed a model of Design for Circular Behaviour Process (Figure 32) (Wastling et al., 2018). After selecting the desired behavioural

goal to fit the business model with the model of Circular Behaviour, the user research phase aims at understanding the user and the context (the authors advise the use of the Behaviour Change tool and the COM-B system). This publication also can help design researchers and practitioners to design interventions for users to transition towards circular consumption. In this dissertation however, a deeper knowledge of the divestment process is needed to understand when, where and how to intervene from a user perspective.

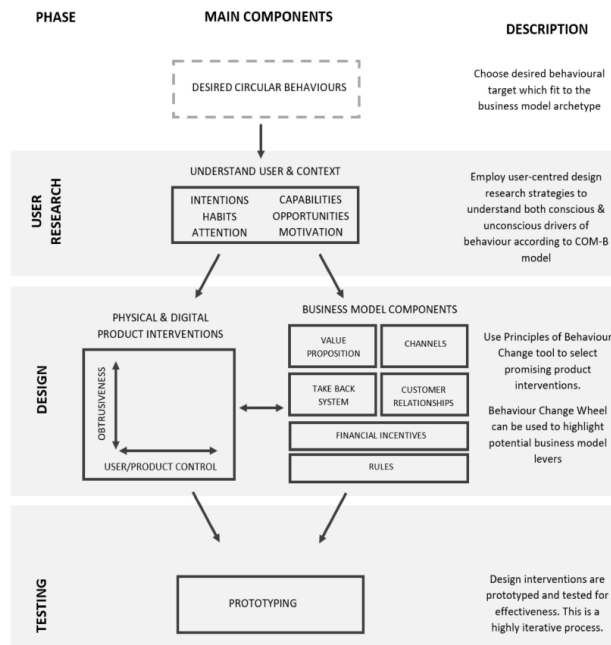


Figure 32. Design for Circular Behaviour Process by Wastling et al. (2018)

Zeeuw van der Laan and Aurisicchio (2019) propose ways to close resource loops with users with their design guidelines for PSSs with close loops during the purchase, use and disposal phases visualised in Figure 33. To this end, PSS companies are invited to (1) state the product lifetime during purchase, (2) govern it during use (i.e., through moment of interaction and monitoring), and finally (3) intercept (i.e., through raising awareness of the existence of gateways, the education on their use and incentives for users to return products) and (4) transition obsoletes (Zeeuw van der Laan & Aurisicchio, 2019). In the same way as the previous two publications, this paper contributes to a good foundation for this research which will have to go more in depth into the divestment process and how to design

interventions to stimulate the return of products.

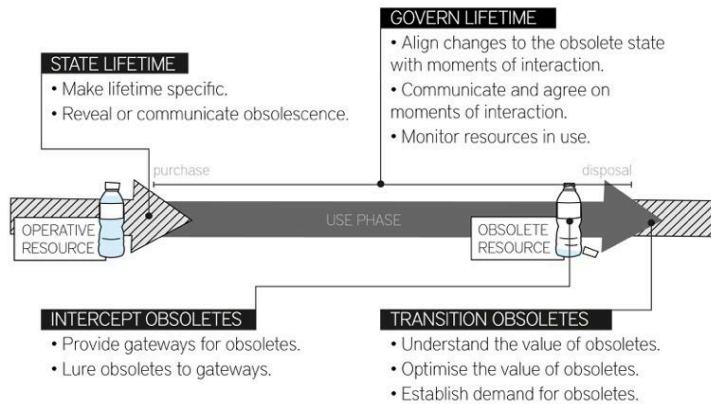


Figure 33. Design guidelines for PSSs with closed loops by Zeeuw van der Laan & Aurisicchio (2019)

Conclusion

At its core, design for a CE being part of the field of design would require to consider technology, business and people. However, as illustrated in Figure 34, the majority of the resulting publications in circular design literature do not consider the user perspective in circular consumption, but mainly focus on technology and business aspects. As mentioned by Selvefors et al. (2019), this technological focus is said to come from the influence of ecodesign in design for circular economy literature. As a result, designers are not yet equipped to design for divestment and to consider it an integral part of the consumption cycle. In contrast, three very recent papers (Selvefors et al., 2019; Wastling et al., 2018; Zeeuw van der Laan & Aurisicchio, 2019) start to cover the people/user aspect of circular consumption and divestment in particular.

Current user behaviour at the end of the use cycle is approached differently depending on the aspect of design considered.

From a technology perspective, when a product is at its end of use, it should be collected to enable refurbishment, remanufacturing or recycling for which it has been designed. Ways to actually refurbish, remanufacture or recycle this product, its components and materials can be thought through corresponding design for CE strategies (e.g. design for disassembly).

From a business perspective, the relationship between companies and users are considered more directly through for example the interaction points

during leasing. From this point of view, people are taken into account based on conceptualisations from the field of economics (i.e., explored in Chapter 2) dealing with return through, for example, monetary incentive. By only focusing on technology and business during divestment, users are thus merely indirectly considered.

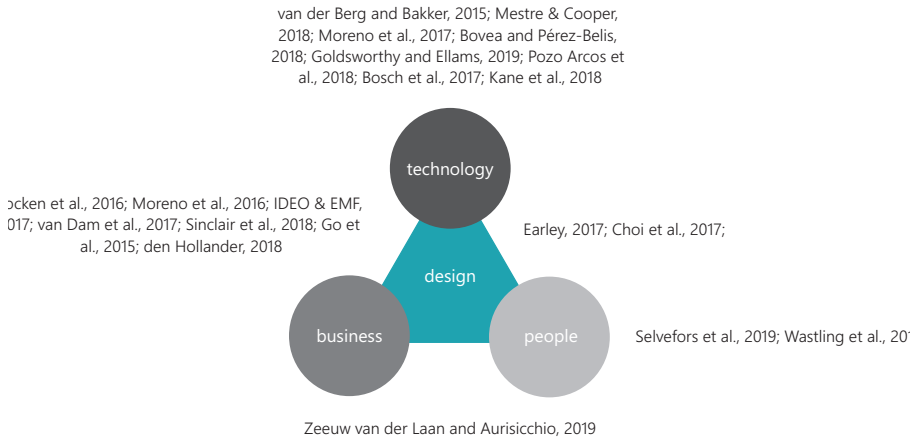


Figure 34. Summary of the literature review results according to the aspects of design considered

From a people perspective, design literature requires more depth when it comes to the process of divestment and influencing individuals and collectives towards divestment behaviour. To this end, insights could be gained from other fields such as psychology and sociology to learn on for instance contagion.

In sum, the sub-question What are the stages of the divestment processes? could not be answered based on circular design literature. Few influencing factors and design interventions for divestment have been mentioned in design literature, providing a little context to designing for divestment. Therefore, the people aspect needs considerable attention to be able to respond to the research questions. On top of this, it is essential for the field of design that a link is made explicitly between psychology and sociology (i.e., people), engineering (i.e., technology) and economics (i.e., business) in the context of divestment. What moves individuals and collectives to change their divestment behaviour?

5.3 Divestment processes in social sciences literature

To bridge the theoretical gap found in design literature, insights on the people aspect of divestment (including the physical and mental/emotional processes shaping it) are needed from other fields of research in social sciences such as psychology and sociology.

Following the structure of the conceptual model of this research, uncovering the divestment decision process and activities, as well as the factors influencing them would enable designers to find potential design interventions to actually get users to bring back their products at the end of the use cycle.

This section first describes the method of the literature review on divestment processes in social sciences. Then, the results of this literature review are presented.

5.3.1 Method

The literature review is guided by the sub-question: What are the stages of the divestment processes according to [social sciences] literature? In the introduction of this chapter, divestment processes were described as the disposition (i.e., physical) and detachment (i.e., mental and emotional) processes. The aim of this literature review is to define clear stages occurring during the final phase of consumption.

Prior to the systematic review, a preliminary review of the literature was performed. This review enabled to uncover relevant search terms. As explained in sub-section 5.1.1, the variety of terms used to refer to the last phase of the consumption cycle is large and several terms (e.g., 'disposition' or 'divestment') are used for other concepts in different research fields. As a result, if the same systematic review were conducted following the method used in 5.2.2 with a return of search terms such as {"close the loop" OR "end of life" OR "end of use" OR "end of the use cycle" OR riddance OR "off boarding" OR "closure experience" OR detachment OR "post purchase alternative evaluation" OR divestment OR disposition OR disposal OR dispossession} AND (consumer OR user) AND (behavior OR behaviour OR decision)), over 10.000 publications would have had to be reviewed. Also, based on the preliminary review, the results would have included an important amount of publications irrelevant to this research for afore-mentioned reasons.

Therefore, the pioneering and influential papers by Jacoby, Berning and Dietvorst (1977) 'What about disposition?' and by Roster (2001) 'Letting go: the process and meaning of dispossession in the lives of consumers' were used as a

starting point for the citation research. Jacoby et al. (1977) provided a decision taxonomy of disposition with a tree modelling the various paths possible for the disposition of a product (i.e., “keep it”, “get rid of it permanently”, and “get rid of it temporarily”) and their sub-categories. Roster (2001) introduced divestment stages including both disposition and detachment processes.

361 publications referred to the first paper in Google Scholar on the 25th of July 2019 and 58 publications referred to the second paper in Scopus on the 20th of August 2019. Although two different databases were used because Jacoby et al. (1977) was not available in Scopus, the same systematic review process was adopted for the review of both sets of results as illustrated in Figure 35.

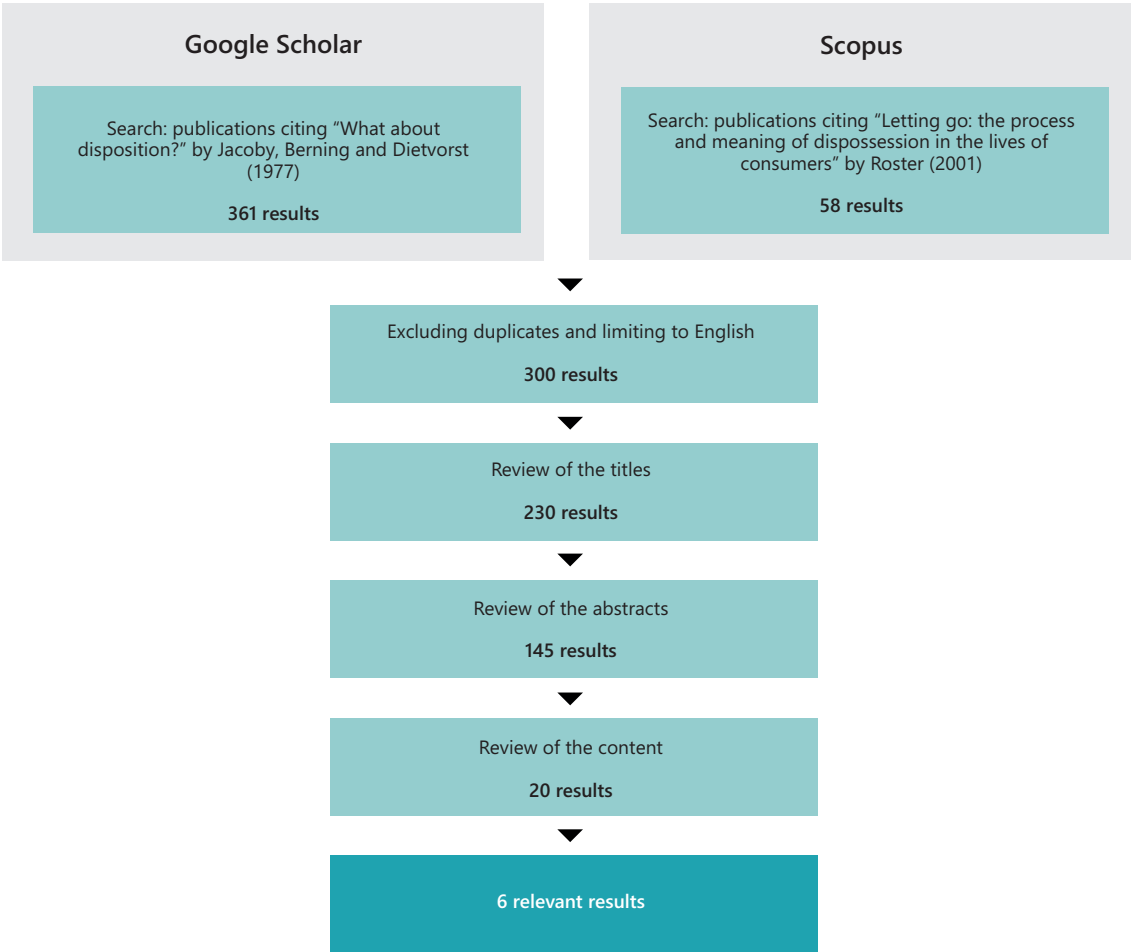


Figure 35. Flow diagram of the systematic reviewing process of the citation research of Jacoby et al. (1977) and Roster (2001)

Duplicates from the set and from the publications handled in the previous circular design literature review were eliminated. The final set of results was obtained by limiting the selection to English publications, and conference papers or journal papers as these were subjected to peer review processes. Also, the scope was limited to the divestment of products excluding “mundane disposal” (Cherrier, 2009). Furthermore, papers limited to one method of disposition, company decisions (versus that of the users), the full consumption process without providing extra insight on divestment, listing of factors influencing only focusing on the choice of a certain disposition method were eliminated. The systematic review yielded the following six relevant results.

Title	Authors	Year	Source Title
From Trash To Treasure And Beyond: The Meaning Of Voluntary Disposition	Albinsson, Yasanthi Perera	2009	Journal Of Consumer Behaviour
Treasured trash? A consumer perspective on small Waste Electrical and Electronic Equipment (WEEE) divestment in Ireland	Casey K., Lichrou M., Fitzpatrick C.	2019	Resources, Conservation and Recycling
Consumer Behavior In The Disposal Of Products: Forty Years Of Research	Cruz-Cárdenas & Arévalo-Chávez	2017	Journal Of Promotion Management
Toward A Consumption/ Evaluation Process Model For Services	Fisk	1981	James H. Donnelly And William R. George, Eds. Chicago: American ...
A Proposed Paradigm For Consumer Product Disposition Processes	Hanson	1980	The Journal Of Consumer Affairs
Letting Go: The Process And Meaning Of Dispossession In The Lives Of Consumers	Roster	2001	Advances In Consumer Research

Table 11. Relevant results from the systematic review of the citation research of Jacoby et al. (1977) and Roster (2001)

Here again, note that the set-up and practice of the empirical studies reported in Chapter 6 have been done in 2018, meaning that the publications from 2019 could not be taken into account. The results of the literature review nevertheless include these publications for the sake of completeness.

Jacoby et al. (1977) did not provide the stages of the divestment processes, however it gave an overview of the various disposition options. When considering

the final act of disposition, this publication will thus also be considered to provide context of this physical step. Nevertheless, as Jacoby et al.'s taxonomy was published in the late 1970's, new developments in return programmes or even the democratisation of the mobile phone were not in the picture during the development of their flow chart of options. A more recent Ph.D. dissertation by Glover (2012) will therefore be considered to complete the overview of disposition options.

5.3.2 The divestment processes in social sciences literature: Results

Six divestment models including both the physical and mental processes were found in social sciences literature. To analyse the results, the literature insights are clustered according to their position relative to this physical act of disposition (i.e., before, during, and after) in Table 12.

Influencing factors mentioned by the researchers are grouped under the name 'factors' and provide insights on the intertwined relationship between the visible act of separation (i.e., disposition) and the psychological and emotional process of separation (i.e., detachment) throughout the divestment of a product.

Before disposition

With the exception of Fisk (1981), all the models considered the mental processes before the act of disposition. At this point, the decision to dispense with the product has to be made.

Albinsson and Yasanthi Perera (2009) did not detail what stages constitute the disposition decision but only mentioned it.

Casey et al. (2019) described the stages prior to disposition as 'inactive Electrical and Electronic Equipment (EEE)' (i.e., when the product is unused or broken), 'critical moment' (i.e., life transition circumstances or external triggers), and 'categorisation' (i.e., evaluation on whether to keep the product or not). It could be argued that making the EEE inactive would already require to have made a decision. Indeed, the particularity of mobile phones in considering the divestment phase is that they are either in use or not. The situation is not comparable to clothes for example, which are not put on every day by the user, but are rather selected to be worn every once in a while.

According to Roster's 'Psychological Process of Dispossession' model (2001), detachment factors (i.e., distancing behaviours, critical events, and value and performance assessments) are principal markers of the ongoing divestment

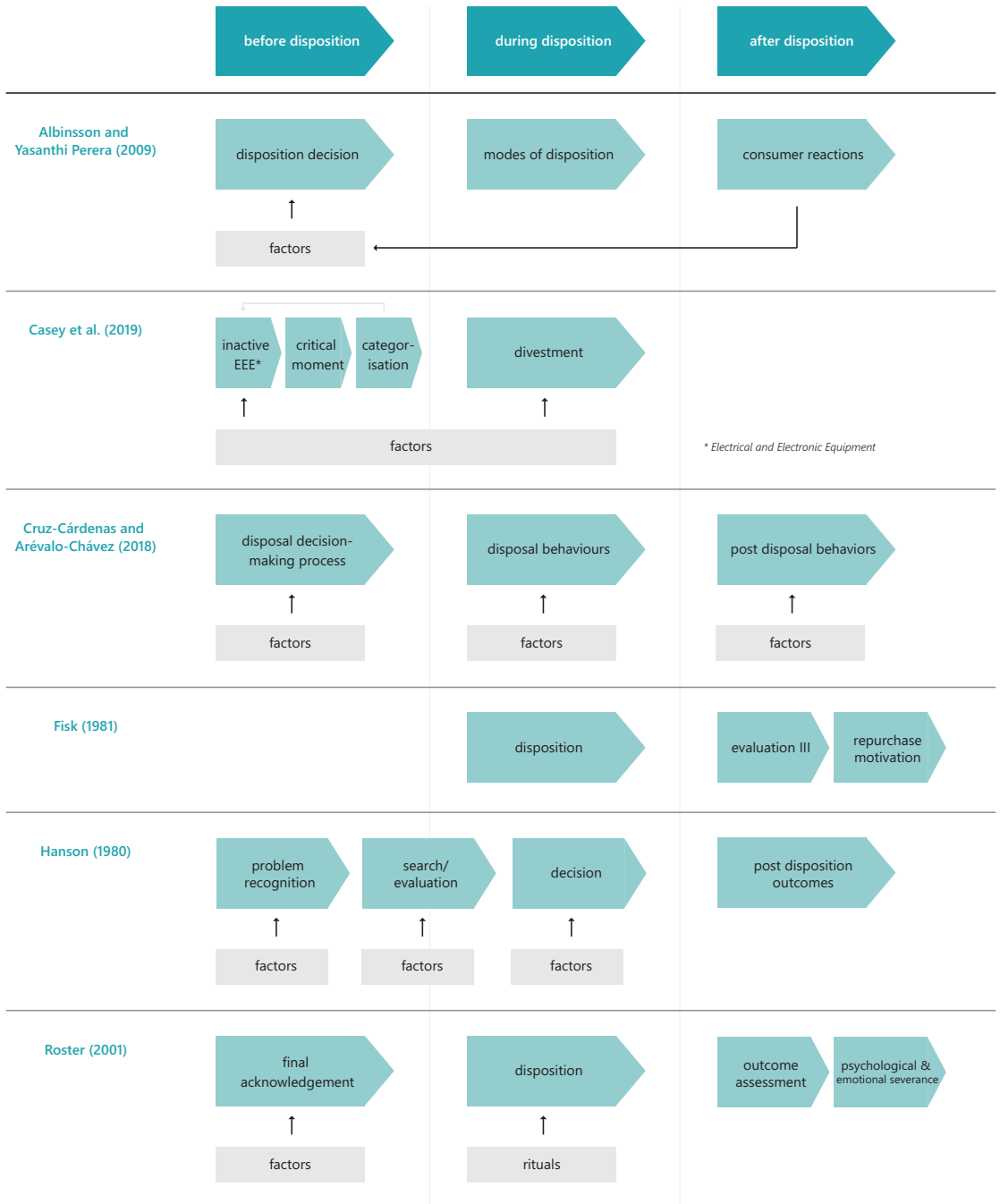


Table 12. Divestment process according to the various publications resulting from the systematic review

processes and are followed by the final acknowledgement. Roster reports that the biggest theme in her participants' reactions was "an underlying tension expressed as ambivalence" (Roster, 2001, p.427). This ambivalence may be more comprehensive if conceptualised as a dilemma of either keeping products that users may need later or of dispensing with products as keeping them would be "increasingly unjustifiable" (Roster, 2001, p.427). Distancing behaviours are mechanisms to corrode the value and performance assessment to, in time, further tip the scale in favour of ending the use cycle when the current user is resisting obsolescence. To resist obsolescence, users cling on to the idea of potential future utility or lingering meaning/value (e.g. "interpersonal ties or affiliations to others" (Roster, 2001, p.427)). Through the final acknowledgement stage, the decision is made to dispense with the product. However, it lacks the decision of how to physically separate from the product (e.g. give to a family member or return to a retailer).

Due to its structure mimicking the stages from the CDP model (Blackwell et al., 2006) following the familiar structure of customer journeys, the 'disposition behaviour process' developed by Hanson (1980) might be helpful in communicating the divestment process to design practitioners and researchers. Also, the search/evaluation stage uses "concepts similar to those in the acquisition [purchase] evaluation process" (Hanson, 1980, p.54). In contrast to the EKB model, the search and evaluation stages are merged in stage 2 of Hanson's model. Moreover, the evaluation is, here again, focusing on whether the product should be physically separated from the user or not. The choice of disposition option is made at the disposition decision stage. Remarkably, Hanson linked the problem recognition with prior phases of the consumption process as this need is triggered during purchase (through for example deposits or buy-back), consumption (through for instance damage or careless use) or disposition (through different types of obsolescence).

Finally, according to Cruz-Cárdenas & Arévalo-Chávez, the disposition decision-making process is defined by two major decisions: the "decision to stop using the products" (Cruz-Cárdenas & Arévalo-Chávez, 2018, p.626) and the "selection of the method of disposal" (Cruz-Cárdenas & Arévalo-Chávez, 2018, p.626). It does not however go further in detail. For them, the user will compare the methods depending on their benefits and costs. The researchers interestingly note that mostly the individual is taken as unit of analysis, which could be explained by the individualistic cultures that studies have been conducted in (Cruz-Cárdenas & Arévalo-Chávez, 2018).

Take-aways

The divestment phase starts with a dilemma on whether or not to continue using a product or not. The first stages of the divestment phase can reflect those of the purchase phase. After recognising the dilemma (i.e., comparable to the 'need recognition' stage during the purchase phase), divestment options can be sought for (i.e., 'search of alternatives' during the purchase phase) and later these divestment options can be evaluated (i.e., 'pre-purchase evaluation'). These first three stages result in two major decisions: the decision to end the use cycle and the decision on the divestment option to select.

During disposition

Early researchers of divestment focused on the actions with respect to the product owned after the user decided that it attained its end of the user cycle (Roster, 2001).

Disposition refers to the visible part of the separation between the user and the product. Through the disposition act, the user renounces "responsibility for and control over the object, forfeits any current or future capabilities or benefits continued possession or the object may afford, and severs any ties that were represented through symbolic aspects of ownership and consumption" (Roster, 2001, p.429). As discussed earlier, after the end of a use cycle, mobile phones can end up in various locations depending on the decision made and the action made by the user.

The final act of disposition is treated differently in the publications of the literature review.

As Fisk (1981) was focusing on services when developing the model, disposition has a minor position in the model due to the intangibility of this action and no further detailing is provided on the subject.

In contrast to the CDP model structure, the act of disposition is not visualised in Hanson's model as the disposition decision directly is followed by post disposition outcomes.

According to Roster (2001), during the physical severance, users renounce the possession of the product, "abdicated responsibility and control over it, and symbolically severed emotional and psychological ties associated with ownership of the object." (Roster, 2001, p.427).

Casey et al (2019) argued that the disposition of EEE either goes through appropriate recycling facilities or via other routes.

Albinsson and Perera (2009) described five modes of disposition (i.e., sharing, exchanging, donating, recycling and ridding).

Cruz-Cárdenas & Arévalo-Chávez mentioned several comparable disposition modes like “storing, gifting, donating, throwing away, selling, etc” (Cruz-Cárdenas & Arévalo-Chávez, 2018, p.629).

To gain more insight on the possible disposition options, the starting point of this systematic review is studied. The first researchers to define a taxonomy for disposition were Jacoby, Berning and Dietvorst in 1977. Jacoby et al. (1977) differentiated three main clusters of disposition modes depending on the level of separation between the consumer and the product: the product can be either (1) kept, (2) permanently rid of, or (3) temporarily rid of (Jacoby, Berning and Dietvorst 1977). These clusters split into 9 disposition modes: Use it to serve original purpose, Convert it to service a new purpose, Store it, Throw it away, Give it away, Trade it, Sell it, Rent it, or Loan it.

Glover (2012) defined 12 disposition modes for products: storing, treasuring (i.e. emotional durability), making do (i.e., maintenance/repair), donating (i.e., to an organisation), passing-on (i.e., donating for the direct reuse by one targeted person), online selling, auction houses, traditional garage sale (i.e., analogue version of online selling with for example ads in the newspaper or at the supermarket), integrated garage sale (i.e., physical), decluttering, kerbside leaving-out (i.e. for reuse by passers-by), and disposal.

Two main clusters of disposition modes are considered in this dissertation: permanent modes (i.e., permanently transferring ownership to another party) or temporary modes (i.e., temporarily transferring ownership to another party or storing the product to have it out of sight). This conceptualisation is due to the definition of end of the use cycle employed in this dissertation, thus excluding for example the disposition mode of repurposing. Like Glover’s and Jacoby et al., the conceptualisation of disposition in this research is focusing on the voluntary process of divestment. However, for the sake of completeness ‘involuntary disposition’ (e.g. theft or loss) could also be included. An overview is provided in Appendix A.

Take-aways

The final act of disposition represents the end of the disposition process as the physical separation has been completed. At this point, the users act upon their decision of ending the use cycle and bring the product to the channel corresponding the disposition option selected.

After disposition

After the physical separation from the product, the detachment process is still ongoing. "Disposition is a process. It entails a process of detaching from and ultimately severing the relationship between the possessor and a possession." (Roster, 2001, p.425). Processes occurring after the act of disposition are considered by all the publications except Casey et al. (2019).

Albinsson and Perera (2009) mentioned the consumer reactions to disposition as either positive, negative or neutral.

Cruz-Cárdenas & Arévalo-Chávez (2018) defined post disposition behaviors as the "behaviors associated with disposition outcomes" (Cruz-Cárdenas & Arévalo-Chávez, 2018, p.628) such as satisfaction and behaviour repetition.

For Fisk (1981), an evaluation follows the disposition of the service to assess whether the use of the product was satisfactory or not. It depends on the previous two evaluations made throughout the consumption cycle, and on the formulated expectations and the actual use experiences. Fisk assumed that evaluation was "an ongoing cognitive process" (Fisk, 1981, p.193) resulting from the comparison of expectations with the perceived performance of the service.

According to Hanson, post disposition outcomes are the feelings of the user after physically separating from the product. The researcher made the parallel with the purchase process as he noticed, similar to post-purchase anxiety, post-disposition anxiety can arise due to cognitive dissonance (Hanson, 1980).

Roster (2001) divided the after-disposition stages in two. During the outcome assessment, users having physically separated from the product reflect "on their decisions, the outcomes both financially and psychologically, and the overall impact of severing their relationships with possessions" (Roster, 2001, p.428). At the end of this full divestment process, the users are psychological and emotional separated from the product (i.e., psychological and emotional severance).

It thus seems that, after disposition, users evaluate the whole consumption process (including the divestment process). The reactions to the disposition are various. For future research, it would be interesting to study which state of mind of the users provides more closure and stimulates the return of products.

Lastly, Hanson (1980), Fisk (1981) and Albinsson and Perera (2009) looped the after-disposition process back to earlier processes (respectively looped back to a future divestment process (Hanson 1980) and to influencing factors (Albinsson and Perera, 2009)). This feedback loop is also implied by Cruz-Cárdenas & Arévalo-Chávez through the repetition of behaviour and by Fisk with the repurchase motivation (if the whole experience was satisfactory).

Take-aways

Divestment does not stop at the final act of disposition. The divestment outcomes, resulting from the physical separation from the product, also have to be considered. The term 'divestment outcomes' is preferred over for instance 'disposition outcomes' so as to keep the denomination of the stages centred on both the physical and mental/emotional processes.

The feedback loop from the divestment phase to the next purchase phase, to the next divestment phase (of the replacement product or even of another product/service) and to influencing factors needs to be taken into account.

Conclusion

The literature review of social sciences yielded six models representing the divestment phase. The results enabled to gather interesting leads of decisions made, the various processes and potential factors to answer the sub-question of What are the stages of the divestment processes? The combination of Hanson (1980) and Roster (2001) enables to consider marketing, strategical and psychological aspects of divestment.

Hanson (1980) based his model on the structure of the decision process of the CDP model used in previous chapters and mimicked the purchase phase for the modelling of the divestment phase.

Roster (2001) added a distinct disposition stage in her model and makes the detachment process more explicit throughout the divestment phase. As a result, two main events happen during the divestment phase: (1) a decision is made to dispense with the product, and (2) the user acts upon this decision. Although seemingly linear, Roster mentioned that "the initial starting point and directionality or the flow of events can be blurred" (Roster, 2001, p.426).

In summary, the literature showed various steps: the decision of ending the use cycle, the decision of which disposition option to choose, the preparation of the product before the final act of disposition, the final act of disposition, and the post-disposition reflective stage. Potentially, a link could be made between this product's divestment phase and the purchase phase of its replacement product.

5.4 Integrating the findings on divestment to the conceptual model

Divestment is the last phase of the consumption cycle (i.e., following purchase and use). It combines both the visible disposition process (i.e., physical separation from the product) and the invisible detachment process (i.e., the mental and emotional separation from the product). The take-aways from the literature review can be integrated to the conceptual model. The resulting conceptual model is visualised in Figure 36.

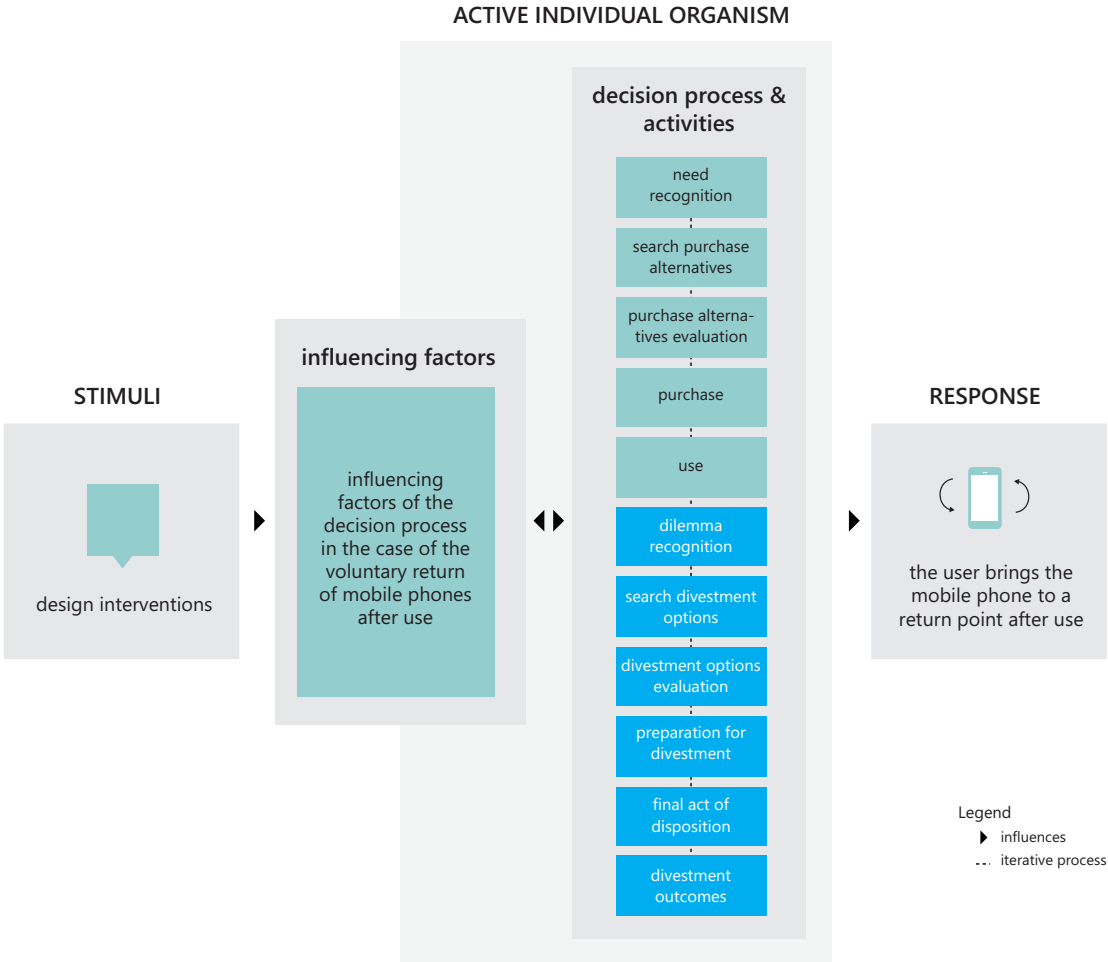


Figure 36. Conceptual model enriched with the findings from the literature review on the stages of the divestment phase (highlighted in dark blue)

The findings from the literature review were implemented in the conceptual model:

- The previously single 'divestment' box at the end of the decision process & activities block is now split into six stages: (1) dilemma recognition, (2) search divestment options, (3) divestment options evaluation, (4) divestment preparation, (5) final act of disposition, and (6) divestment outcomes.
- Both the detachment process and the disposition process should always be considered. Therefore, the names of the stages were carefully crafted so that the physical separation would not overshadow the mental and emotional one in terms of visible activities. The term 'preparation for divestment' is thus preferred over 'disposition preparation', and 'divestment outcomes' instead of 'disposition outcomes'.
- These stages of divestment mimic the stages of the purchase phase of the CDP model while introducing unique vocabulary for divestment to avoid confusions between purchase and divestment. The first stage of divestment is thus named 'dilemma recognition' to mirror 'need recognition' while demarking itself from the purchase stage and reflecting the tension between keeping a product or not. The search and evaluation occurring during divestment is based on 'divestment options' over 'alternatives' mentioned during the purchase phase.
- To further avoid confusion in the terms used throughout the consumption cycle, the terms employed during the purchase phase need to be more precise. The second stage of the purchase phase is therefore changed to 'search purchase alternatives'. The third stage of the purchase phase is also adapted to 'purchase alternatives evaluation'.
- Similarly to the purchase phase, the divestment phase is not as linear as it visually seems. Users indeed do not go through the steps in a neat order, but rather go through the stages at their own pace and possibly returning to previous stages or jumping to a later stage during the process. As a result, the arrows between the stages are removed.
- A feedback loop should be taken into account between the divestment phase to the next purchase phase, to the next divestment phase (of the replacement product or even of another product) and to influencing factors.

5.4.1 Dilemma recognition

The decision process for divestment starts with the activation and recognition of a dilemma for users regarding the utility, meaning or satisfaction of the product

in use (Hall & Zhao, 2016). The dilemma is about whether to keep the product in the current use cycle or to end the product use cycle. When choosing to end the product use cycle, users have to consider the selection of a disposition option. These disposition options can influence whether users choose to keep a product or end its use cycle. Dilemma recognition occurs when users experience a discrepancy between the actual state and the desired state of a product or service. Dilemma recognition can be sparked by a critical event in the user's circumstances (e.g. unemployment), occurrences/changes with respect to the product, or an accumulation of small events (Roster, 2001).

5.4.2 Search divestment options

Following the stage of dilemma recognition, a search starts for "potential need satisfiers" (Blackwell et al., 2006) to achieve the desired state of the product or service. In the case the user decides to end the product/service use cycle, a divestment option (i.e., a way to separate from the product) should be found. This search is both internal (i.e., user's memory) and external (e.g. internet, family and friends) and usually takes place over a period of time.

5.4.3 Divestment option evaluation

Next, a user evaluates the divestment options. This results in a decision of whether to keep the product in use or not, and if not, how to dispense with the product. This evaluation usually relies on the user's memory of pre-existing evaluations or new evaluations based on new information. The evaluation is based on the value and performance assessment of the product and disposition option. The evaluation is dynamic and can vary over time. A static snapshot is made at the "final acknowledgement" (Roster, 2001) resulting in an intended decision on the preferred divestment option. The decision to stop using a product does not mean that users will dispense with the product directly when the decision has been made, but that this can also be planned for the future. It also does not mean that the disposition will actually happen, it is an intention. To illustrate, a user may have the intention to return the product to a return point, but then forgets about this intention and leaves it in storage.

5.4.4 Divestment preparation

To help act on a divestment decision, the divestment preparation can 'sooth' the detachment process i.e., the process of mental and emotional separation (Roster, 2001). Trial divestment (e.g. by storing it in a drawer), overexposure (e.g. forcing

frequent confrontations) and cleaning (i.e., decontaminating it from one's emotional value) are practices that 'erode' value prior to the disposition. The practices of gradual downgrading and brutal use capture the value of the product to the fullest and prevent "lingering value" (Türe, 2014, p.65). Gradual downgrading is adapted from "gradual garbaging" from Türe (2014)(p.54) during which, for instance, a phone is first used as primary phone, and then as back-up phone. More insights on these practices is available in the coming section of this chapter.

5.4.5 Final act of disposition

The final act of disposition is the moment of physical separation. An array of disposition options is available to users, such as donating or selling, temporarily transferring ownership by lending the product or making it accessible to others, or involuntary transfer through loss (Jacoby et al., 1977).

5.4.6 Divestment outcomes

Following the final act of disposition, several divestment outcomes can be experienced. These can be objective (e.g. financial gain from selling the product or space availability in the user's house) and subjective (e.g. lifting the perceived burdens of ownership). This outcome will have an influence on the next divestment process (i.e., repeat behaviour). Here, the user can reflect on their satisfaction regarding divestment (by comparing expectations with the actual experiences) and the whole consumption cycle.

5.5 Factors influencing the divestment processes

Now that more insight is provided on the divestment phase, the factors influencing it require attention to get a better understanding of the processes. To this end, a literature review is conducted.

This section first describes the employed method for the literature review. Then, the resulting factors influencing the divestment processes are explored.

5.5.1 Methods

The literature review is guided by the sub-question: What are factors influencing the divestment processes in the case of voluntary return of owned products after use?

The starting point of the literature review is the systematic review of social sciences literature (from the previous section) and a snowballing process (Wohlin, 2014) to collect other relevant publications from social sciences and beyond. Although the method used to collect data leads to circumstantial results, the overview of gathered factors still enables to understand the concept and facets of divestment further.

The influencing factors found in literature did not explicitly mention the stages of the divestment model identified in the previous section. However, factors could be found regarding the decision to end the use cycle (resembling the dilemma recognition stage) and concerning the decision of which disposition option to select. Therefore, as illustrated in Figure 37, the resulting factors found in literature are organized according to their influence on (A) the decision to end the use cycle, (B) the decision of which disposition option to select, (C) divestment preparation, (D) final act of disposition, and (E) divestment outcomes.

5.5.2 Results

The results of the literature review are divided according to their influence on the divestment stages. Publications treating the factors influencing the divestment processes specifically in the case of mobile phones are indicated with an asterisk.

Roster (2001) mentioned the value and performance assessments done by the users as one of the factors influencing the final acknowledgement stage of divestment. Before diving into the extensive number of factors, the term 'value' should first be specified as it is recurring throughout the results in multiple shapes. In this dissertation, the concept of value is employed in an economics and semiotics sense, not a philosophical one. Value is the "interactive, experiential, and subjective

relation” between users and products (Türe, 2014, p.54). Value can be clustered around the physical durability of the product, psychological (e.g. moral, relational, symbolic and aesthetic), economic and technological aspects. The users’ perception of the value of products depending on their consumption needs and wishes, their expectations and beliefs about the product, and their prior experiences (Bowman & Ambrosini, 2000). Throughout these processes occurring during the use cycle of the product, value is augmented, maintained, and eroded (adapted from Türe, 2014). Users can retrieve value during the purchase phase (i.e., by acquiring the product to fulfil certain needs and wants), during the use phase (e.g. by caring for the product) and during the divestment phase (e.g. by gifting the product to a recipient in need) (Türe, 2014). Value assessment is thus dynamic over time and is relative to the beholder.

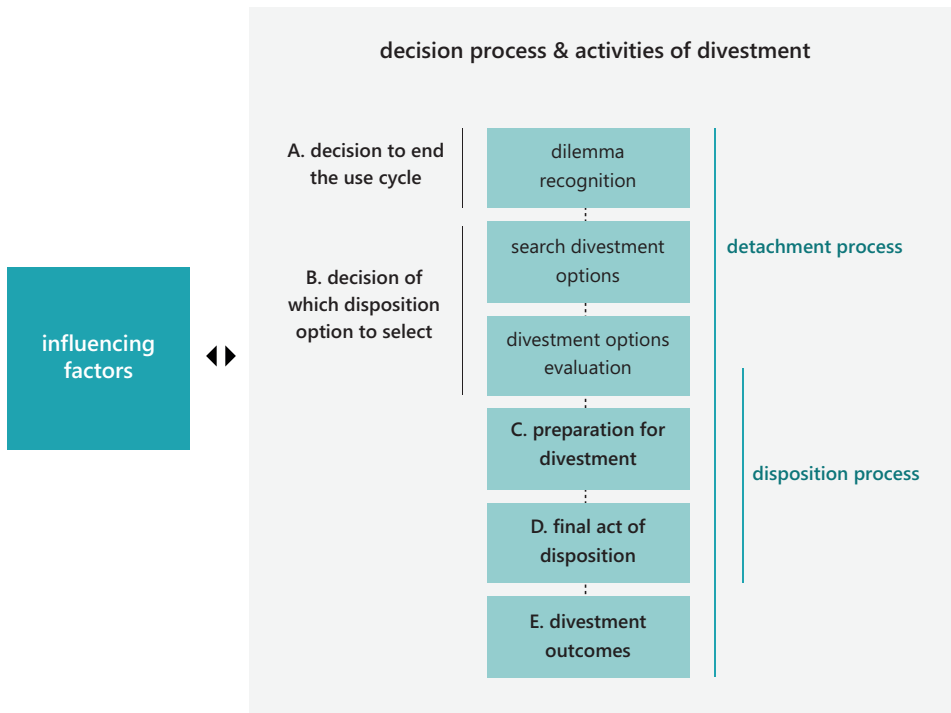


Figure 37. Influencing factors to be defined across the divestment processes

The factors relevant before the final act of disposition are split into three categories: (A) the ones influencing the decision to end the use cycle, (B) the ones influencing the decision of which disposition option to select, and (C) the preparation for this final act. This categorisation emerged from the results in literature and was made to emphasize the importance of the context of the factor.

A. Decision to end the use cycle

The decision to end the use cycle is made if the product does not provide enough value to the user anymore. As visualised in Table 13, influencing factors can be split between user factors (i.e., user characteristics and the perception of the design interventions) and artefact factors (i.e., factual factors linked to the design interventions) related to the product service system, the context and the options. This distinction was chosen as the product and user are the core of the relationship studied and that their context (e.g. geographical, social, market) and options have an impact on this relationship. Note that the different types of factors influence each other. The user’s perception is interwoven into the paragraphs about the user and artefact factors.

A. Decision to end the use cycle	
User factors	Artefact factors
User’s perception - Perceived obsolescence of the product service system (PSS): psychological, economic and technological obsolescence - Perceived context - Perceived divestment options	Product service system Physical obsolescence
User characteristics - Demographics - Competences - Aspirations and beliefs - Habits - Economic situation	Context - Visibility of the product - Life-changing events - Trends, peer/family behaviour and media - Special replacement opportunities - Technological developments
	Options Special divestment opportunities

Table 13. Summary of the relevant factors influencing the decision to end the use cycle

• User characteristics

A product will be kept as long as it remains of sufficient importance for the user (Mugge, 2007). Certain personal traits stimulate or inhibit the decision to dispense with a product and impact the sensibility of the user with respect to

product- and context-related factors.

Demographics such as age, gender, education and income have an influence on all the previously mentioned factors (Cruz-Cárdenas & Arévalo-Chávez, 2018; Hanson, 1980). Users' competences on repair or recontextualising also influence their ability to extend the use cycle of a product rather than ending its use cycle (Türe, 2014).

Moreover, certain aspirations and beliefs have an impact on how moral value is retrieved from for example not wasting materials by using it until the physical obsolescence, or giving an underutilized product to someone in need (Türe, 2014).

Also, user habits are also relevant when it comes to the usual use cycle duration of products (Türe, 2014).

The economic situation of the user will also have an influence.

- ***Product service system***

Users can decide to end the use cycle of the product due to physical obsolescence (also named "absolute obsolescence" (Granberg, 1997)). In this case, the physical durability declined because of failure caused by product design or use (e.g. through wear and tear) and poor maintenance (Cooper, 2004; Granberg, 1997) (Albinsson & Perera, 2009; Cruz-Cárdenas & Arévalo-Chávez, 2018; *Nowakowski, 2019; *Speake & Yangke, 2015). Physical durability is defined as the "ability of products to withstand wear, stress, and environmental degradation and remain able to fulfil all physical functions for which it was designed over a long period of time" (Den Hollander, 2018, p.34).

However, the user perception also has a considerable impact on this decision. Users can make this decision based on perceived obsolescence (also named "relative obsolescence" (Granberg, 1997)) due to declining emotional durability. Emotional durability is defined as "the ability of products to remain wanted by users over a long period of time" (Den Hollander, 2018). Perceived obsolescence can occur in three ways: psychological obsolescence, economic obsolescence and technological obsolescence (Cooper, 2004). Psychological obsolescence occurs when the users' needs and wishes, their expectations and beliefs about the product, and their prior experiences change. Changes ensue from, for example, fashion trends, marketing, emulation, peer pressure, lifestyle shifts or relations altered (Albinsson & Perera, 2009; Cooper, 2004; Cruz-Cárdenas & Arévalo-Chávez, 2018; Roster, 2001; Yang et al., 2018). Users may keep their products because of the psychological value of the representation of self and others (Hall & Zhao, 2016) or when for instance the products are mementos of key identities, events, experiences and relationships (Albinsson & Perera, 2009; Cherrier, 2009). Furthermore, the significance given to

interpersonal relationships is relevant as certain feelings such as relational guilt can occur (Hall & Zhao, 2016), obstructing the user to dispense with the product. Note that the psychological value derived from a product can not only come from the product specimen, but also from the product variant, brand, product category and products in general (e.g. materialism) (Mugge, 2007). Nevertheless, with the specificity of mobile phones being constituted of the combination of the physical product (i.e., hardware) and its digital content (i.e., software), what are users retrieving value from (Wilson et al., 2017)? Additionally, users can not only gain value from the purchase or use of the product, but also through its divestment by shredding their 'old life' and reconstruct a new identity or lifestyle by dispensing with their possessions (Cherrier and Murray, 2007; Cherrier 2009). Moreover, the sensibility to fashion trends changing (Cruz-Cárdenas & Arévalo-Chávez, 2018) are influences the perceived obsolescence of the product.

Economic obsolescence happens when the user assesses that the product is not economically worth keeping (Albinsson & Perera, 2009; Cooper, 2004; Hall & Zhao, 2016; *Nowakowski, 2019; Roster, 2001; *Ting et al., 2019). Dimensions to take into account are initial costs of the purchase, maintenance and use costs, performance/cost ratio, repair/refurbishment costs, replacement costs, divestment gains (e.g. resell price and market trends augmenting the demand for a certain product), and divestment costs (e.g. fuel costs to drive to a return point or a dropping resell price if kept in a drawer). Also, the sensibility of users for economic mechanisms (e.g. valuing frugality (Lastovicka et al., 1999)), valuing minimalism (Cherrier 2009), strong endowment effect, sunk cost fallacy or investment guilt (Hall & Zhao, 2016)) influence the retention of their products or not.

Technological obsolescence occurs when users perceive that the current product does not fulfil the technological needs anymore in comparison to newer products (Cooper, 2004; Hanson, 1980; Roster, 2001; *Speake & Yangke, 2015; *Ting et al., 2019). This perception alters because of "innovation through new knowledge, reduced environmental impact, information or communication capability" (Cooper, 2004, p.427). The sensibility of users who have a higher desire of using the newest technologies on the market is relevant here.

Through this list, it becomes clear that divestment is closely related to the purchase of the product itself and that of replacement products (Cruz-Cárdenas & Arévalo-Chávez, 2018; Roster & Richins, 2009; van Nes & Cramer, 2005). For this parallel decision-making process, the relative advantage of the desired situation is compared with that of the actual situation of the mobile phone (van Nes & Cramer, 2005).

• **Context**

To make the decision to end the use cycle, users need to be aware of the existence of the owned product to be able to evaluate it for potential disposition or not (Hall & Zhao, 2016). Indeed, as described by Roster (2001) distancing behaviours (such as trial divestment, which is explained later) can occur making the product invisible in for example cupboards.

Also, life-changing events (or “critical events” (Roster, 2001) such as moving in with a partner (Casey et al., 2019; Cherrier, 2009; Cruz-Cárdenas & Arévalo-Chávez, 2018; Roster, 2001) can change the expectations and needs of the user, which could lead to perceived obsolescence.

Moreover, evolving trends, peer/family behaviour and media (Albinsson & Perera, 2009; Ellen MacArthur Foundation, 2013; van Nes & Cramer, 2005; Türe, 2014) influence the previously mentioned perceived obsolescence.

Special opportunities for replacement devices such as telecom provider deal, fixed contract durations or hand-me-down from family (van Nes & Cramer, 2005) or upcoming clothing swap or a family member in need of a new device (Türe, 2014) can also have an influence.

Finally, the speed of the industry’s technological developments is also influencing the technical obsolescence of products (Bakker et al., 2014).

The users have a certain perception of their context (Albinsson & Perera, 2009).

• **Option**

The decision of ending the use cycle is interwoven with the decision of which disposition option to select. Users have a certain perception of these options with or without any prior research on their options.

B. Decision of which disposition option to select

Choosing a disposition option can be influenced by the user characteristics, product service system, the context, and the options available to choose from. The summary of the factors found that influence the decision of the selection of the disposition option is visualised in Table 14. Again, note that the different types of factors influence each other.

B. Decision of which disposition option to select	
User factors	Artefact factors
User’s perception • Psychological value of the PSS • Economical value of the PSS	Product service system • Physical condition • Size

• Technological value of the PSS • Awareness of the available options • Psychological value of the options • Economical value of the options		• Brand
User characteristics	Context	
• Demographics • User traits • Prior behaviour • Need for control • Financial situation	• Time & space resources • Population size of the municipality • Special occasions of return events • Community of the user • Economical context of the market	
		Options
		• Environmental performance • Data privacy • Transparency

Table 14. Summary of the relevant factors influencing the decision of which disposition option to select

• **User characteristics**

Links can be made between the demographics of the user and the chosen disposition options. For example, younger users chose less responsible options (Cruz-Cárdenas & Arévalo-Chávez, 2018). Women were also found to make more responsible disposition choices (Cruz-Cárdenas & Arévalo-Chávez, 2018; Darby & Obara, 2005). Users’ traits (e.g. laziness (Darby & Obara, 2005) and cognitive factors (e.g. perceived financial value) influence the perceived effort investment to dispense with the product (Hall & Zhao, 2016).

Additionally, the prior purchase and use behaviours (*Ting et al., 2019) and disposition habits (Darby & Obara, 2005; *Welfens et al., 2016) have an influence on the decision. Interestingly, the selection of a specific disposition option is different across product categories, but seems stable within a product category (Cruz-Cárdenas & Arévalo-Chávez, 2018).

Furthermore, some users have the need to control the fate of the product and thus want to know what happens to it when dispensed with (Albinsson & Perera, 2009; Lastovicka & Fernandez, 2005; Saunders, 2010). Users have a sense of preserving value (e.g. through storage) by controlling the product’s future through the selection of the disposition option (see practices during disposition) (Walker, 2006). “This desire for control may help to explain the preference for known versus unknown recipients in the prior qualitative work” (Walker, 2006, p.43).

- ***Product service system***

The physical condition of the device (i.e., material, components and assembly quality) (Albinsson & Perera, 2009; Jacoby et al., 1977) and brand of the product (*Ting et al., 2019) influence its disposition. The size of the product has an influence on its potential to be stored into hibernation (Cruz-Cárdenas & Arévalo-Chávez, 2018; Darby & Obara, 2005; Jacoby et al., 1977; *Welfens et al., 2016).

Also, the psychological value given to the product by the user influence the disposition option selected (Albinsson & Perera, 2009; Casey et al., 2019; Lastovicka & Fernandez, 2005; *Ting et al., 2019; *Welfens et al., 2016; Wilson et al., 2017; *Ylä-Mella et al., 2015). Some users prefer storage to wait for a “suitable” recipient for the product as reciprocity is expected during disposition (Türe, 2014). Packrats prefer to gift products to friends and family so as to retain a close relationship to the product (Coulter & Ligas, 2003). Users giving an importance to moral value are interested in the level of environmental responsibility, altruism or social responsibility obtained from dispensing with the product through a specific option (Albinsson & Perera, 2009; Jacoby et al., 1977). Here again, the importance put into relationships influences the choice of disposition option (Cruz-Cárdenas & Arévalo-Chávez, 2018; Hall & Zhao, 2016). As a result, one may prefer not to waste resources and choose for reselling a product or may prefer to donate the product to a more needing person. Note that power imbalance can also be seen as an issue when one gifts a product to the receiver who is then in debt of another gift to the gift giver (Türe, 2014).

The perceived economic value guides the selection of the disposition option (linked to replacement costs or initial costs for example) (Albinsson & Perera, 2009; Jacoby et al., 1977; *Nowakowski, 2019; Saunders, 2010; *Speake & Yangke, 2015). The financial situation of the user will have an influence on the importance of monetary compensation of the disposition option (Jacoby et al., 1977). If the transferable economic value is high, users might look for trade-in or resell options to get compensated. On the other hand, several users are willing to pay for a responsible disposition option (*Nowakowski, 2019).

Moreover, the product can be stored keeping a future purpose in mind for the users themselves or others (Casey et al., 2019; Hall & Zhao, 2016; *Nowakowski, 2019; *Speake & Yangke, 2015; Wilson et al., 2017; *Ylä-Mella et al., 2015). In the case of mobile phones, the unused device can be kept as a future emergency device (e.g. when the new device unexpectedly breaks down) or back-up.

In addition, the technological value of the product has to be taken into account. As illustrated by one of the respondents of Türe (2014), extended use of his mobile phone has made the product out-of-date and thus diminished its

transferable value.

- **Context**

Time resources or urgency play a role in the decision of the disposition option. When time is valuable or limited, a product will more often be given away or thrown away (Jacoby et al., 1977).

Various options can be selected depending on the space resources of the user. "We keep because we can." (Ekerdt, 2009, p.69). When storage space is available and the product is easy to store (i.e., which is the case for small mobile phones), the probability that an item will be kept will increase, and the probability that it will be dispensed with will decrease (Jacoby et al., 1977). This storage availability can influence the "intrinsic, object valuation and disposal effort factors" (Hall and Zhao, 2016, p.301). The population size of the municipality influences this decision as users would be more knowledgeable or not on the available infrastructures (*Nowakowski, 2019).

Special occasions of return events such as fundraisers (Casey et al., 2019) and clothing exchanges (Albinsson & Perera, 2009) can guide the decision of the disposition option.

Also, the community of the user has an impact on choosing the disposition option (Albinsson & Perera, 2009) through its social norms (*Welfens et al., 2016), the culture (Cruz-Cárdenas & Arévalo-Chávez, 2018), or peer pressure (Jacoby et al., 1977). For example, collectivist cultures would be more inclined to donate their unused products to friends or family (Cruz-Cárdenas & Arévalo-Chávez, 2018).

Moreover, the economical context of the market (i.e., supply and demand) (Jacoby et al., 1977) influences the affinity for certain monetary disposition options. As mentioned earlier, the divestment of the current product can occur in parallel with the purchase of the replacement product.

- **Option**

The lack of awareness of the various disposition options is often mentioned in literature. Users are often not aware of the disposition options and thus do not know the proper way to dispense with them (Darby & Obara, 2005; *Nowakowski, 2019; Ongondo, Williams, & Cherrett, 2011; *Speake & Yangke, 2015; *Welfens et al., 2016; Wilson et al., 2017; *Ylä-Mella et al., 2015).

In addition, due to the environmental awareness of some users, the moral value out of the environmental performance of the disposition option can be considered, therefore preferring responsible options like reuse and return points (*Speake & Yangke, 2015; *Ylä-Mella et al., 2015).

Moreover, the need for data privacy has been observed as a barrier to the responsible disposition of devices (*Huang, Yatani, Truong, Kientz, & Patel, 2009).

Furthermore, some users mistrust certain disposition options due to the lack of transparency on the path of the product after being handed in (*Welfens et al., 2016). Users need a trustworthy and reliable party to transfer the value of the product.

Also, the convenience linked to the disposition option factors in the decision. Users' effort put in the transaction of the chosen option such as bargaining and cleaning the phone before the eBay sale or the time and energy required for travelling to the return point need to be taken in to account (Albinsson & Perera, 2009; Casey et al., 2019; Cruz-Cárdenas & Arévalo-Chávez, 2018; Darby & Obara, 2005; Hall & Zhao, 2016; *Speake & Yangke, 2015; *Welfens et al., 2016; *Ylä-Mella et al., 2015). As illustrated by *Nowakowski (2019), the lack of action leads to storage.

What's more, users expect reciprocity for their sacrifice (e.g. time, and mental and bodily power) through the disposition option. The sacrifice needs to be recognized by the exchanging party and compensated accordingly by for instance leveraging the moral value resulting from not wasting resources by ensuring their recycling (Türe, 2014).

Finally, users expect a certain financial compensation matching their perceived value of their product (Cruz-Cárdenas & Arévalo-Chávez, 2018; *Welfens et al., 2016; *Ylä-Mella et al., 2015).

C. Preparing for the final action of disposition

The threshold to dispense with a product depends on the user and the circumstances at the moment of evaluation. The factors influencing the detachment and disposition processes are summarized in Table 15.

C. Preparing for the final action of disposition	
User factors	Artefact factors
	Trial divestment practice
	Overexposure practice
	Cleansing practice
	Gradual downgrading practice
	Brutal use practice

Table 15. Summary of the relevant factors influencing the preparation for the final action of disposition

As mentioned by Roster (2001), certain divestment practices can be used to

remove meaning to facilitate detachment and enable to make the decision as well as actually acting on this decision. These practices do more than erase or transfer private psychological value, but can also “create, reinforce, or retain meanings” (Lastovicka & Fernandez, 2005). Cherrier (2009) adds that divestment practices happen mostly for positively charged products, not negative ones. As a result, the to-be-dispensed-with product becomes less of oneself and goes toward becoming someone else’s (Lastovicka & Fernandez, 2005). The trial divestment practice, overexposure practice and the cleansing practice are practices to erode value prior to the disposition to help stimulate the detachment process. The practices of gradual downgrading (adapted from “gradual garbaging” from Türe, 2014) and brutal use prevent “lingering value” by using the value of the product to the fullest (Türe, 2014).

Trial divestment practice (Lastovicka & Fernandez, 2005) can serve as a transitional step towards the ‘permanent out of use’ status of the product to try out whether actually ending the current use cycle would be doable for the user. During this practice, a mental distance is created and meaning is removed by preparing for the separation from the possession by putting it in a “transition place” (McCracken, 1986; Young, 1991) often out of sight (Lastovicka & Fernandez, 2005) (for instance by storing a mobile phone in a drawer).

In contrast, overexposure to the product can also be used to force frequent confrontations to the product (Türe, 2013). This practice can help ease the feeling of guilt of dispensing with a product that still has value, actually legitimize dispensing with a underutilized product, or even build up a certain resentment for it by creating visual disorder (Türe, 2013).

Also, cleaning a product to prepare it and the user for disposition involves its “decontamination” to restore “them to their natural or neutral state” (Roster, 2001). This practice enables the link between the divestment for the current user and the purchase/attachment experience of the new user.

Moreover, gradual downgrading prepares for the final act of disposition when the product does not have transferable value and the end of the use cycle is imminent but other values prevent the user to feel ok with dispensing with the product yet (Türe, 2014). Optimal use of the resources could provide psychological value (i.e., relational and moral value), prevent “lingering value”, diminish anxiety and decrease feelings of guilt for dispensing with the product (Türe, 2014). In this case, a flip phone was first used as intended, then after some time as its value is decreasing it is kept as back-up device or as “party phone” (i.e., where the means of communication of a phone is needed but using your primary phone would run the risk of damage), and when nearing the lowest value the flip phone could now be

used as a toy.

Finally, brutal use can be employed in a similar situation as gradual downgrading. Brutal use stands for careless/non-diligent use of products in order to decrease its value (Türe, 2013). This practice provides comparable benefits as gradual downgrading with the bonus of “boosting the use value” as the user is “using the object till the end” (Türe, 2014, p.65).

D. During the final act of disposition

As shown in Table 16, the iconic transfer and legacy transfer practices can stimulate the detachment process during the disposition.

D. During the final act of disposition	
User factors	Artefact factors
Iconic transfer practice	
Legacy transfer practice	

Table 16. Summary of the relevant factors influencing during the final act of disposition

Through iconic transfer practice, the positively charged private value of the vessel is retained and transferred into another vessel (or, ‘the icon’ (Lastovicka & Fernandez, 2005)) through for instance a photograph of it. As a result, users can dispense with the former vessel “without undue emotional burden” while keeping its “positively charged private meanings” (Lastovicka & Fernandez, 2005, p.817). Here, the psychological value is thus transferred from product to product.

During the legacy transfer practice (Price et al., 2000) (also named ‘carthartic’), the current user tries “to convey private meanings to potential buyers” (Lastovicka & Fernandez, 2005, p.818). A variation of this practice is the ‘safe passage’ where users ensure that the symbolic value of the product is passed on to its new user by making them aware of its value and appreciate it (Roster, 2001). Its value is provided through storytelling by relaying the history of the object to “relinquish lingering emotional ties” and new owners relay their plans for the product for reassurance of appreciation of value (Roster, 2001, p.428). To warrant safe passage, pricing barriers can be installed by the current user by imposing excessive or non-negotiable prices on the product so that the new user automatically has an appreciation of its value (Roster, 2001).

Planning to do these two practices can also sooth the decision of ending the use cycle. These two practices, as well as the two mentioned earlier, are considered

beneficial for the detachment of the user from the product throughout the divestment processes.

E. After disposition

Cruz-Cárdenas & Arévalo-Chávez (2018) made a call for research on the post-disposition evaluation stage. Indeed, the aftermath of the divestment process seems rarely considered in literature.

A positive result of divestment would be closure for users, client retention for companies, and closing the loop for society by sparing the Earth. At this point in time, users reminisce the product experience when it had considerable psychological value (Jimenez et al., 2015). Users can reflect on the overall consumption process (i.e., purchase, use and divestment) comparing expectations to the actual experiences.

According to Cruz-Cárdenas & Arévalo-Chávez (2018), disposition can be followed by the satisfaction of the user with the results or even by behaviour repeat. More in particular, users can reflect on the divestment process by evaluating the success of the consumption process and the final value transfer during divestment. This evaluation is, for instance, done by assessing the recipient’s reactions (i.e., providing moral value), the financial compensation received (i.e., providing economic value), the established/enhanced relationships (i.e., providing symbolic value), the return point not having convenient opening hours (i.e., unsatisfying experience with more effort required than anticipated), or by finding out afterwards that the recycling process was not as sustainable as anticipated (i.e., lowering the moral compensation and trustworthiness of the company). The list can thus logically be filled with all the factors mentioned before (and more) as visualised in the table below.

E. After disposition	
User factors	Artefact factors
User’s perception • Psychological value of the PSS • Economical value of the PSS • Technological value of the PSS • Psychological value of the options • Economical value of the options	Product service system • Physical condition • Size • Brand
User characteristics • Demographics	Context • Time & space resources

• User traits • Prior behaviour • Need for control • Financial situation	• Population size of the municipality • Special occasions of return events • Community of the user • Economical context of the market
Options	
• Environmental performance • Data privacy - Transparency • Compensation	

Table 17. Summary of the relevant factors influencing the user after disposition

Conclusion

In conclusion, the factors influencing the divestment processes can be product-, user-, context- or option-related. The lists of factors identified in this chapter are not exhaustive and cannot be seen as prescriptive or predictive. The factors influencing the divestment processes are numerous, dynamic over time, influencing each other, and thus complex.

Note that publications were regularly unclear on which specific part of the divestment processes was being influenced by the mentioned factors.

5.6 Conclusion

This chapter provided an overview of the concept of divestment based on general design literature, circular design literature, and literature from other social sciences. In doing so, the first step was made in the direction of an answer for

RQ1B: What conceptual model could be used to understand the interaction between users, mobile phones and providers for the return of devices in ownership-based consumption?

and

RQ3: What design interventions could influence users to divest their owned mobile phones?

by studying the divestment processes and their influencing factors.

- **Defining the concept of divestment.** Social sciences literature (e.g. marketing, psychology and sociology) was consulted to remediate the lack of attention for the user perspective in the field of circular economy and for divestment in design literature. Divestment is defined as the overarching term referring to the final phase of the consumption cycle after the purchase and use phases and focusing on the user perspective. It is the combination of the disposition process and the detachment process. Disposition refers to the physical separation of the product, which represents the visible part of divestment. Detachment refers to the mental and emotional separation of the product, which represents the invisible part of divestment.
- **Stages of the divestment phase.** Based on the literature review, the decision process and activities of divestment were defined in six stages mirroring the first phases of the CDP model. As illustrated in Figure 38, the stages of the divestment phase are: (1) dilemma recognition, (2) search divestment options, (3) divestment options evaluation, (4) divestment preparation, (5) the final act of disposition, and (6) divestment outcomes.
- **Factors influencing the decision process and activities of divestment.** A variety of factors influencing the divestment phase were found in literature. Following Granberg's (2007) take on obsolescence, a distinction is made between artefact-related factors and their perception by users.

The decision to end the use cycle of a product and the decision of which divestment option to choose depends on the user's perception of these artefact-related factors. These factors influence each other as well as the user. For instance, users could choose to not extend the life of their current product due to their lack of DIY repair experience and their attraction to a newly-launched product. These factors range from *user perceptions* (e.g. perceived distance to the return point) and *characteristics* (e.g. gender and competences), the *product service system* (e.g. physical condition of the product), the consumption *context* (e.g. moving or user's community) and *option-related factors* (e.g. lack of awareness). Due to their amount and interdependencies, the factors cannot be used as predictive triggers for the design of interventions to stimulate users to return their products after use. However, they do provide further understanding and important insights in the complexity of the divestment process. These preliminary findings have led to the further development of the conceptual model, as visualised in Figure 38.

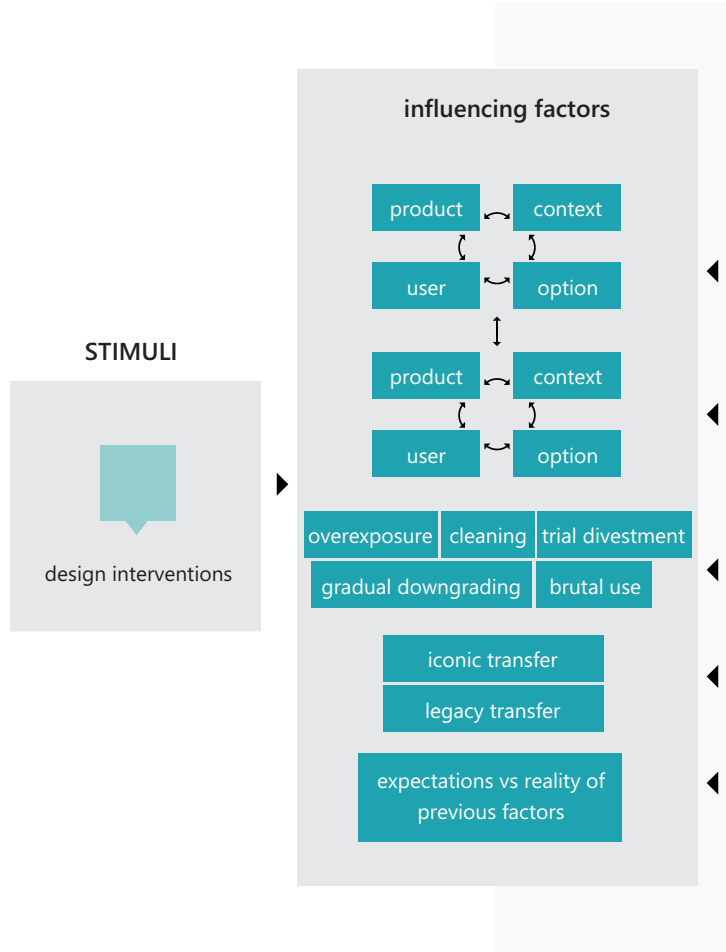
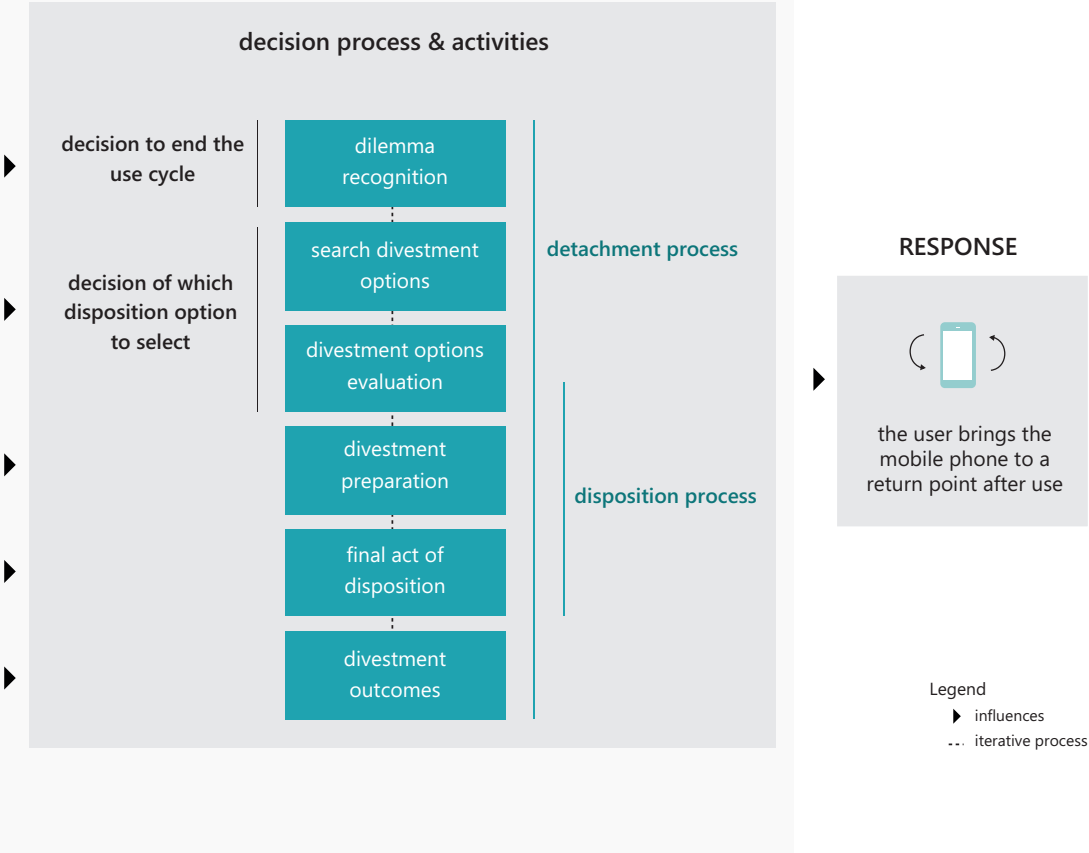


Figure 38. Preliminary overview of the divestment processes and influencing factors resulting from the literature review

ACTIVE INDIVIDUAL ORGANISM



CHAPTER 6

The divestment of devices in ownership- based consumption: Empirical studies

6. Divestment of devices in ownership-based consumption: Empirical studies

6.1 Introduction

Link to previous chapters

In order to ensure that users return their mobile phones after use, designers have to influence disposition by leveraging the detachment process. Chapter 5 contributed to generating a better understanding of interpretations of the divestment processes and the factors influencing them based on literature. These insights are a stepping stone to the development of design interventions. The reviewed literature lacked resources for design researchers and practitioners to actually design for divestment. To bridge this knowledge gap, further empirical research is required. How can technology, business and people come together in design practice when it comes to divestment?

Objective of this chapter

This chapter answers the research question:

RQ3: What design interventions could influence users to divest their owned mobile phones?

The objective of this chapter is to provide design insights on divestment, and to develop a set of divestment design principles for design practitioners and researchers. The principles should enable designers to create design interventions to guide users through divestment, and as a result, foster the CE through the timely recovery of used good quality products, in sufficient quantities. To research this, a series of empirical studies were conducted using a Research through Design (RtD) approach, with smartphones as case study.

Outline of this chapter

This chapter is composed of the peer-reviewed paper '*Design for Divestment in a circular economy: stimulating voluntary return of smartphones through design*' by Flora Poppelaars, Conny Bakker & Jo van Engelen, published on the 17th of February

2020 in Sustainability.

The chapter is closed with a short reflection on the embeddedness of the paper within the dissertation.

Appendix C provides a reflection on the stages of the divestment model based on the empirical studies mentioned in this paper.

6.2 Design for Divestment in a Circular Economy: Stimulating Voluntary Return of Smartphones through Design

This section of the chapter is an adapted version of the paper 'Design for Divestment in a Circular Economy: Stimulating Voluntary Return of Smartphones through Design' published in Sustainability on the 17th of February 2020. As the publication is very recent, the thinking has not evolved considerably since. Note that the conceptual model differs from the one presented in Figure 36 in that the arrows between the stages of the divestment model are still present, giving the illusion of linearity. Also, the block of influencing factors is here positioned on the right of the decision process and activities of divestment in the paper's Figure 41 and Figure 49. No changes have been made to the journal paper except for its layout and referencing system. The pronoun 'we' was employed to refer to the authors of the paper: Flora Poppelaars (author of this dissertation), prof.dr. Conny Bakker and prof.dr. Jo van Engelen (her supervisory team).

6.2.1 Introduction

The circular economy (CE) is a promising approach towards sustainable development (Geissdoerfer et al., 2017; Ghisellini et al., 2016). For a successful transition toward a CE, it is essential that products are returned at their end-of-use to be reused, repaired, refurbished or remanufactured (Korhonen et al., 2018). In other words, products are looped back into the economy with minimum loss of value (Webster, 2015). While the recovery of used products has been extensively addressed from a business perspective (e.g., (Bakker et al., 2014; Bocken et al., 2016; Lewandowski, 2016)) and technical perspective (e.g., (Mestre & Cooper, 2017; Moreno et al., 2016; Rubio et al., 2007)), the user perspective has been relatively underexplored (Camacho-Otero et al., 2018; Selvefors et al., 2019). Therefore, the overarching question we ask in this paper is how can users be enabled and stimulated to return their products at end-of-use in order to ensure circular consumption?

Two major challenges of high-quality recovery are its "many-to-few" networks, i.e., from many dispersed users to a few collection points, and the related high degrees of uncertainty in timing, quality, and quantity of the return flows (Fleischmann et al., 1997). From a user perspective, we ask: how can we contribute to reducing these uncertainties? For instance, how can we stimulate users to return their products as soon as they have made the decision to replace them, thereby

discouraging them from “storing and forgetting”? How can we induce users to maintain their products well, and allow them to reap a benefit when returning a high-quality product? Related to the quantity of return flows, how can we create a “culture of return,” where users routinely seek appropriate modes of disposition after use, e.g., donating at collection points or selling through a take-back scheme?

Within the context of CE, this study focuses on design for divestment from a user perspective. It addresses these questions from a Research through Design (RtD) approach. From a design point of view, it is interesting to observe the imbalance between the extensive care put into the design of product purchase and product use experiences, and the careless way in which the final phase of consumption is often designed. We thus ask, can design contribute to creating more valuable and valued divestment processes from the user perspective?

Following Glover (2012) and Gregson et al. (2007), we use the term divestment to refer to the final phase of the consumption cycle of purchase, use, and divestment. Divestment represents the combination of physical separation and mental and emotional separation processes that users go through when ending the use cycle of a product (see Table 18). Divestment is depicted here as the combination of disposition (i.e., physical separation) and detachment (i.e., mental and emotional separation of the product).

Divestment overarching term referring to the final phase of the consumption process after the purchase and the use phases	
Disposition physical separation of the product, the visible part of divestment	Detachment mental and emotional separation of the product, the invisible part of divestment

Table 18. Descriptions of divestment, disposition and detachment

The two processes of disposition and detachment happen simultaneously during divestment. Disposition behaviour is often the point of focus in literature as it can be quantified and helps to measure what route is chosen by the user to dispense with their products (e.g., (Pérez-Belis et al., 2015; Pitts & Mizuki, 1996; Thiébaud (-Müller) et al., 2018)). However, this behaviour is the output of an intangible detachment process, which represents an, as yet, unspecified part of divestment.

Several publications in the field of design research consider the user perspective at the end of the use cycle (e.g., (Choi et al., 2017; Earley, 2017; Selvefors et al., 2019; Wastling et al., 2018; Zeeuw van der Laan & Aurisicchio, 2019)). Selvefors et al. (2019) distinguish between design for postuse, design for exchange, and design

for multiple use-cycles. Design strategies noted by the authors are for instance “design for detachment,” when the product is no longer in use, and “design for easy disassembly and reassembly,” which allows for timely upgrades and the removal of (physical and psychological) contamination of products by for example deleting personal information. Zeeuw van der Laan & Aurisicchio (2019) also developed design principles, for instance, making a product’s lifetime more explicit to inform users of the optimum moment for replacement, making take-back services more accessible, and by offering return services at the moment a product is likely to become obsolete. An example given by the authors is a postal service for the return of baby clothes at the moment they are outgrown. These principles are valuable starting points and will be taken into account in the subsequent development of a set of design for divestment principles.

Our objective is to provide design insights on divestment, and to develop a set of divestment design principles for design practitioners and researchers. The principles should enable designers to create design interventions to guide users through divestment, and as a result, foster the CE through the timely recovery of used good quality products, in sufficient quantities. To research this, a series of empirical studies were conducted using an RtD approach, with smartphones as case study. Smartphones are high-value products renowned for their tendency to “hibernate” in drawers. Wilson et al. (2017) found that only a third of previously owned mobile phones were returned back into the system, with an average hibernation of three years.

This study focuses on how the voluntary return of used smartphones can be stimulated in a product ownership context. Product ownership refers to a business model where the legal ownership of a product is transferred to users at the purchase phase and where users are de facto responsible for their maintenance and disposition. We do, however, recognize that certain circular business models, such as lease and product-as-a-service models could facilitate the return of used products like smartphones, but our focus is on product ownership, as it is still the dominant business logic today.

We start by presenting a model of the divestment stages in the consumption cycle. We then describe the materials and methods of the RtD approach, followed by the results of the empirical studies. These results finally lead to divestment design insights and design principles to help stimulate and enable the return of products.

6.2.2 Background

The influential Consumer Decision Process (CDP) model, also known as the Engel-Kollat-Blackwell (EKB) or Engel-Blackwell-Miniard (EBM) model, considers

user behaviour and divides it into decisions and activities. The model is meant as “a roadmap of (users’) minds” by reporting the way users “think, evaluate, and act” (Blackwell et al., 2006, p. 70). It was originally introduced in 1968 and has evolved ever since. The most recent version of the model’s decision-making process (Blackwell et al., 2006) is visualized below in Figure 39. The blocks in blue concern divestment. In the CDP model, the concept of divestment is defined as the act of dispensing with a product. The divestment process has not been conceptually developed as well as the purchasing process, creating an imbalance in the CDP model.



Figure 39. The decision-making process of the Consumer Decision Process (CDP) model by Blackwell et al. (2006) with an emphasis of the underexposed divestment phase in blue

To address this imbalance, it is necessary to further unpack the processes of detachment and disposition. In previously published work (e.g., (Blackwell et al., 2006; Cruz-Cárdenas & Arévalo-Chávez, 2018; Hanson, 1980; Roster, 2001)), six stages were identified for the divestment phase (Figure 40). These are: (1) dilemma recognition, (2) search divestment options, (3) divestment options evaluation, (4) divestment preparation, (5) final act of disposition, and (6) divestment outcomes. These stages mirror the stages of the CDP model purchase process and introduce unique terms to avoid confusion.

The decision process for divestment starts with the activation and recognition of a dilemma for users regarding the utility, meaning or satisfaction of the product in use (Hall & Zhao, 2016). The dilemma is about whether to keep the product in the current use cycle or to end the product use cycle. When choosing to end the product use cycle, users have to consider the selection of a disposition option. These disposition options can influence whether users choose to keep a product or end its use cycle.

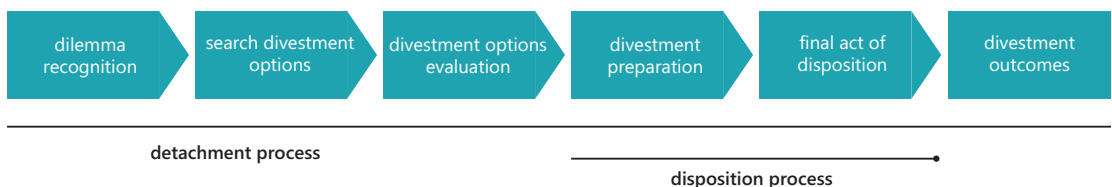


Figure 40. An analytical cognitive model of consumer behaviour for divestment based on (Blackwell et al., 2006; Cruz-Cárdenas & Arévalo-Chávez, 2018; Hanson, 1980; Roster, 2001)

Dilemma recognition occurs when users experience a discrepancy between the actual state and the desired state of a product or service. Dilemma recognition can be sparked by a critical event in the user's circumstances (e.g., unemployment), occurrences/changes with respect to the product, or an accumulation of small events (Roster, 2001).

Following the stage of dilemma recognition, a search starts for "potential need satisfiers" (Blackwell et al., 2006) to achieve the desired state of the product or service. In the case the user decides to end the product/service use cycle, a divestment option (i.e., a way to separate from the product) should be found. This search is both internal (i.e., user's memory) and external (e.g., internet, family and friends) and usually takes place over a period of time.

Next, a user evaluates the divestment options. This results in a decision of whether to keep the product in use or not, and if not, how to dispense with the product. This evaluation usually relies on the user's memory of "preexisting evaluations" or new evaluations based on new information (Blackwell et al., 2006). The evaluation is based on the value and performance assessment of the product and disposition option. The disposition option is evaluated as a trade-off between benefits (i.e., factors that provide an advantageous or desired situation) and sacrifices (i.e., factors that the user needs to give up in order to acquire the proposed service). The evaluation is dynamic and can vary over time. A static snapshot is made at the "final acknowledgement" (Roster, 2001) resulting in an intended decision on the preferred divestment option. The decision to stop using a product does not mean that users will dispense with the product directly when the decision has been made, but that this can also be planned for the future. It moreover does not mean that the disposition will actually happen, it is an intention. To illustrate, a user may have the intention to return the product to a collection point, but then forgets about it, causing it to remain in the drawer where it was stored.

To help act on a divestment decision, the divestment preparation can "sooth" the detachment process, i.e., the process of mental and emotional separation (Roster, 2001). Trial divestment (e.g., by storing it in a drawer), overexposure (e.g., forcing frequent confrontations), and cleaning (i.e., decontaminating it from one's emotional value) are practices that "erode" value prior to the disposition. The practices of gradual downgrading and brutal use capture the value of the product to the fullest and prevent "lingering value" (Türe, 2014). Gradual downgrading is adapted from "gradual garbaging" from Türe (2014) during which, for instance, a phone is first used as primary phone, and then as back-up party phone.

The final act of disposition is the moment of physical separation. While in this paper we focus on the permanent and voluntary transfer of ownership through

the return of the product to manufacturers, retailers, telecom providers or other organisations' collection channels, an array of other disposition options is available to the user, such as donating or selling, temporarily transferring ownership by lending the product or making it accessible to others, or involuntary transfer through loss (Jacoby et al., 1977).

Following the final act of disposition, several divestment outcomes can be experienced. These can be objective (e.g., financial gain from selling the product or space availability in the user's house) or subjective (e.g., lifting the burdens of ownership). This outcome will have an influence on the next divestment process.

The many different factors influencing the divestment process make it impossible to establish direct causal relations between any one factor and the successful return of products. The factors went from user characteristics (e.g., gender (Favot & Grasseti, 2017) and competences (Türe, 2014)), to that of the product service system (e.g., physical condition of the product (Albinsson & Perera, 2009), or perceived distance to the collection point (Lange et al., 2014)), the consumption context (e.g., moving (Casey et al., 2019) or a replacement opportunity (van Nes & Cramer, 2005)) and option-related factors (e.g., lack of awareness (Ongondo et al., 2011)). These factors can therefore not be used as predictive triggers for the design of interventions that will actually make users return their products. However, they do provide further understanding and important insights in the complexity of the divestment process.

These preliminary findings have led to the development of a conceptual model of divestment (Figure 41). Figure 41 shows the model of consumer behaviour for divestment (from Figure 40) and its influencing factors. Following Granberg's (1997) take on obsolescence, a distinction is made between artefact-related factors and their perception by users. The decision to end the use cycle of a product and the decision of which divestment option to choose depends on the user's perception of these artefact-related factors. These factors influence each other as well as the user. For instance, users could choose to not extend the life of their current product due to their lack of DIY repair experience and their attraction to a newly launched product.

6.2.3 Materials and Methods

Due to the gap in design literature concerning divestment from a user perspective and the lack of predictive factors for the return of devices, a qualitative research approach was followed to find how design can stimulate users to bring back their devices at the end-of-use.

ACTIVE INDIVIDUAL ORGANISM

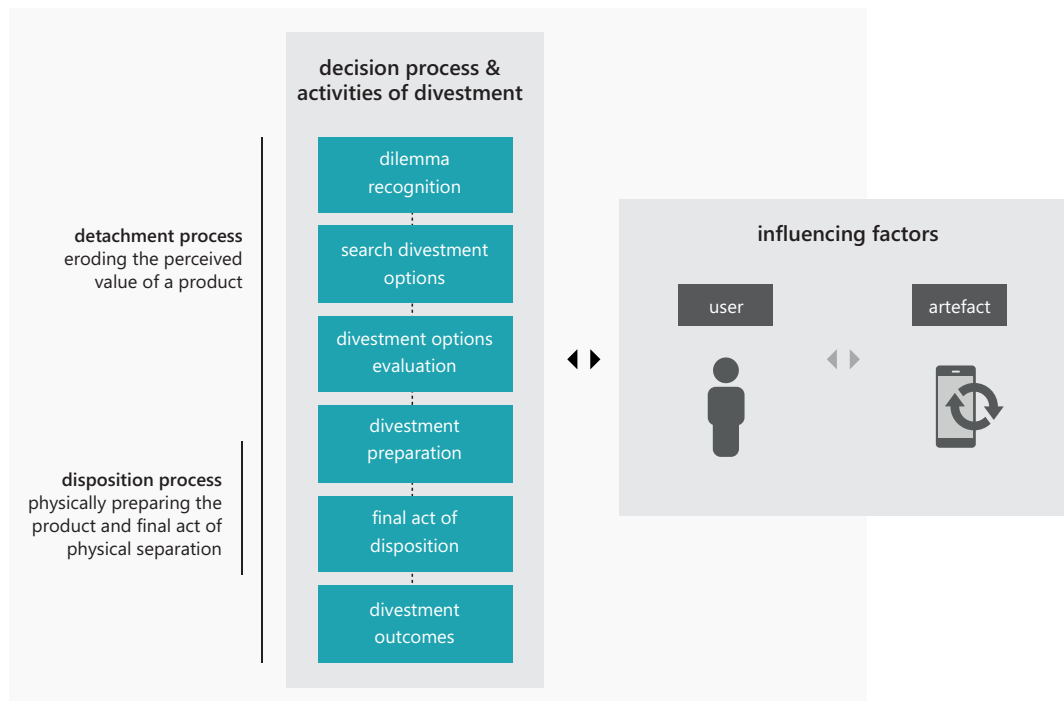


Figure 41. Conceptual model of divestment (the artefact is depicted as a mobile phone as our focus in this paper is on mobile devices)

Research through Design approach

Designing is “changing existing situations into preferred ones” (Simon, 1996, p. 67), which in this research meant that unused phones should get out of drawers and back into the loop. As this endeavour requires exploration, qualitative research fitted this research.

A Research through Design (RtD) approach was adopted to generate the missing knowledge. RtD is defined as “the designerly contribution to new knowledge” (Stappers & Giaccardi, 2017, p. 63). This approach gets insights from design practice to better understand complex problems in the field of design (Godin & Zahedi, n.d.). Based on action research and reflective practice, designers put specific interventions based on research into practice and reflect on the effects of these interventions in a systematic manner (i.e., iterative process) (Zimmerman et al., 2010). In line with Zimmerman et al. (2010), we agree that the focus of RtD is societal change, and that

RtD “is a theory of action followed by meaning” (Zimmerman et al., 2010, p. 311), which should result in a “proposition for a preferred state” (ibid).

The objective of this research is not to predict user behavior (as the situation is complex), but rather to understand the processes of divestment and how designers deal with the creation of design interventions aimed at stimulating users to return their products. At the end of the research, design principles for divestment are proposed.

Design activities were studied in design practice to focus our inquiry across several cases. A rigorous approach was followed with documentation that covers the whole design process from problem framing to the final outcome, with the aim of using insights gained from the design projects to propose a set of design principles, and also to reflect on the value of the divestment model and its influencing factors. In this sense, the RtD approach is used as a systematic method of inquiry.

Data Collection

Research through Design “employs methods and processes from design practice as a legitimate method of inquiry” (Zimmerman et al., 2010, p. 310). To access latent knowledge (i.e., deepest level of knowledge) (Sanders & Stappers, 2012) from designers, designers were invited to create divestment use experiences to express their thinking and emotions during generative sessions (Sanders & Stappers, 2012). As shown in Table 19, seven design projects were conducted with design professionals and students. Four design projects were conducted during an expert workshop held at the Design Research Society conference in Limerick, Ireland in June 2018. The three other design projects were done by industrial design engineering master students finalizing their degree at the Delft University of Technology in the Netherlands. These projects ran between March 2018 and January 2019. The students worked full-time on their project for 23–26 weeks. Their design brief was to design a solution to close the loop of mobile devices from a user perspective. The data collected is textual data arising from the design activities and artefacts (e.g., posters, notes and reports). Various methods such as break-up letters and journey maps were employed to gather rich data from the designers during the workshop and design projects.

Data Interpretation

The data interpretation was structured around the following questions: What factors did participants consider during the creation of their design interventions which would influence the divestment decision process and activities? and What design insights (and eventually, principles) can be derived from them?

Empirical Study	Aim of the study to generate knowledge	Format	Participants	Data collected
Workshop DRS (resulting in four design projects)	- Uncovering how we can make endings valuable and a real part of the consumption process - Creating divestment user experiences and reflecting on decisions of designers - Using the prototype as "physical hypothesis" to prove the feasibility of divestment experiences	Four-hour workshop	18 participants in the workshop session	- Audio recordings - Notes of the presentations - Break-up letters - Posters of journey maps - Posters of the design of offboarding solutions - Group manifestos
Design project Diede Mertens	- Uncovering how the data loss aversion barriers of users can be lifted or softened through design - Creating a divestment user experience and reflecting on decisions made throughout the project - Using the prototype as physical hypothesis to prove feasibility - Using the prototype as provocation for users	Final project (30 ECTS) for an MSc degree at the faculty of Industrial Design Engineering (TUD)	One "Design for Interaction" MSc student	- Notes of progress meetings - Final research report - Demonstration of the prototype
Design project Esra Polat	- Uncovering how the relationship between the telecom provider and the user can be engaged in the process of divestment - Creating a divestment user experience and reflecting on decisions made throughout the project - Using the prototype as a "physical hypothesis" to prove feasibility - Using the prototype as provocation for users	Final project (30 ECTS) for an MSc degree at the faculty of Industrial Design Engineering (TUD)	One "Integrated Product Design" MSc student	- Notes of progress meetings - Final research report - Demonstration of the prototype
Design project Jingwei Ren	- Uncovering how awareness and convenience barriers for users to bring back their products can be lowered through design? - Creating a divestment user experience and reflecting on decisions made throughout the project - Using the prototype as a "physical hypothesis" to prove feasibility - Using the prototype as provocation for users	Final project (30 ECTS) for an MSc degree at the faculty of Industrial Design Engineering (TUD)	One "Design for Interaction" MSc student	- Notes of progress meetings - Final research report - Demonstration of the prototype

Table 19. Overview of the empirical studies, their aims within the RtD approach, format, participants, and data collected

Data interpretation of the design projects was based on the three research reports, the descriptions of the physical and virtual prototypes developed by the students, as well as notes made during progress meetings. The workshop resulted in observer notes and visual & written output on flip-overs and post-its. The 4-h long workshop was recorded to provide backup in the case the written notes were ambiguous or contradictory.

All written output by the designers was coded in ATLAS.ti. The conceptual model of divestment visualized in Figure 41 generated starting points for the identification of possible codes. After eliminating redundancies, 154 textual codes were identified. The KJ method was then used to cluster the codes into eight main factors (Scupin, 1997), as visualized below in Table 20.

To avoid researcher bias and test intra-coder reliability, the internal consistency between the four empirical studies was tested, coding was done twice at an interval of approximately one year, and patterns and relations found in the studies were compared to literature. This process permitted the elimination and alteration of redundancies and ambiguous codes, as well as to ensure the robustness of the findings. The open source coded data is available [here](#).

6.2.4 Results

Together with a graphic designer, the results of the workshop groups and the design projects were translated into seven poster-like graphics in order to effectively convey the central ideas of the projects and allow comparison.

Main factor	Description	Examples
Awareness of collection solutions	User knowledge on the existence of collection options and how they work	Native app
Understandable collection solutions	Easy to understand messaging on the benefits and the procedure to follow to reduce uncertainties	Simple texts and images explaining the rules for collection
Reversing physical condition	Postponing divestment by extending the product use cycle through software refreshment or through hardware repair and refurbishment	Exchange of components within the community to keep using the product
Financial compensation	Perceived and actual monetary value in exchange for divesting the device through the collection solutions	Transparency of the financial value of the device over time
Technological compensation	Perceived and actual engineering value in exchange for divesting the device through the collection solutions	Extra storage to save the digital content of old devices
Psychological compensation	Perceived and actual moral, relational (with phone, community, brand, telecom provider) and symbolic award to users in exchange for divesting the device through the collection solutions	Having a shared benefit with relatives through the telecom provider when returning a device
Effortless collection	Unburdening users from the hassle of collection through omnichannel, available and accessible collection infrastructures	Self-diagnosis system shortening the evaluation of the physical condition of the device to be returned
Freedom of choice	Leaving decision-making possibilities open for users	Choosing the type of compensation or having a trial divestment

Table 20. Overview of the main factors identified in the empirical studies

DRS Workshop Results

The participants conceived the following four concepts, all created to ensure a valuable divestment user experience.

The first group wanted to acknowledge the end of the use cycle at the purchase phase, and devised ways to ritualize a form of “reincarnation” of the data from the current device into the replacement device. The personification of the smartphone highlights the importance of the product for the user reaching beyond its functionality. The psychological compensation offered for the return of the smartphone thus needs to leverage this relationship, for instance by soothing separation anxiety. To this end, the group created a “product relationship counsellor” as part of an after service (Figure 42). This counsellor illustrates the two factors of an effortless collection procedure and clear communication to sooth negative emotions.



Figure 42. Impression of group 1's concept

The second group proposed a “ceremony to say goodbye” to give the replacement phone a good start by cleaning the digital content from the old phone before putting it “into a new body” (Figure 43). An offboarding app guides users through the steps, here again illustrating the factor of effortless collection. The group also noted that access models could enable users to feel less attached to their products (i.e., playing with the psychological compensation factor) and that the idea that “new is good” should be denormalized (i.e., to extend the product use cycle).



Figure 43. Impression of group 2's concept

The third group made a thought experiment by comparing the relationship between the phone and the user with a marriage (Figure 44). The phone and user would evolve together by exchanging components to prolong the relationship, here again showing the importance of the factor of appropriate psychological compensation. The marriage not only constitutes a user relationship with the product, but also with the active community behind the product to enable component swapping and know where the products go to. The factor of reversing the product's physical condition is thus at the core of this concept to postpone divestment.



Figure 44. Impression of group 3's concept

The fourth group thought of building in a self-diagnosis system to evaluate the performance of the device and help sell it after use (Figure 45). It combines both the factors of financial compensation and effortless collection. This group also considered the flash reincarnation of the soul of the device into the cloud (and thus automatically on the replacement phone) and making the “re-boxing” of the old phone a memorable experience (a deliberate opposite to “unboxing”).



Figure 45. Impression of group 4's concept

Mertens: Data Concerns

During her user research, Mertens (2018) identified data concerns as a significant barrier for “letting go” of a device. Her design interventions focused on the factor of effortless collection by helping users to make a back-up, transfer personal data onto the replacement phone, and safely delete the data on the current phone (Figure 46). Her objective was to ensure a comfortable, reassuring and efficient experience which would give users the confidence that their actions were successful. The factor of psychological compensation is represented in the concept through the relationship of the users with the content of their phone. She emphasized the need for clear communication on the steps to follow to create a reliable and trustworthy process. By enabling to reminisce and look back at old phones as well as their digital content at the time, Mertens plays on the factor of psychological compensation.

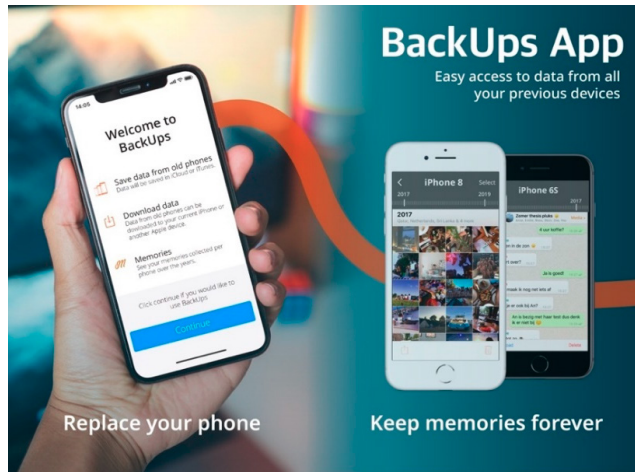


Figure 46. Impression of the BackUps app designed by Mertens (2018)

Polat: Relationships

Learning from beneficial co-operations found in nature (i.e., biomimicry), Polat (2019) designed a return programme for the Dutch telecom provider, KPN (Figure 47). To stimulate (future) telecom provider clients to hand in their devices, Polat's KPN Collect concept proposes multiple mutual benefits to users who involve family and friends in the reward programme. Her concept is designed to be easily integrated in the telecom provider's existing digital ecosystem (i.e., website, forum and MijnKPN app) and procedures (e.g., end of contract). The concept mainly focused on the compensation factors and making the collection effortless, while also considering all of the other main factors described in Table 20.

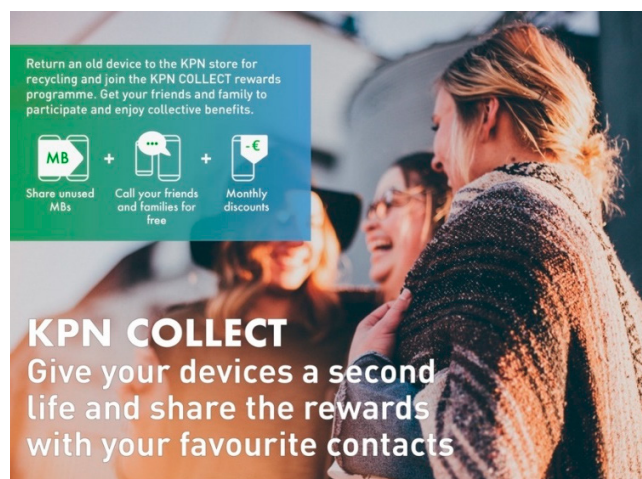


Figure 47. Impression of the KPN Collect designed by Polat (2019)

Ren: Easy and Transparent Offboarding

After trying to trade-in his iPhone at various locations, Ren (2018) learned first-hand how badly designed these offboarding experiences were. He subsequently designed a trade-in app which would be activated at the moment of purchase of a new phone (Figure 48). The app would alert users about the optimum time to replace the phone, i.e., when its financial value is still enough for the user to make replacement interesting, and for the service provider/OEM to harvest additional value from the phone through refurbishment and resale. Ren also proposed a meaningful goodbye to users with the design of a trade-in kit. The divestment user experience is thus supportive, effortless and seamless. His concept foremostly focuses on the effortless collection and financial compensation factors.



Figure 48. Impression of the Trade-In app designed by Ren (2018).

6.2.5 Discussion

We first reflect on the conceptual model of divestment (Figure 41) before translating the results of the empirical studies into design insights for divestment. We finish with a digestible summary of design principles for both design practitioners and researchers.

Reflection on the Conceptual Model of Divestment

Analysis of the empirical studies showed that the divestment stages were not followed one after the other. Often, the designers combined multiple stages, or

processed them in parallel. The model is thus not designed to be prescriptive; we emphasize that it should be used by considering the discursiveness of design and that of users.

All the influencing factors found in the empirical studies (Figure 49) are reflected in the literature. For instance, the lack of awareness of collection solutions is a prominent factor in publications (Darby & Obara, 2005; Nowakowski, 2019; Ongondo et al., 2011; Speake & Nchawa Yangke, 2015; Welfens et al., 2016; Wilson et al., 2017; Ylä-Mella et al., 2015). The importance of finding the appropriate collection solution is evident in the work by, for example, Ren (2018), who designed an app to seamlessly connect the use phase with the divestment phase and pro-actively inform users on divestment solutions. In another example, Huang et al. (2009) raised the issue of data privacy. Mertens (2018) not only permitted users to delete their data by going through the appropriate steps but also reduced the anxiety linked to this activity by making the back-up “tangible” as the users could digitally see their old device and scroll through it in the cloud.

Moreover, the empirical studies show the importance of catering to the detachment process to provide closure for users at the end of divestment. To illustrate this, Roster (2001) mentioned certain practices such as trial divestment and cleaning to remove meaning to facilitate detachment and enable making the decision to part with the product, as well as actually acting on this decision (Roster, 2001). By having a comprehensive explanation of the collection solution integrated in trusted telecom provider platforms, Polat (2019) enabled users to clearly estimate future compensation and thus to act upon the disposition decision.

Detachment is a complex process with interconnected and dynamic factors bringing the user to a decision but the decision to dispense with a product does not automatically lead to the corresponding action. The main factors identified in the empirical studies did not diverge greatly from those found in the literature. Nevertheless, these studies were valuable, as they gave more prominent insights into user experiences and perceptions of the divestment process through the emergence of certain patterns (see design insights below). These patterns provide directional leads to guide designers when creating a satisfying divestment experience.

However, as the resulting design solutions have not been piloted in the real world, it remains uncertain whether the proposed design interventions will lead to an actual divestment outcome i.e., whether users will really act on any of the proposed interventions.

Design Insights for Divestment

The design interventions described in the empirical studies were done at the

following levels: (1) the phone's software (e.g., offboarding app), (2) its packaging (e.g., reboxing), (3) information provision of the collection service during the search and evaluation stages (e.g., the financial value of the phone over time, campaigns on collection solutions), and during the preparation for disposition (e.g., real-life and virtual support, return kit), (4) the service's infrastructure (e.g., omnichannel solutions), and (5) the development of routines and rituals surrounding divestment as proposed by workshop group 2.

Design insights were formulated based on the patterns emerging from the identified divestment stages, the terminology used, influencing factors at the core of the solutions, and designed interventions in the empirical studies. The bracketed numbers in the text correspond to the numbered design principles listed in Section 5.3.

- **Guiding the Users**

Users are not yet used to collection as a logical end of the consumption cycle and are exposed to a great variety of options cluttering the route towards current collection solutions. By understanding the psychology behind the users' decision to choose and act on a disposition solution, designers get an overview of relevant decisions and activities to leverage and can identify relevant touchpoints. Overall, designers need to spark a thoughtful process at the start of the divestment decision process (1), guide the user through the divestment process (2), and ensure that users act upon their disposition decision (3).

As users currently have the relatively painless habit of putting phones in drawers, a nudge is needed to make them aware of neglected opportunities. Finding and selecting appropriate collection solutions is yet uncharted territory for most users, thus it leads to uncertainties. A possible strategy is to psychologically support users during the divestment phase, giving them confidence to 'do' divestment (e.g., Mertens, workshop group 1). Others focus on financial compensation as a core trigger (e.g., Ren, Polat, workshop group 4) for users to choose collection solutions. As phones are generally replaced by another one, the divestment of the current device and the purchase of the new device occur in parallel (6). It means that offboarding can draw inspiration from onboarding, as suggested by workshop group 3 and embodied by the concepts of the offboarding apps designed by Mertens (2018) and Ren (2018), who used clear, confirmative and empowering messaging, satisfaction through fast offboarding processes, and considerations of what the old device has brought the user (Mertens, 2018; Ren, 2018). This connection enables the identification of leverage points on how to spark the divestment thinking process for users, and to stimulate users to undertake actions to return their device.

Every purchased product will become a dilemma at some point. After going through the process once, this thus implies that the user will consider the upcoming dilemma. An excellent experience here not only fosters brand loyalty, it also fosters repeated collection behaviour (10).

- **Knowing Users to Understand What Makes Them Tick**

To make divestment possible, designers should take a user-centred approach (4). The influencing factors identified in Table 20 all depend on the individual and their context and will evolve over time. The MSc students all conducted thorough user research to use as a base of insights when characterizing the target user group. This approach was relevant, therefore we can conclude that it is important to gain deep user insights and an understanding of the target group, as this aids the choice of a set of influencing factors to work with.

The “invisible” part of divestment (i.e., detachment) should not be forgotten (5). All the designers went beyond enabling the physical separation with the user by increasing the numbers of collection points and making them more visible. Special care was put into “doctoring” how users could distance themselves mentally and emotionally from their used phone through specific practices like digital cleanse (e.g., workshop group 2) or trial divestment (e.g., Ren). The stage after disposition was also relevant for the feeling of closure, by giving users visual digital traces of their old device, helping them to reminisce on the relationship (e.g., workshop group 2 and Mertens) or just the functional knowledge of having a plan-b data back-up in the cloud (e.g., Mertens and Ren). On top of this, old phones were made traceable so that their destiny could be consulted by users (e.g., Polat).

- **Considering the Specificity of Smartphones: Hardware Combined with Software**

A clear distinction needs to be made between users’ attachment to the tangible product and that to the digital content. You have to consider the phone as a vessel, and place peoples’ attachment in the context of its digital content (9). This duality within one possession is also found in the literature (Denegri-Knott & Watkins, 2012; Gilbert, 2017). Data loss anxiety combined with the constant need to be connected leads to users wanting to keep their phones “just in case.” However, the lack of this “lingering attachment” to an empty shell should, in principle, make the actual disposition of the device much easier for a user. As suggested by the workshop groups and all the graduate students, both the body and soul of the device have to be considered (7) to leverage the relationship with the product (9) and reach the user during onboarding and use of the phone (7). Elements used are

the deliberate personification of the device (e.g., enhancing the understanding of the empty shell through the concept of reincarnation) leading to a ceremonial goodbye (e.g., Ren, DRS group 2) or to more concrete built-in software, which will instigate the process itself (e.g., Ren and Mertens).

- **Leveraging Existing Relationships**

Building on the previous insight, designers could leverage the relationship between the user and their phone and its brand (9). The perceived trustworthiness of the device's manufacturer or that of the users' telecom provider can be used for the design of new services, by using the brand's environment. Interventions designed by the participants lower uncertainties by keeping users in an environment where they feel supported and reassured (e.g., Polat, Ren, and Mertens).

Moreover, the relationship between the user and their community (8) could be leveraged. For instance, Polat used the connection to users' relatives to trigger altruistic factors and enable return behaviour to become normalized across a community.

- **Design Principles for Divestment**

To point designers toward valuable design for divestment avenues, we have translated the design insights into ten design principles for the divestment of mobile devices. Their aim is to break the current habit of phone-hibernation and to create a new habit of collection behaviour. This behaviour should ideally be repeated over time, meaning that collection rates will increase and returning used devices becomes the "new normal." Note, however, that we do not put the onus of closing the loop entirely on users. Their behaviour will need to change, but we emphasize that other parties such as manufacturers, retailers and governmental agencies will need to make this possible.

The structure of the conceptual model appears to support organizing the design insights of the empirical studies through the positioning of design principles. Figure 49 presents the key steps of the divestment processes (1, 2, and 3), the user-centred approach (4), and the instrumental factors (5, 6, 7, 8, 9, and 10).

The visual representation of the 10 design principles in Figure 50 provides an overview of designing for divestment and generates accessible insights for designers.

The proposed design principles contribute to the emerging debate on divestment. Note, however, that their development was limited to the study of smartphones and to small-scale empirical studies with design professionals and

students. The Design for Divestment design principles will need to be further researched in the future.

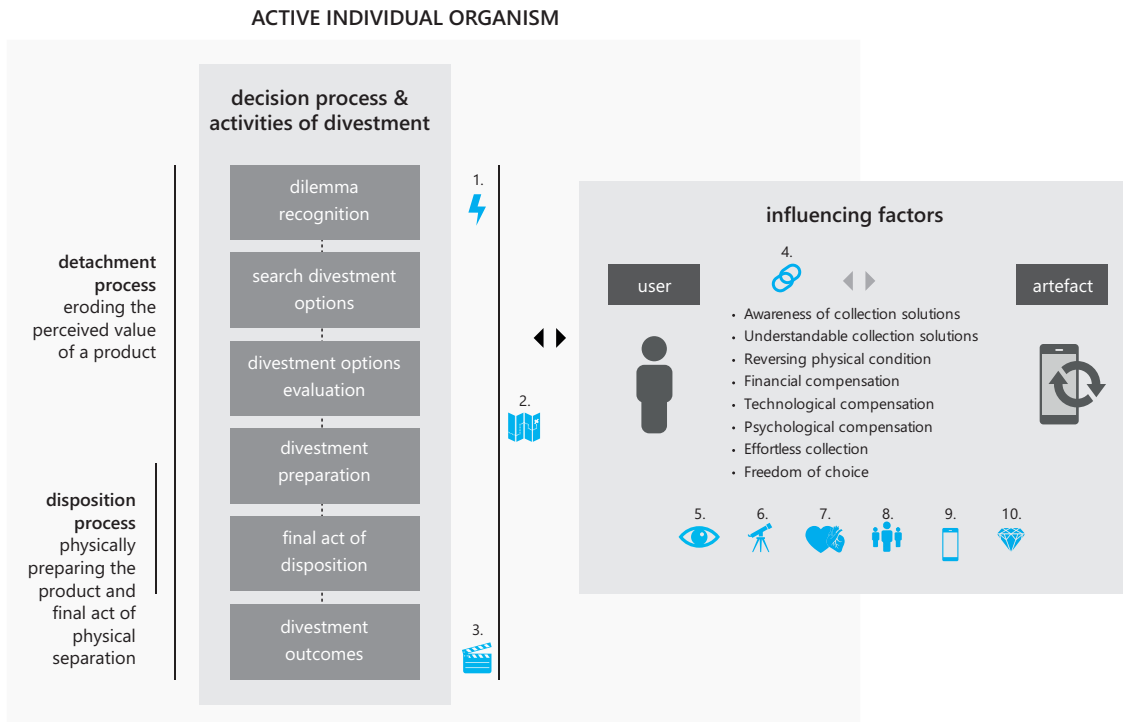


Figure 49. Conceptual model of divestment and the position of the design principles.

6.2.6 Conclusions

In order to ensure that mobile devices can be reused, remanufactured and recycled in a circular economy, users have to return their products at the end of the use cycle, preferably without delay (Fleischmann et al., 1997). Our study contributes to the CE transition by taking a user perspective and exploring how designers could stimulate users to return their products. Divestment should become the new normal for users, and the divestment process should be well-integrated in the consumption cycle. To address the lack of literature on the topic of divestment from a user perspective, we used a RtD approach to answer the questions: What factors were considered during the creation of design interventions to influence the decision process and activities of divestment? and What design insights and principles can be derived from them?

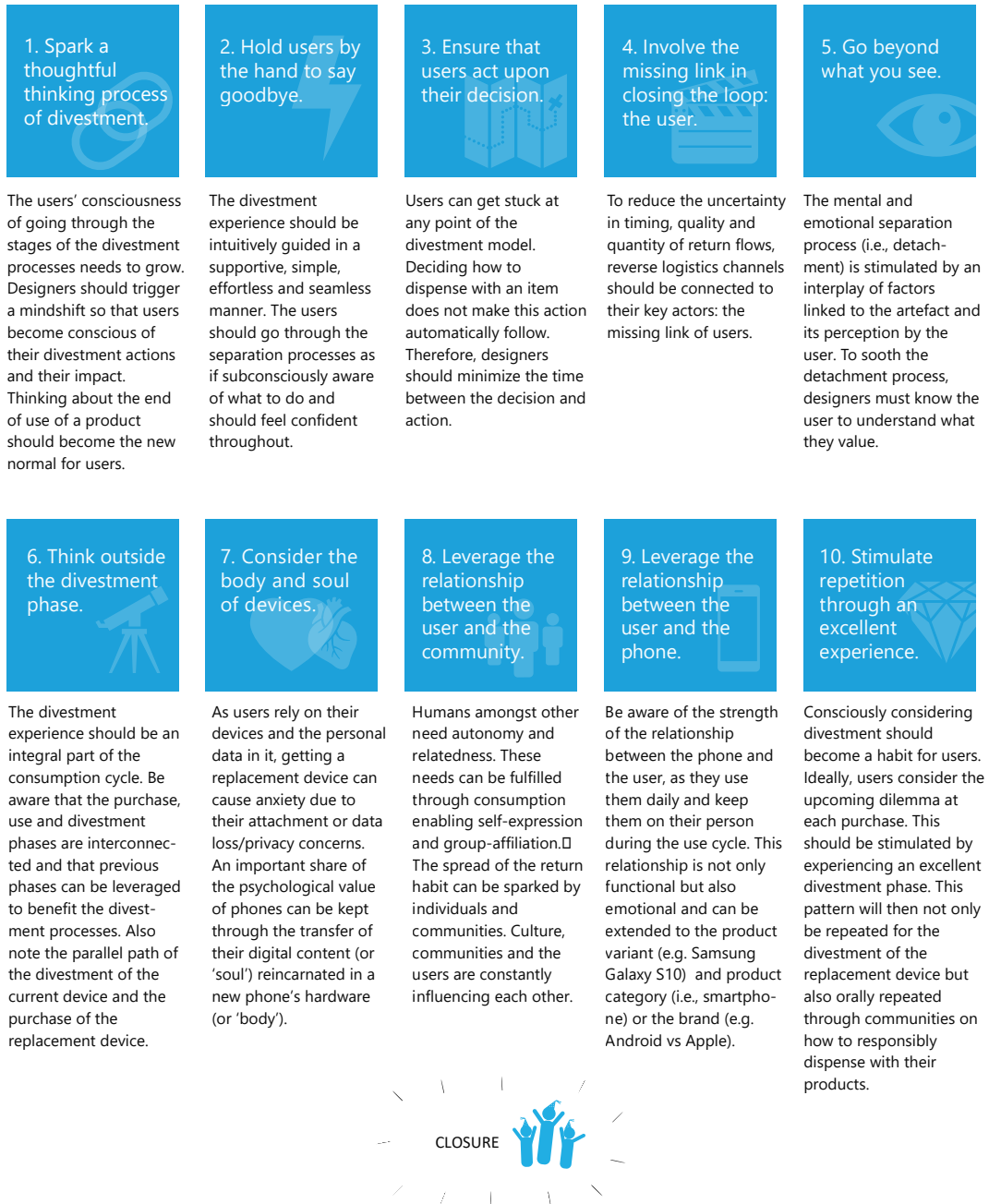


Figure 50. Design for Divestment design principles for smartphones

After introducing a conceptual model of divestment based on an extension of the Consumer Decision Process model (Blackwell et al., 2006), we describe the results of seven design projects on the design of a divestment experience for smartphones. These projects show that many factors influence divestment (e.g., various types of compensations and effortless solutions), but they are interrelated, change over time, and vary per user. In view of this complexity, a blueprint for an ideal divestment process with a list of linear causal links as ingredients is impossible.

Nevertheless, several patterns emerged from the factors. Although the focus during divestment is often on its visible part (i.e., measuring the various disposition paths of phones), the invisible detachment process that users go through with their phone requires considerable attention.

Designers should create design interventions to influence this process by, for instance, emotionally supporting users during their currently unknown experiences riddled with uncertainties (e.g., Where can I get the highest value back for my old phone?) and confusions (e.g., Will my data be lost forever?). Thus, they need to provide a trusted guiding hand, giving them confidence regarding data security, and providing information at the right moment (e.g., the residual economic value of the phone over time) to spark a thoughtful thinking process regarding a responsible and valuable divestment.

This study is the first to explore consumer divestment processes through design interventions, putting the user centre-stage. It gives deep insights into users' psychological and physical barriers to "do" divestment. These design insights were translated to a proposal of unique "design for divestment" principles to help design practitioners and researchers create solutions for more valuable and valued divestment processes. The key steps of the divestment processes need to be known by designers (i.e., spark a thoughtful thinking process of divestment, hold users by the hand to say goodbye, and ensure that users act upon their decision), a user-centred approach needs to be adopted, and instrumental factors (e.g., consider the body and soul of devices, and leverage the relationship between the user and their community) could be utilized to stimulate users to return their devices. The design insights and design principles for divestment are novel contributions to the fields of design research and consumer research.

Future research is needed to validate these design insights and principles in other set-ups. One could possibly develop them for other product categories or even generalize them for all product development. Design practitioners and researchers should further assess the design principles of this article in their practice. The concepts resulting from the empirical studies could also be tested with users

on a larger scale through a real-life pilot to find out to what extent return rates are improved.

For the time being, we contributed to making divestment an integral part of the consumption cycle. Although the user perspective on circular consumption is but one facet of CE (versus, for instance, the technical perspective of product recovery), these findings bring closing the loop one step closer.

6.3 Conclusion

Chapter 6 focused on answering:

RQ3: What design interventions could influence users to divest their owned mobile phones?

Based on empirical studies taking a Research through Design approach, this chapter provided knowledge regarding designing for divestment.

- **Design for Divestment design interventions examples.** The workshop with design professionals and the three projects with design students yielded seven concepts regarding the divestment for mobile phones. These concepts provided knowledge to better understand the applicability of the previously developed divestment stages. They also demonstrated the many factors influencing the decision process and the everyday practice of divestment activities. The design interventions and insights can serve as inspiration when designing for divestment.

- **Design for Divestment design principles.** The design insights were then summarized into a set of 10 Design for Divestment principles based on the design concepts and conversations with designers. These design principles are a start in offering concrete levers to design practitioners and researchers to develop effective design interventions stimulating the return of mobile phones after use.

A reflection on the feasibility of this transition and parallels between the two consumption modes will be discussed in Chapter 7.

CHAPTER 7

Conclusions, reflections and recommendations

7. Conclusions, reflections and recommendations

7.1 Introduction

Link to the previous chapters

In the context of circular economy, current issues with mobile phones in the business-to-consumer (B2C) market are their relatively low return rates, stocks hibernating in drawers, and volumes lost through irresponsible disposal. To close the loop from a user perspective, this dissertation focused on creating a better understanding of how users could be stimulated to return their products after use. The two main parts of this dissertation dealt with (1) contractual return at the end of the contract in access-based consumption; and (2) voluntary return after mobile phone use in ownership-based consumption.

Objective of this chapter

This final chapter zooms out to look at what has been achieved and how the resulting knowledge was built up for the defined problem areas explored.

Outline of this chapter

First, the main findings of this research are summarized (7.2). This is followed by their implications for the research questions and a description of their scientific and societal contributions (7.3). Reflections on the research design are made (7.4) and recommendations for future research avenues are provided (7.5). Finally, the dissertation ends with closing remarks (7.6).

7.2 Summary of the main findings

This research has generated the knowledge with which the loop for mobile phones can be closed from the user perspective. First, the contractual return of products is considered and the acceptance of access-based consumption is studied (7.2.1). Second, research into the voluntary return of products at the end of use in ownership-based consumption is discussed in greater depth by exploring divestment (7.2.2).

7.2.1 The acceptance of access-based consumption

From a CE perspective, access-based consumption is said to be an interesting avenue to follow (Ellen MacArthur Foundation, 2013; Stahel, 2010). In access-based consumption, legal ownership of a product remains in the hands of service providers, while users pay for the right of its use for a limited period of time (Malone et al., 2006).

At the beginning of this Ph.D. research, companies were starting to explore access-based consumption for mobile phones and had little experience on how to successfully achieve this. For example, the Dutch telecom provider KPN attempted to durably seize this market with KPN Lease in the early 2010s, but discontinued the programme shortly after to return to the practice where users own their phone. Several hybrid versions of access-based consumption were also offered by telecom providers or Original Equipment Manufacturers (OEMs), where users could access a new smartphone each year by exchanging their old one as part of an exclusive plan. However, there was little acceptance from users.

To address the lack of user acceptance of access services for mobile phones, an empirical study was conducted. Interviews were held to provide a better understanding of the factors influencing individuals' decision-making process during the adoption and acceptance (or not) of KPN Lease and the hybrid Vodafone New Phone Every Year. The more widely accepted case of car access services was studied in order to formulate recommendations for design interventions that could improve acceptance of access-based consumption for mobile phones. The findings of this study are summarized in Figure 51, with the main findings highlighted in blue. The conceptual model builds on the Consumer Decision Process model by Blackwell et al. (2006).

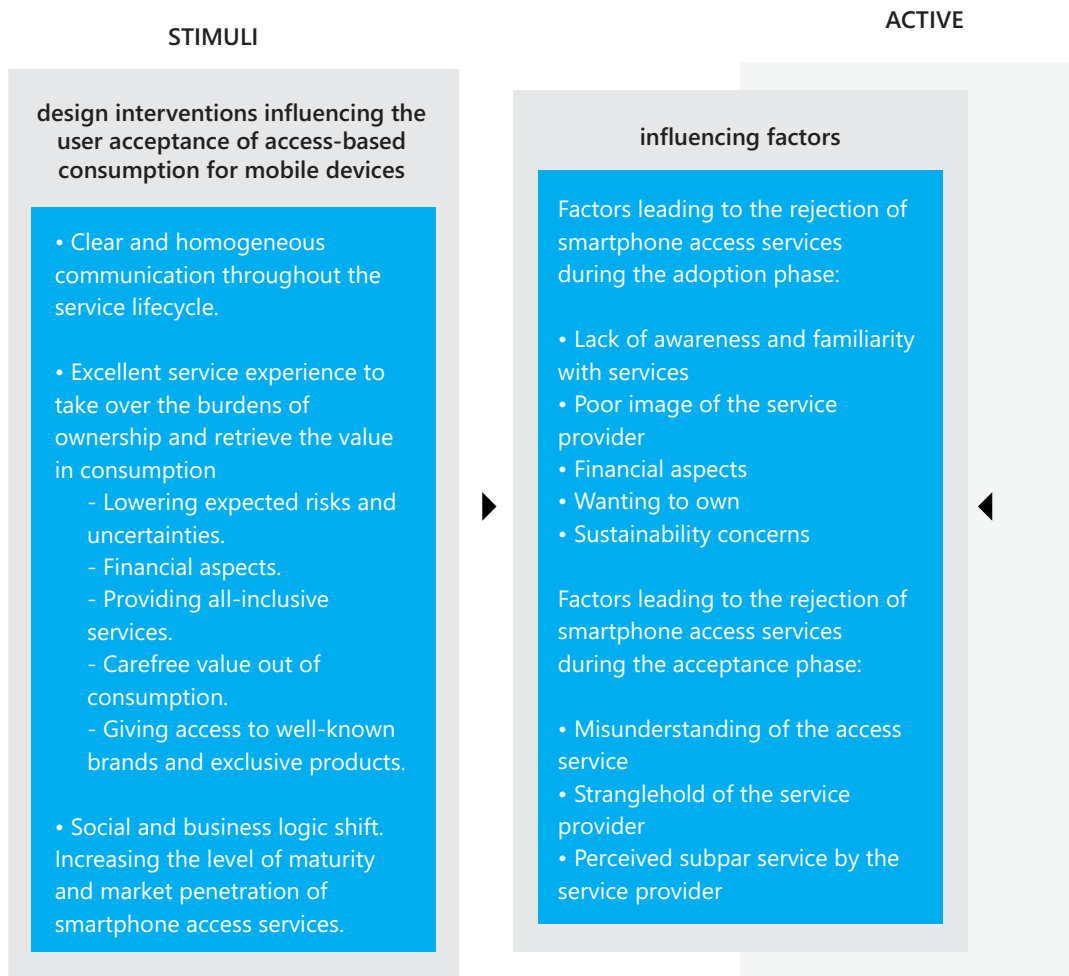
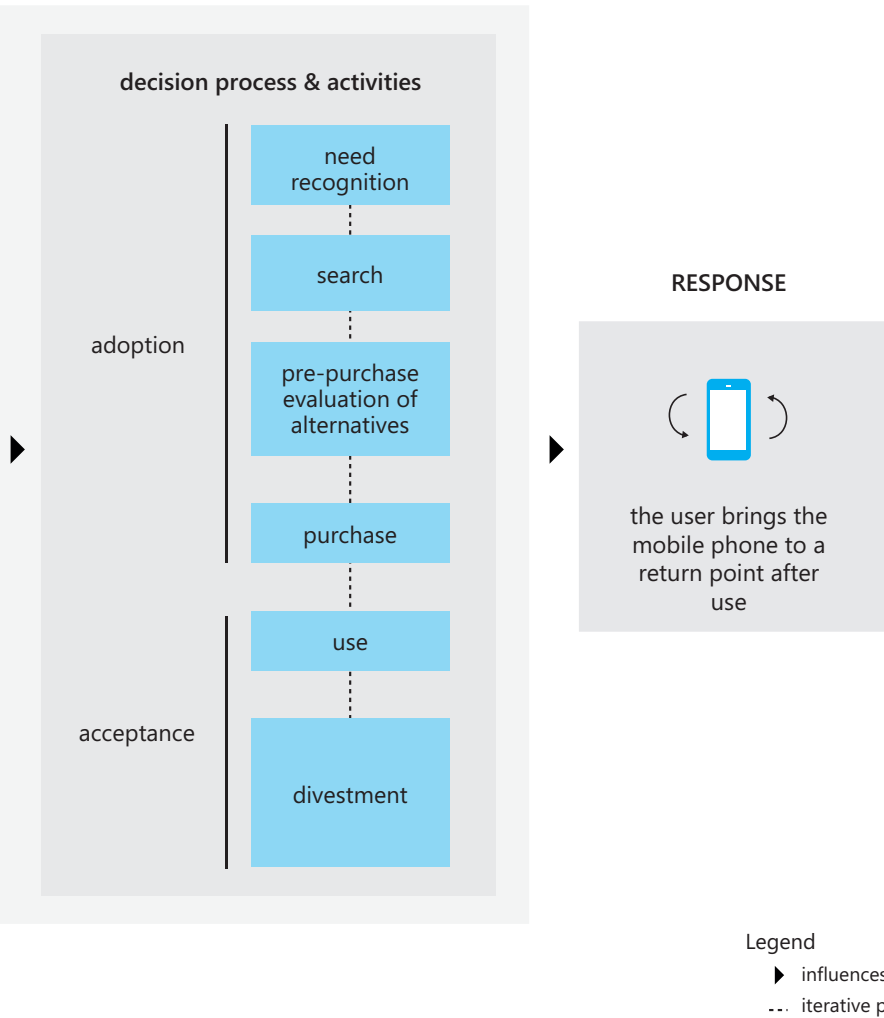


Figure 51. Conceptual model including the main findings of the study on the acceptance of access services for mobile phones (blue blocks)

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- **Decision process & activities of adopting and accepting access services.**

The stages of the decision process & activities of consumption (i.e., third block on the right in Figure 51) were found to be representative throughout the empirical study.

A distinction was made between the adoption and the acceptance of access services. 'Adoption' is the process that users go through when searching, selecting and purchasing a certain service or not. 'Acceptance' refers to the process of credence in a service, including the product at its core. The nuance between the two concepts is that adoption is based on the expectations of potential users, and that acceptance occurs after purchasing the service when users actually experience the service. As a result, the adoption phase goes from need recognition to adoption, and the acceptance phase starts after purchasing the service until its divestment. Users can reject the service on three different occasions during the adoption phase (i.e., by not selecting it or by not going through with the purchase) and once during the acceptance phase. This distinction between the two processes was found to be especially useful during the interviews, as the stages of the decision process are not clear-cut in practice, but the difference between expectations and experiences is.

- **Factors influencing the adoption and acceptance of access services.**

Factors leading to the rejection of smartphone access services identified in the empirical study are presented in the second block of Figure 51. These factors influenced the adoption phase and/or the acceptance phase.

In the adoption phase, the rejection of smartphone access services was due to lack of awareness and familiarity with these alternative services. Users did not even consider these types of services or, when aware of their existence, did not grasp their appeal in the B2C market, as users were in the habit of (legally and psychologically) owning products. Moreover, although being relatively successful parties, the service providers studied in this research had a poor image to some users. This was not helped by the users' perception of the exceedingly high price of the services as they, for instance, considered access-based ownership as a sacrifice of ownership benefits and would thus expect lower prices. In addition, sustainability concerns were voiced regarding the service where the product could be frequently upgraded.

During the acceptance phase, smartphone access services were rejected because of the users' misunderstanding of the access service. They were expecting an access service comparable to what was known, namely all-inclusive car lease, however the reality was different. Further to this confusion, users perceived pressure from the service provider as they, for example, contractually had to keep the "borrowed" product at its highest possible state to avoid fines. Some participants received an older replacement device during times of repair while paying the same monthly fee, which resulted in dissatisfaction with the level of service offered. The moment of damage (i.e., when the device contractually required repair for which the user had to pay an, often unforeseen, deductible) was identified as 'make or break' event.

- **Design interventions to enable users to access mobile phones instead of owning them.**

Based on the small set of interviews, proposals were made for design interventions leveraging the identified influencing factors.

Insights gained from car access services identified the need for service providers to increase trust by reducing expected risks and uncertainties, and to take over the risks and inconveniences of ownership with an all-inclusive service and carefree value (e.g. access to fun and luxurious ways of driving).

To enhance the adoption and acceptance of access services for smartphones, the communication with the user could thus be clear and unified throughout the full consumption cycle. Moreover, it could provide an excellent experience that takes over the inconveniences of ownership while retaining the enjoyments (especially with carefree repair). Thus, to achieve this, both a social and business logic shift would be needed.

Overall, the industrial exchange logic of value creation, where manufacturers create value whilst users destroy it, needs to shift to a new logic of co-creation where all stakeholders contribute to value creation.

7.2.2 Divestment in ownership-based consumption

Access-based consumption is still emerging in the B2C market, where ownership-based consumption remains the dominant way of purchasing a smartphone. In contrast to access-based consumption, the return of the products after use in ownership-based consumption is a voluntary action from the users.

While conducting this research on mobile phones, return options were still in their infancy. The landscape of return schemes in the Netherlands mostly consisted of Wecycle or Weee Nederland return points (i.e., where Waste Electrical and Electronic Equipment could be dispensed with for free) found in stores or at municipal waste collection sites. Less visible, were the “take-back”, “trade-in” and “buy-back” schemes from several telecom providers, OEMs or other organisations willing to pay users to hand in their product. Return rates were relatively low as the small devices were kept in drawers unused (41% of functioning phones in 2017), or even thrown away with the household waste (12% of non-functioning phones were trashed in 2017) (Witte & van Grinsven, 2017).

To better understand why users relatively seldom returned their smartphones directly after use, systematic literature reviews were conducted and a Research through Design approach was adopted to generate missing knowledge on the last phase of the consumption cycle (i.e., divestment). Social Sciences literature (e.g. marketing, psychology and sociology) was consulted to remediate the lack of attention paid to the user perspective and the lack of attention given to divestment in design.

A summary of the findings is provided in Figure 52 on the following pages.

- **Defining the concept of divestment.**

To start the process of restoring the balance between divestment versus purchase and use in design, the concept of divestment was explored in depth. Divestment is the overarching term given to the final phase of the consumption cycle after the purchase and use phases from a user perspective. It is the combination of the disposition process and the detachment process. Disposition refers to the physical separation of the product and represents the visible part of divestment. Detachment refers to the mental and emotional separation of the product; the invisible part of divestment. In contrast to the current focus on what is visible (i.e., the return rates resulting from the disposition process), detachment should be equally taken into account.

- **Decision process & activities of divestment.**

Further developing the conceptualisation of the divestment phase casts a new light on this neglected final phase of the consumption cycle. The divestment phase of the conceptual model was sub divided into six distinct stages, as illustrated in Figure 52. These reflect those of the purchase phase and all phases take both the

disposition and detachment processes into account.

1. The decision process for divestment starts with the recognition of the dilemma of whether to keep the product in the current use cycle or to end the product use cycle.
2. Then, a divestment option (i.e., a way to separate from the product) is sought.
3. Next, a user evaluates the found divestment options, resulting in a decision on how to dispense with the product.
4. To help act on a divestment decision, the divestment preparation can 'soothe' the detachment process.
5. When ready, the user acts on the decision regarding the final act of disposition and physically separates from the products.
6. Finally, several divestment outcomes can be experienced including, for instance, financial gain or lifting the burdens of ownership.

By introducing a more thorough divestment phase in the model of the consumption cycle decision process and activities, several name changes were made in the purchase phase to avoid confusion. The second and third stages of the decision process are now called 'search purchase alternatives' and 'purchase alternatives evaluation'.

It is worth noting that the divestment process is iterative; it is not linear as users can, for instance, receive new information before the final act of disposition and change their mind. The model and its stages thus represent the process once it has been undergone.

- **Factors influencing the decision process & activities of divestment.**

Many factors were found to influence divestment processes. As noted in the case of access-based consumption, users are also unaware of and unfamiliar with mobile phone-specific divestment options such as trade-in schemes. Linked to this unfamiliarity, users lacked an understanding of return options, which combined with the lack of guidance, resulted in uncertainty. These options would benefit from more transparency about what happens with the products after they are no longer with the users. Moreover, users are not sufficiently stimulated by the compensation offered in exchange for the mobile phone (e.g., cash, discount, space gain, access to special services, etc). This can also be linked to a lack of trust in the divestment party. The required effort to return the devices does not contribute positively to the perception of return options. Finally, users currently undergo the decision process passively, which leads to relatively high rates of mobile phones ending up in drawers.

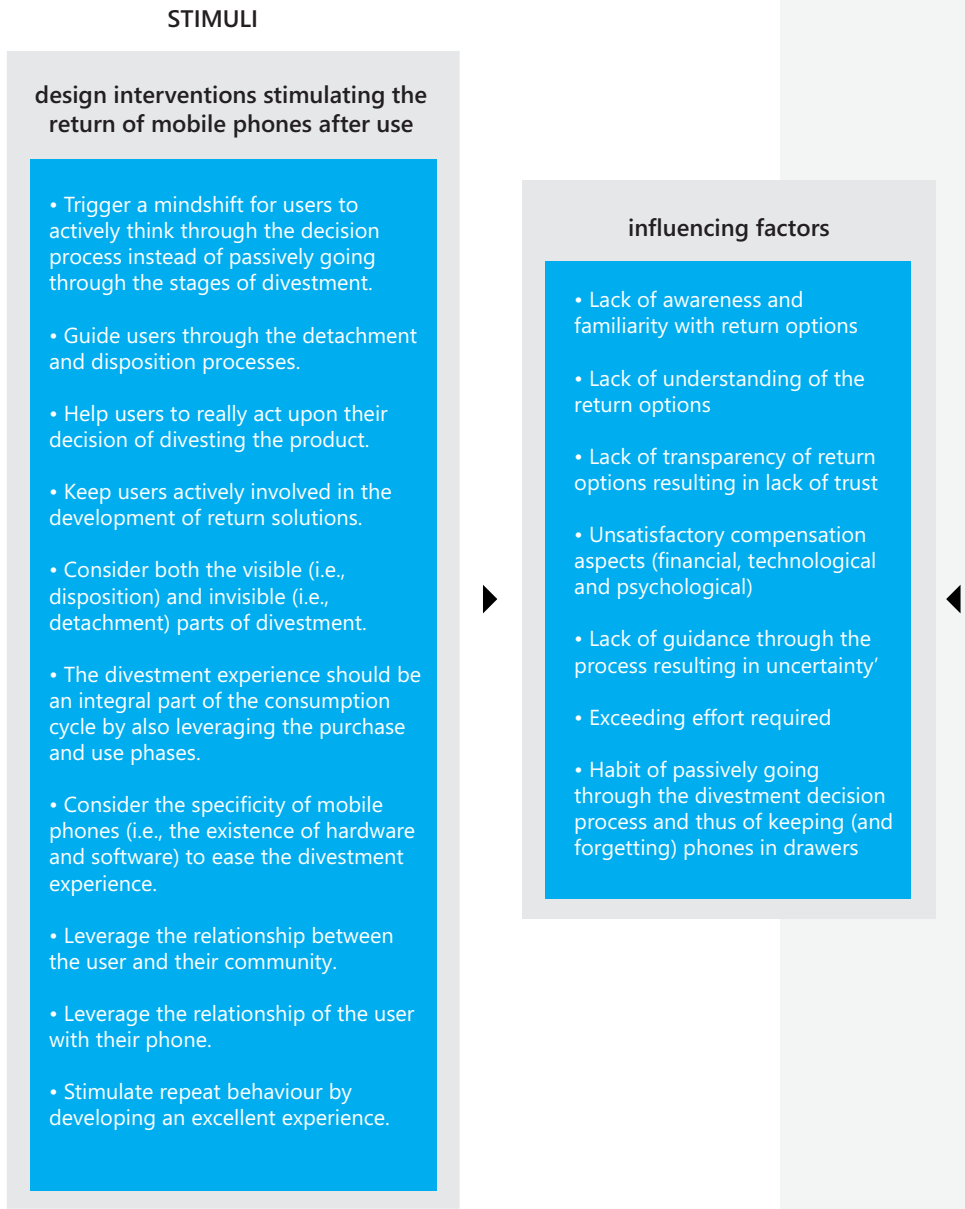
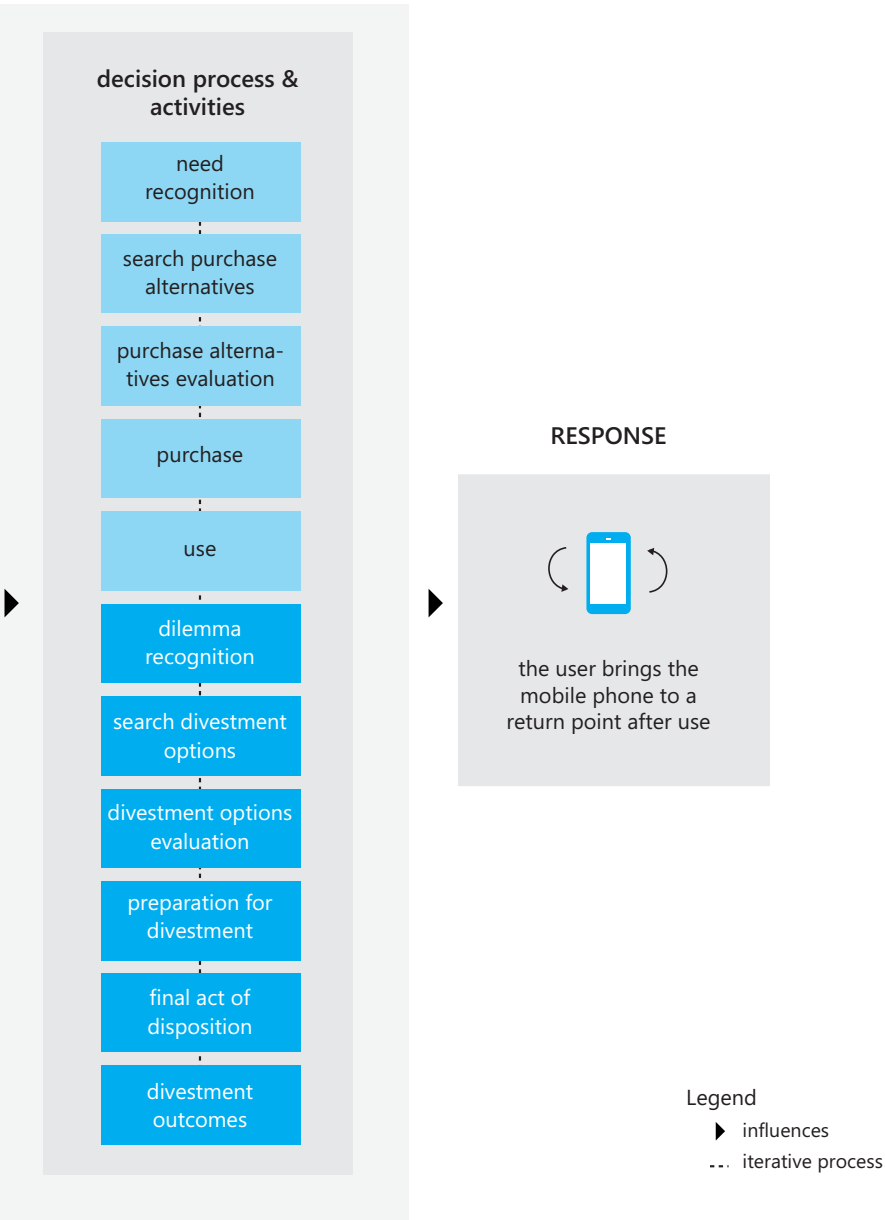


Figure 52. Conceptual model including the main findings of the study of the divestment of mobile phones (blue blocks)

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- **Design interventions.**

As the identified factors are interrelated, dynamic over time, and vary per user, a mix of ingredients is required to design for the complex problem of divestment. Patterns emerging from the design insights gained from the literature reviews and empirical studies identified an interplay of the multiple factors needed to create valuable design interventions.

Professional and student designers were prompted to create divestment solutions for mobile phones in a workshop and as graduation projects. These design projects provided insights into how designers design for divestment. The resulting concepts provide examples of how design can integrate divestment. These insights are summarized in a proposal for 'design for divestment' principles visualised in Figure 53. This set of principles is meant to support design practitioners and researchers when designing solutions to create more valuable and better-valued divestment processes for smartphones. It provides a quick overview of the literature review and empirical study findings, and makes them accessible to designers. The design principles are intended to give inspiring general directions for the design process. This list of design principles was transposed to practical design interventions in Figure 52 providing more context at once. Neither of the sets are checklists with linear causal links.

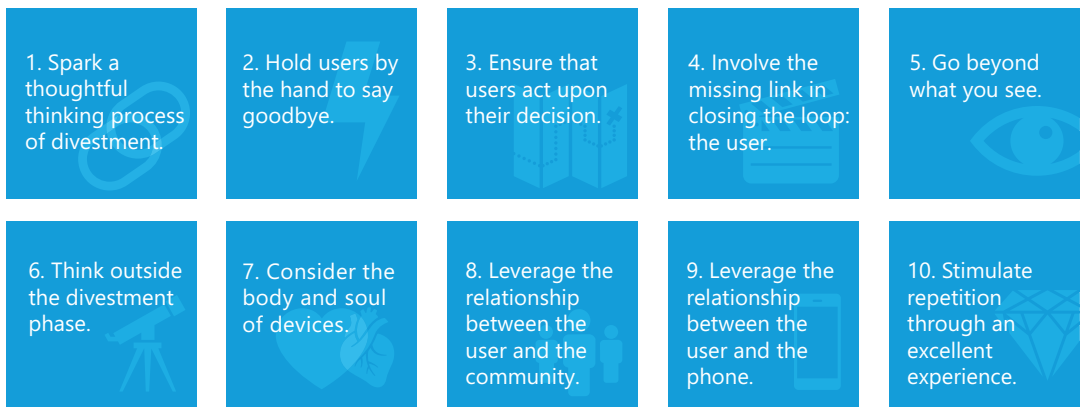


Figure 53. Design principles for a valuable divestment experience for mobile phones

1. **Spark a thoughtful thinking process of divestment.** The users' consciousness of going through the stages of the divestment processes needs to grow. Designers should trigger a mindshift so that users become conscious of their divestment actions and their impact. Thinking about the

end of use of a product should become the new normal for users.

2. **Hold users by the hand to say goodbye.** The divestment experience should be intuitively guided in a supportive, simple, effortless and seamless manner. The users should go through the separation processes as if subconsciously aware of what to do and should feel confident throughout.
3. **Ensure that users act upon their decision.** Users can get stuck at any point of the divestment model. Deciding how to dispense with an item does not make this action automatically follow. Therefore, designers should minimize the time between the decision and action.
4. **Involve the missing link in closing the loop: the user.** To reduce the uncertainty in timing, quality and quantity of return flows, reverse logistics channels should be connected to their key actors: the missing link of users. Who are they? What factors play a role in their divestment processes?
5. **Go beyond what you see.** Although the focus during the last phase of consumption often lies on the physical action of disposition, mind the importance of detachment. The mental and emotional separation is stimulated by an interplay of factors linked to the artefact and its perception by the user.
6. **Think outside the divestment phase.** The divestment experience should be an integral part of the consumption cycle. Be aware that the purchase, use and divestment phases are interconnected and that previous phases can be leveraged to benefit the divestment processes. Also note the parallel path of the divestment of the current device and the purchase of the replacement device
7. **Consider the body and soul of devices.** Mobile phones are the combination of their hardware and software. Make sure to leverage both the outside and inside of the devices when designing the interventions. For instance, an important share of the psychological value of phones can be kept through the transfer of their digital content (or 'soul') reincarnated in a new phone's hardware (or 'body').

8. **Leverage the relationship between the user and the community.** Humans amongst other need autonomy and relatedness. These needs can be fulfilled through consumption enabling self-expression and group-affiliation. The spread of the return habit can be sparked by individuals and communities. Culture, communities and the users are constantly influencing each other.
9. **Leverage the relationship between the user and the phone.** Be aware of the strength of the relationship between the phone and the user, as they use them daily and keep them on their person during the use cycle. This relationship is not only functional but also emotional. For example, some users may keep the product as a memento, whereas this need could be met without keeping the product in a drawer. The relationship can be extended to the product variant (e.g. Samsung Galaxy S10) and product category (i.e., smartphone) or the brand (e.g. Android vs Apple).
10. **Stimulate repetition through an excellent experience.** Consciously considering divestment should become a habit for users. Ideally, users consider the upcoming dilemma at each purchase. This should be stimulated by experiencing an excellent divestment phase. This pattern will then not only be repeated for the divestment of the replacement device but also shared within communities on how to responsibly dispense with their products.

7.3 Research questions and contributions to science & practice

7.3.1 Research question 1

The summary of main findings resulted from answers to the three research questions.

The first research question

RQ1: What conceptual model could be used to understand the interaction between users, mobile phones and providers for both (A) the acceptance of access-based consumption and (B) the divestment of devices in ownership-based consumption?

was considered in two separate parts (Figures 51 and 52). The first part of the question (RQ1A) is explored in Chapter 4 and the second part (RQ1B) in Chapters 5 and 6.

Consumer Decision Process

The conceptual model central to this dissertation to structure the concepts, relationship, and actors needed to change the situation is based on the Consumer Decision Process (CDP) model by Blackwell et al. (2006) (also known as the Engel-Kollat-Blackwell (EKB) or Engel-Blackwell-Miniard (EBM) model). The CDP model is defined as “a roadmap of consumers’ minds” capturing “the activities that occur when decisions are made in a schematic format, and shows how different internal and external forces interact to affect how consumers think, evaluate, and act” (Blackwell, Engel, Miniard, 2006, p.70). It provides a clear overview of the key processes of consumer behaviour and the factors influencing them.

As prefaced in Blackwell et al. (2006), the original EKB model (1968) focused on the purchase phase, and the CDP model (2006) expanded the coverage of the use phase. One of the most important changes in this dissertation’s conceptual model was the inclusion of divestment as an equal and integral part of the consumption cycle. Stipulations are described in Chapter 2 and Section 7.2. The conceptual model has been enriched with a deeper understanding of divestment for both ownership-based consumption and access-based consumption in the current user context.

Divestment stages in access-based consumption

The conceptual model was extended independently for each of the two main studies as illustrated in Figures 51 and 52. However, the sum of this dissertation's parts also yields greater insights. The divestment stages identified in the ownership-based consumption part were only considered in the context of ownership-based consumption. Nevertheless, they also provide a better understanding in the case of access-based consumption.

Although probably unintentional, access-based consumption automatically prepares users for the divestment of their accessed device. As the disposition of the phone has been defined by the terms of the signed contract, the user is mentally prepared for the detachment process from the outset. Indeed, leasers know from the start that the accessed product will need to be returned at the end of the contract. Even though they can appropriate the smartphone by customizing it and transferring the 'soul' of their previously owned device onto their new one, users still know that the 'body' will finally have to be handed back to the service provider. At the end of use, the dilemma recognition is built in the access experience through the end of the contract. The approaching expiration date stimulates the thoughtful process of divestment. There are options allowing the user to extend the contract, to let it terminate and purchase the product, to let it terminate and return the product, and to terminate it early. Often, a fine has to be paid if the returned product is not in appropriate physical condition, so the product has to be repaired to prepare its divestment.

Influencing factors identified for access-based consumption and ownership-based consumption

Several parallels can be made between the influencing factors identified in the two parts of the research:

- The contexts of the two parts of the research are parallel in the sense that both deal with immature business models with which companies have recently been experimenting. As a result, users lack the awareness and familiarity with these rather new offers of access services and return options in ownership-based consumption. This unawareness and unfamiliarity negatively influences their adoption and acceptance by users.
- The service providers sometimes have issues with their image, leading to mistrust of the terms and conditions of the services. For access services, users were wary of telecom providers as they were seen as being overpriced.

In the case of ownership-based consumption, suspicion occurred when it came to, for example, privacy issues linked to untrustworthy data removal services.

- The compensation received for the perceived effort to not own a phone or to return an investment is not always considered in line with the financial and psychological value of alternatives (i.e., owning a phone or keeping a phone). The current compensations offered such as relief from owning responsibilities through access or a discount when handing in your phone are considered insufficient to persuade users to change their mind.
- The experience with the service itself was perceived as under par if users encountered a discrepancy between expectations of the service and its reality (e.g., when dropping a phone and having to pay for the repair which was exclusive to the access service, or experiencing an experience disconnection between the trusted manufacturer platform to the return platform of their return logistics partners).
- Finally, both the acceptance of access-based consumption and the return of owned phones after use are hindered by users' current habits of owning and keeping these small devices in drawers. Therefore, certain engrained cognitive biases and mental shortcuts are keeping users from questioning their way of consuming, and need to be superseded.

These parallels in barriers demonstrate why closing the loop is currently such an issue.

7.3.2 Research questions 2 & 3

To change the current user behaviour to the envisioned behaviour of return at the end of user, design interventions were sought through the following two research questions:

and

RQ2: What design interventions could enable users to accept accessing mobile phones instead of owning them?

RQ3: What design interventions could enable users to divest their mobile phones and voluntarily return them?

A variety of factors (i.e., internal and external incentives as well as internal and external facilitators) influencing the acceptance of access-based consumption and influencing the divestment in ownership-based consumption were identified. Following the Theory of Second Best (Lipsey & Lancaster, 1956), this dissertation looked for a realistic factor that could stimulate users to return their products. Pluriform approaches (i.e., literature reviews, interview and multi-case Research through Design) were employed to explore what could change individual behaviour. The interconnectedness of the resulting influencing factors revealed how compound the issue mobile phone return actually is. Through this research, the studied problem can be qualified as a composite with seemingly clear factors; yet solving a single factor will not solve this problem as a whole. A system approach needs to be adopted taking the complexity of the problem into account.

Various patterns emerged from the empirical studies and were translated into design insights for design researchers and practitioners. The research yielded a better understanding of the concepts, relationships and factors to take into account when designing for more acceptance of access-based consumption and designing an enhanced divestment experience. For access-based consumption, an overview of factors influencing the adoption and acceptance phases was provided, and insights were given into which design interventions could improve the user perception and experience of these alternative services. For ownership-based consumption, this research provided a divestment model for designers accompanied by an overview of influencing factors, and divestment design principles to support design researchers and practitioners.

As illustrated in Figure 54, closing the loop from a user perspective can be achieved in two ways. For access-based consumption to be better accepted, these services need to be better spread and visible so that potential users are aware of their existence and know what they offer. By increasing familiarity, accessing a new phone instead of owning one could become a viable option when considering a replacement. The services should be transparent and clear in their communication so as to instigate trust and avoid misunderstanding along the use and divestment phases. Moreover, there is a need to clarify the terms of use from the outset by, for example, comparing this 'untraditional' service with the all-inclusive car lease service and explaining the differences. Special attention should be placed on the make-or-break moment of repair, for instance by replacing the device with a technologically equal or superior phone during repair. In ownership-based consumption, several interventions could ensure an increase in the return of phones. At the circular-

optimal moment (depending on the value proposition), every user would know that return programmes exist and understand what they bring to them. Users would be highly intrinsically and extrinsically motivated to return their product, and they would have the ultimate means to operationally hand the phone in (e.g. someone picks the product up) when they want to dispense with it. These two behaviours would not only be in the short term, but can be repeated across generations of phones, be applied to other product categories, and be spread through collectives.

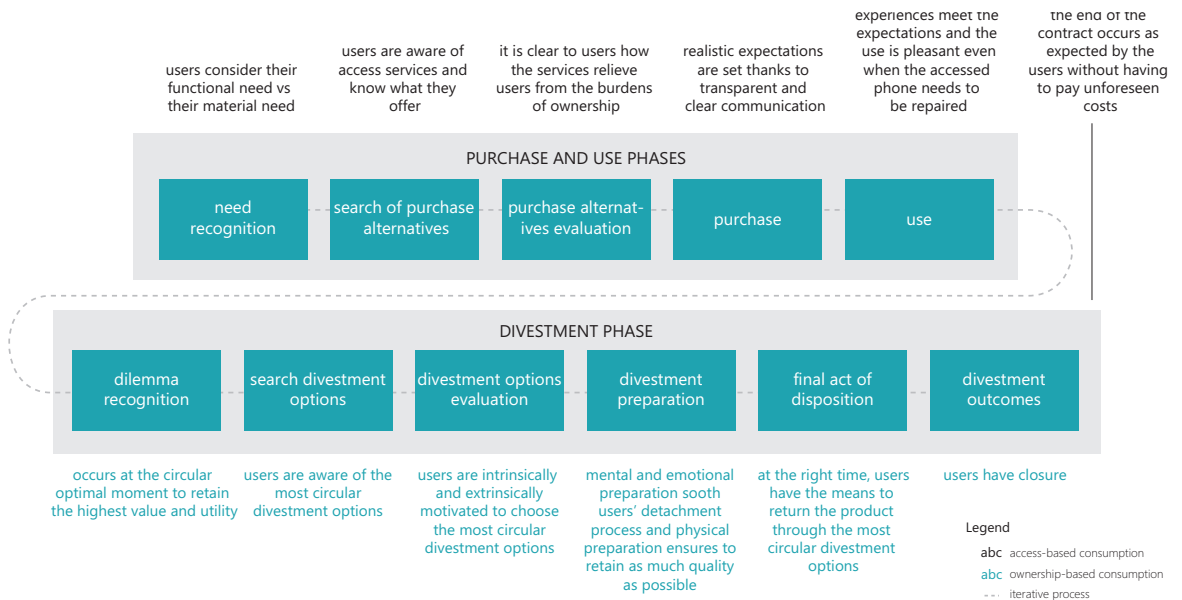


Figure 54. Optimal situation to increase the acceptance of access-based consumption (in black) and stimulate the return of mobile phones in ownership-based consumption (in blue)

7.3.3 Contributions to science and practice

The main research objective was to find potential solutions to increase the return of mobile phones after use so as to foster a transition towards a Circular Economy. To this end, both access-based consumption and ownership-based consumption were studied. This work contributes to science and practice in various ways.

Contributions to science

- **Developing a better-fitting model to conceptualize user behaviour regarding the return of mobile phones.** Traditional rational and linear models were found suboptimal in the context of the complex situation of smartphone return. This dissertation proposes a conceptual model of user behaviour enriched with insights on access-based consumption in Figure 51 and on ownership-based consumption in Figure 52. Further reflections on the model are made in Section 7.4.
- **Exploring the new research field of design for divestment.** Divestment is an emerging debate in the field of design. The research contributes scientifically by providing a better understanding of divestment from studying the case of smartphone return after use. This study is one of the first to explore divestment from a user perspective through design interventions. The definition of divestment as the combination of the physical and mental/emotional separation from the product, the developed 6-stage model of divestment, design insights from smartphone divestment experiences, and design for divestment principles are novel contributions to the fields of design research and consumer research.
- **Exploring access services from a user perspective through an in-depth field study.** This research scientifically adds to the body of work on access-based consumption for smartphones. The study identified influencing factors and design interventions to improve their acceptance. The empirical study provides in-depth user insights on recent access services developments and offers a better understanding of how users experience the services (based on their expectations as well as on the actual use and divestment experience).
- **Using the novel Research through Design approach.** The research on design for divestment was approached using Research through Design (RtD). As the RtD approach is still at a formalizing phase (J Zimmerman et al., 2010), this dissertation also contributes to the discussion on this approach by offering another case to demonstrate its use. More reflections on the RtD approach are made in Section 7.4.

Contributions to practice

- **Supporting the development of access services during their infancy phase.** The research on the acceptance of access-based consumption also yields contributions for the burgeoning practice of access services for smartphones. Recommendations for these services were formulated based on the identified factors and in comparison to more widely accepted services from the car industry. These recommendations can be used by service providers to enhance their practices. The research thus contributes to the transition towards an improved acceptance of access-based consumption.
- **Supporting the development of divestment experiences for users.** For practitioners, this explicit design for divestment knowledge offers the chance to change the perspective within companies, organisations, and governments to create concrete design interventions enhancing the divestment experience. The results of this dissertation are explorative. However, as shown by the low return rates, this knowledge made explicit can have a significant impact on seriously considering divestment as an integral part of the consumption cycle and enabling a transition towards CE. Thus, instead of solely focusing on the technological and business aspects of getting products back, an in-depth consideration of user aspects may help increase return rates.

7.4 Reflections on the research design

A Ph.D. project can only research so much within its confines. As with any research, the space of the scientific world explored in this dissertation had to be narrowed down to be researchable. Moreover, the research was conducted using the ‘research goggles’ defined in Chapter 3 on the research design. Limitations are noted with regards to the scope, the conceptual model, and the methods employed.

7.4.1 Focus on users & design

As the user is central in consumption systems, this dissertation focused on the behaviour of this particular actor. Users currently have the path of their owned product (e.g. the trashcan, a return point, a direct new user) in their hands after use. Acknowledging the ongoing debates on who bears the responsibility of closing the loop or who should ‘start’, it can be questioned whether attempting to change user behaviour is the most effective approach to transition towards a circular economy.

The assumption is made that design can and should influence users to stimulate the ‘right’ behaviour change. However, the power and position of design can be questioned. All the organisation levels (i.e., governments, businesses, and users) are interconnected and dynamic in these production and consumption systems.

7.4.2 Further scope

Getting products back after a use cycle is a worldwide problem. Even though the physical result is similar, each region has its own culture and thus a specific perception of the world. Scoping the context of the research therefore particularly influences the results. The chosen scope of user behaviour concentrates on the decision process and activities of the consumption cycle happening within individuals. It also includes internal and external factors influencing the individuals’ decision process and activities. Although the conceptual model focuses on behaviour at an individual level and was based on the CDP model, opening the reviews up to other theories and models in social sciences permits a better overview of the phenomenon. The focus was placed on various disciplines within social sciences. In retrospect, the scoping choices were adequate considering they yielded results which enabled to answer the research questions. Now the question is how to further develop the knowledge to fit product categories other than the specific case of mobile phones, and to explore a wider cultural context outside Western Europe.

7.4.3 Consumer Decision Process model by Blackwell et al. (2006) as foundation

For the studies presented in Chapters 4, 5, and 6, the conceptual model based on the CDP model appeared to be a sound starting point. With minimal stipulations, the model was made into a suitable conceptual model to study the acceptance of access-based consumption and the divestment phase in ownership-based consumption. The knowledge from the literature and empirical studies was conveniently organised and analysed following the structure and concepts of the conceptual model.

Using the empirical studies, the conceptual model was further enriched. Literature and empirical research showed that no one influencing factor is superior, but that an interplay of factors is needed to change behaviour. There is no causal link with one single factor, however multiple combinations of factors need to be considered to deal with the complexity of human behaviour, interconnectivity, and the dynamic situations. Organisations will have to iteratively develop solutions using a diverse range of design interventions in a continuous process of trial-and-error.

7.4.4 Reflection on RtD

Industrial context

My Ph.D. project was conducted in an industry context. Several lessons can be drawn from this experience for future researchers who will spend a part of their time in a similar context.

The chosen set-up helped the research in multiple ways. Being a consulting researcher within a company offered the opportunity of becoming closely familiar with the stakeholder's day to day activities. It thus provided the chance to better understand the internal dynamics, evolution and stakes between the sustainability/circular issues and design innovation. This position enriched my research by equipping me with this enhanced understanding of the complex situation (e.g. experiencing legal barriers) while grounding it in practice (i.e., keeping the applicability in mind). Furthermore, concrete questions from the company allowed me to leave my 'PhD rut' by thinking and acting on foreseeable tasks. Additionally, the international setting enabled to be even more aware of the influence of culture on user behaviour.

On the other hand, this set-up resulted in some obstacles for the research

that need to be accounted for. The inherent need of a business for confidentiality can conflict with the academic requirement of public information. It took some time to navigate these waters. Some research avenues could not be followed and some results (e.g. internal workshop) had to be cut. Moreover, there is also a risk of engendered biases, for example, assuming all industry players are built in the same manner.

Workshop with experts and master students supervision

As the workshop organisation and the student supervision were labour-intensive, the number of cases was restricted due to financial means and time feasibility. The cases tackled the same design assignment from various angles, from biomimicry to data management, and offered a rich pallet of design insights. This pluriform approach coupled with the theoretical findings emanating from literature provided robust findings through abductive reasoning. As noted by Gaver and Martin (2000), the context of this research made the participating designers push aside commercial queries and be less restrained in their design process than in reality. The workshop with experts permitted an assessment of previous insights with more experienced design practitioners and researchers, which provided further understanding of multiple perspectives and interpretations. The regular discussions with the students were particularly enriching as they brought new angles and insights to the table with, for instance, the results from their service safari, interviews, prototypes and tests.

Several limitations can however be noted. Possible cross-pollination has occurred between the projects as they were done in parallel and several students discussed their project together. These events may have skewed the insights by converging these across the graduation projects and prearranging the results instead of letting the designers act freely. Moreover, as with every action research, interacting with the participants will always influence them (even though avoided as much as possible through prior research). Following constructivism, I believe that gaining knowledge from someone is "'constructed' through acts of cognition"(van Gigch, 2002, p.554). "Objectivity is the delusion that observations could be made without an observer" (von Foerster 1978, epigraph, cited by van Gigch, 2002b). For instance, accessing latent knowledge is still collected indirectly through the study of generative sessions where participants express this latent knowledge. It comes back to the conception that humans are not robots and do not operate following pre-determined programmed paths.

Formalization of the RtD approach

As the RtD approach is still in a formalizing phase (Zimmerman et al., 2010), ways of bringing scientific rigour are being sought. RtD has, for instance, to face the challenge of the verifiability of the results (Zimmerman & Forlizzi, 2008). The empirical studies can be replicated using similar starting points of the design projects: the design briefs for the graduation projects and the workshop slides. To address this limitation, the data collected (within the boundaries of GDPR-requirements) and its analysis is available for other design researchers to consult and conduct peer evaluations.

RtD is “the designerly contribution to new knowledge” (Stappers & Giaccardi, 2017, p. 63), which means that researchers from research fields outside of design may have difficulties understanding it and can question its scientific rigour. Storni (2015) expressed his challenges in introducing the RtD approach in the world of sociologists and ethnographers. Their work is often qualitative in nature and has been epistemologically reshaped by the constructivist movement (van Gigch, 2002), therefore this bridge does not seem far-stretched. Yet, remnants of positivism seem persistent as illustrated by Storni (2015): “It was pointless to echo the Heisenberg Principle and the Hawthorne Effect by arguing that sociologists also design their surveys, interview questions, and field visits, which change the reality to be studied” (Storni, 2015, p. 75). The traditional conceptualisation of scientific rigour remains that as is generally represented in physical science (i.e., chemistry, geology and physics) where the existence of a universal truth is assumed. In contrast to social sciences, knowledge in physical science is gained from non-living entities (van Gigch, 2002). Design aims at changing a situation. Through this research, design interventions and the phenomenon of return interact, and new (non-universal) knowledge is provided (Storni, 2015).

7.5 Future research avenues

Future research avenues have been identified based on either the complete dissertation or its distinct parts on access-based consumption and ownership-based consumption.

7.5.1 Overall

Individual vs collective

To make the main research questions researchable, the situation of return was simplified by focusing on individuals. A user is part of a group of users who are influenced by themselves, companies, governments and others. Change starts with an individual that takes action (see the Stairway to Heaven by Nijs (2013)), therefore this research took the individual user as focus point.

However, researchers are invited to build on this dissertation by leveraging the individual processes identified to develop a strategy to spread the behaviour change across communities through social networks. Further research would benefit from approaching this human behaviour at a collective level as it provides a different perspective on behaviour change, and this is seen to be potentially highly relevant when researching phenomena (see Chapter 2). With this dissertation's insights at an individual level, the underlying interactions within communities have been exposed. It can be reasonably expected that a tipping point can be reached for a societal shift where returning products becomes the standard.

Next step for the conceptual model proposed

The conceptual model was drafted to research the real-life phenomenon of the return of mobile phones from a user perspective based on scientific knowledge found in the literature. Stipulations were made, for example by defining divestment, to bridge knowledge gaps and study the real-life phenomenon. The drafted conceptual model was then verified with various empirical studies including both the analysis of the phenomenon and how to change user behaviour through design. Nevertheless, the proposed conceptual model needs further validation. Future research could, for instance, study the acceptance of access-based consumption with other mobile phones offers, with other contexts, or using other contextmapping methods.

Reflection on a transition from ownership-based consumption to access-based consumption

The exploration of the access-based consumption of mobile phones in Chapter 5 showed that the user acceptance requires a logic shift from the dominant way of consuming where users 'eternally psychologically and legally own products' to a situation where users 'temporarily psychologically own a product through access'. As shown in Figure 55, 'relooped ownership' could be introduced as a transitional step between the two modes of consumption. In 'relooped ownership', closing the loop is a habit for users. Users would still legally own the product and predispose of the right to control it. However, they would know from the outset that each product they purchase and use will eventually be returned to flow in the resource system. In the context of mobile phones, Shyam (2016) also advised to concentrate on closing the loop on a short term and to transition towards connectivity as a service on a longer term. Moeller and Wittkowski (2010) illustrated the concept of 'relooped ownership' with a study on auction participants who buy and resell their products (Trendburo, 2008). The researchers emphasized factors of temporary ownership "are likely to be relevant to the rising demand for non-ownership" (Moeller and Wittkowski, 2008). As reported in Chapter 5, the perceived need to own products appeared to be a force of habit, this intermediate step could enable a slight move from owning products without closing the loop, to owning products while having the habit of returning them at every end of the use cycle. Temporary ownership and access could, in time, subsist in parallel. This reflection should however be further investigated.

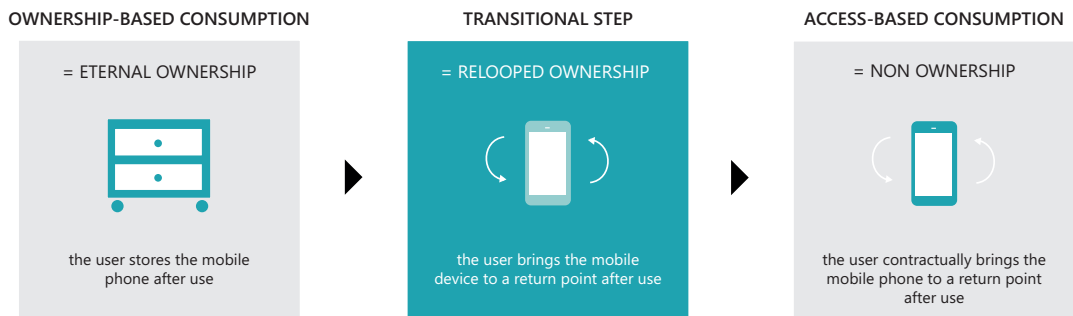


Figure 55. From the current behaviour to the wanted behaviour

Divestment in a circular economy

From a circular economy perspective, products, components and materials are kept at their highest utility and value (Webster, 2015). In the case of mobile phones,

the conceptualisation of circular practices need further debate. Is repairability or durability preferred? What would the 'right' time be to divest from a smartphone keeping its 'afterlife' (or preferable, 'after-use') in mind? How would the 'right' time from a circular perspective compare to the 'right' time for users (i.e., when the preparation for detachment is complete)?

Rebound effects

As the whole system is being considered, the rebound effects from accessing products and returning products come to mind. Zink & Geyer warn for the potential "circular economy rebound" (Zink & Geyer, 2017). The potential decrease in resource demand and environmental impact attained from adopting circular strategies could be counteracted by these effects. Makov & Font Vivanco estimated that the rebound effects in the case of smartphone reuse could result in a loss of 27% to 100% of the emission savings (Makov & Font Vivanco, 2018). More research is needed to understand how user behaviour evolves and whether closing the loop in the ways studied in this dissertation might actually not be counteracted (or even made worse) by other behaviour.

7.5.2 Access-based consumption

Resilience

What if users accessed every single item in their life? If users lose their income, would they lose their access to telecommunication, food refrigeration, and even clothing? Also, in the long term, these costs add up and finally can be higher than the required financial investment of owning a product. On top of this, in the Netherlands, these access contracts bring hidden costs with them as users are automatically registered in the 'Bureau Krediet Registratie' to list their loans, which means that they would be entitled to a much lower loan than if the products had been purchased at their purchase price. Even though these issues are out of the scope of this research, these topics require considerable further thought.

One product per user

The access-based consumption considered in this research in the case of mobile phones focused on access to a product for one single user. Nevertheless, there are other different business models where the user does not legally own the product. Could one phone be used by multiple users as Car2Go does with cars, or like Uber by only accessing a phone when requiring to make a call? These models

are even further from current practices, and will thus require a change of user logic, amongst others.

7.5.3 Ownership-based consumption

Beyond the focus of return in ownership-based consumption

The main objective of the second part of the dissertation was to stimulate the return of mobile phones in ownership-based consumption. Nevertheless, the commercial or charitable return programmes are not always the most circular options in order to maximize value and utility retention. Although the influencing factors and design principles identified can be applicable to other contexts, further research is needed to widen the scope to, for instance, include other disposition routes such as peer-to-peer resell or other consumption modes such as access-based consumption. Moreover, the differences between using a valuable divestment experience to (a) prevent currently used phones to be put in hibernation, and (b) get unused phones out of hibernation need to be explored.

Next step for the design principles proposed

Design principles proposed in this dissertation are based on the descriptive conceptual model, the analysis done by the workshop participants and the graduation students, and the design interventions resulting from these design projects. The design interventions were tested with users by the graduation students. Nevertheless, further research is needed to validate the design principles resulting from the design processes to evaluate to what extent the developed solutions increase the return of mobile phones in ownership-based consumption. Pilots could be conducted with manufacturers, telecom providers or other organisations.

Other types of design interventions should also be considered. The design brief could be approached in collaboration with municipalities or reverse logistics organisations. Moreover, all of the concepts created by the design students and experts were based on a rewarding experience for the users. But what if, for instance, more friction would be taken into account, like deposit schemes or bonus/malus constructions?

Beyond mobile phones

The design principles have been specifically developed for the case of mobile phones. These principles are not generalizable to other products as the relationship with a mobile phone is different from that with, for instance, the packaging of pasta.

Further research is needed to test their applicability to other product categories.

Divestment debate

The second part of the dissertation integrated knowledge from the fields of business administration (e.g. Hanson (1980)) and marketing (e.g. Roster (2001)) in to the field of design. The results of the empirical studies offer a good starting point for the emerging research area of divestment in design. Considerable scientific debate is needed to correct the imbalance between the attention for the purchase and use phases versus that for divestment in the field of design.

Design for Divestment

Circular designers are educated to consider the technical aspects of a CE and build them into PSS design. Also, designers already place users at the centre of their activities and think beyond the current product across generations of the product line. Therefore, to avoid compromising the needs of future generations of users and to stimulate a logic shift towards closing loops through return, designers need to make the pivotal part between products – namely divestment – an undeniable part of product use cycles.

This dissertation contributes to the development of Design for Divestment by presenting knowledge from other disciplines to designers and spreading the divestment knowledge. If designers are taught to consider divestment in their education, this divestment phase will become a natural part of their design practice. This integration will equip designers to create solutions for a circular economy throughout the design cycle.

In the same way that the knowledge from the literature and empirical studies have enriched my take on the CDP model, one can consider enriching formative design models such as Roozenburg & Eekels' model to readjust the balance between the attention for the purchase, use, and divestment phases. Figure 56 shows the Product Innovation Process model by Roozenburg and Eekels (1995), first adapted by Bakker (2018), and now also including my adaptations. Following recommendations of Baldassarre et al. (2020) and Diehl & Christiaans (2015), the model was adapted to broaden the strategic objectives of industrial designers and shift from product design to Product Service System (PSS) design.

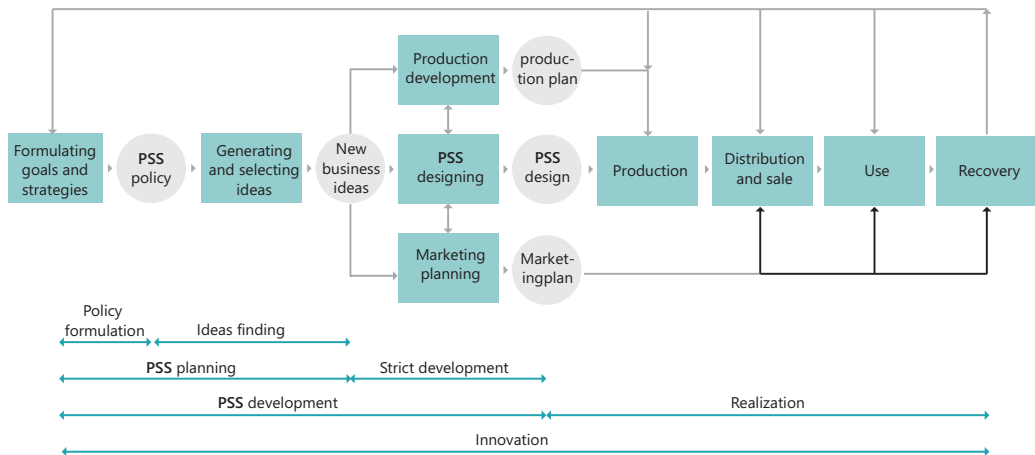


Figure 56. The Roozenburg and Eekels (1995) Product Innovation Process model, adapted by Bakker (2018), and further adapted by Poppelaars (bold text and black arrows). Recovery includes both the return of products, reverse logistics, and the technical aspects to circularly treat the product

To further develop Design for Divestment, future research should explore which methods and tools can be leveraged to support design researchers and practitioners to integrate divestment.

To my knowledge, Hanna Timmerman, one of the master design students who worked on our graduation assignment, is the first to create a design tool to specifically design for divestment in a CE. The tool included the combination of the current consumer-product lifecycle and the new and improved end-of-use consumer experience following her proposed stages with the support of value cards and behaviour cards. She extensively tested it through multiple iteration cycles with fellow industrial design engineering students. Further research could thus build on her ‘Design for product detachment – Saying goodbye to a(n) ...’ tool (Timmerman, 2018).

The Use2Use design Toolkit launched in 2020 by Dr Anneli Selvefors and Dr Oskar Rexfelt also offers valuable insights on how to approach circularity from a user perspective. Although focusing on the whole consumption cycle, parts of the toolkit (e.g. various cards in the journey exploration pack, multiple use cycles exploration pack and thinking activation pack) provide concrete handles for designers to design for divestment (Selvefors & Rexfelt, 2020).

In addition, other tools and methods currently used in design with a focus on the purchase and use of products could be of use for design for divestment if appropriately adapted. For instance, as shown by the graduate students, personas and service blueprints could also be leveraged to fit Design for Divestment.

7.6 Closing remarks

In the course of this Ph.D. research, multiple positive movements occurred in the Netherlands. For one, access-based consumption is now making a comeback by OEMs with, for instance, Samsung's private leasing programme and by start-ups such as Go Lemon and Swapphone. When it comes to divestment in ownership-based consumption, various OEMs have integrated their collection programmes more intuitively into their purchase process. In the case of Apple, for example, this integration resulted in over a third of new iPhone purchases being linked to the trade-in of the user's old device (Varghese, 2019). Furthermore, the link between divestment and purchase has also recently been utilized by telecom providers. This link is illustrated by the T-mobile Recycle Deal in which the user agrees to return the phone after the contract in exchange for a monthly discount on their plan (T-mobile, n.d.).

This research contributes both scientifically and socially to a transition towards a CE, by providing a conceptual model integrating behaviour science within design research, recommendations for access services, divestment model, influencing factors, design insights and principles for designer practitioners and researchers. Hopefully, this dissertation will inspire and motivate designers to stimulate the acceptance of access-based consumption and to further consider divestment in ownership-based consumption, to enable the return of mobile phones on a greater scale. It may also potentially move readers (i.e., who are likely all mobile phone users) to consider access-based consumption for their next device, or to take their unused devices in their drawers to return points.

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Appendices

Appendix A | Disposition options

Referred to in Chapter 1 and Chapter 3

Once the consumer has decided to end of the product use cycle as she/he does not want to continue to use the mobile device for original purpose, multiple paths can be wandered. Based on Jacoby et al. and Glover, two main directions can be taken: (1) the consumer keeps the product in ownership and temporarily ends the product use cycle, or (2) the ownership of the product is transferred to someone else and the product use cycle is permanently ended. The path of a mobile device at the end of the product use cycle is various as visualised in the figure below.

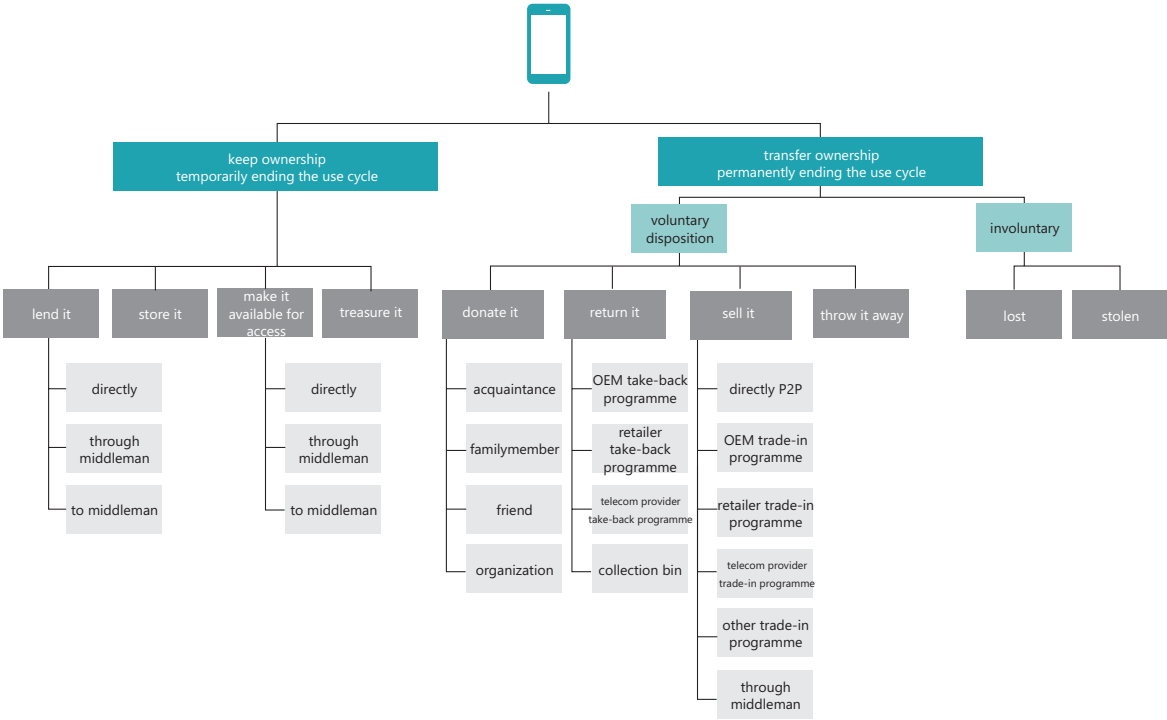


Figure A1. Flowchart of ending the product use cycle options for mobile devices based on Jacoby et al (1977) and Glover (2012)

1. Keep ownership

By temporarily ending the use cycle, the consumer keeps the door open to reversing his/her decision to end the use cycle. Four options are possible: (a) lend it,

(b) store it, (c) make it available for access, and (d) treasure it.

a. Lending the device means that the mobile device is that the device is temporarily used by another consumer for free. However, the ownership of the product remains into the hands of the original consumer and the product is meant to be returned at some point. This direct reuse to another consumer enables to close the loop. Nevertheless, in the time the product is not lend, the disused device has to be stored. Storing the device makes it an idle asset with a constantly decreasing financial value [ref].

b. Storing the mobile device in a drawer or garage waiting for further utility of the device, may it be for example as a spare phone, possible lending device for a friend or just when a decision is made of what to do further with the device. The currently most recurring scenario is when the device is put away and forgotten in a drawer or garage and has no further utility in a CE context. This occurs when the consumer wants the product out of sight and avoids dealing with it [ref].

c. Making the device available for access enables reuse of the product by another consumer in exchange for something (undefined). Similar to lending the device, this option is circular by closing the loop through reuse, but requires storage. The former two disposition options are on top of this not well spread in the case of mobile devices [ref].

d. The mobile device can also be treasured by the consumer as for example a memento of her/his first mobile phone or as piece of design/art. Even though not used for its original use, the product has utility.

For the purpose of this study, 'temporarily out of use' will be avoided as the product will hibernate in every case and not be used to its full capacity. The consumer thus ideally needs to be aware of the repercussions of hibernation and take a more reasoned circular decision.

2. Transfer ownership

By a transfer of ownership, the mobile device/s use cycle is permanently ended. The action is irreversible and thus the current use cycle is irrevocably ended.

- **Voluntary**

Voluntary transfers of ownership are considered as the only options defined as disposition options. Indeed, here the consumer chooses to permanently deals with ending the product use cycle. As defined by Roster (2001), consumers renounce the possession of a specific product and thus abdicates their responsibility and control over it at its disposition. In a same fashion as Cherrier (2009), I frame disposition as

the “conduit through which the material circulates”, allowing for the flow of products (Cherrier 2009). Similar to purchase, disposition can also be impulsive.

a. Mobile devices can be donated for free to another party. The ownership of the product is transferred from the current donor to the receiver (may it be an acquaintance, family member, friend or organization). This enables the further circular use of these resources may it be through direct reuse, or indirect remanufacture, remanufacturing and recycling (i.e., when the organization sells the devices to expert party).

b. The product can also be returned through a take back programme of expert parties (e.g. of the retailer, manufacturer or telecom provider) or put it in a collection bin installed by municipalities or regulative agencies. No financial gain to the consumer occurs. This enables the further circular use of these resources may it be through reuse, remanufacture, remanufacturing and recycling.

c. Mobile devices can be sold to another party directly to another consumer, through a trade-in programme from retailers, manufacturers, telecom providers or others, or through a middleman. This enables the further circular use of these resources may it be through reuse, remanufacture, remanufacturing and recycling.

d. The last option is to throw the device away in the overall waste stream. In terms of circular processing, ‘throw it away’ is the worst disposition option as it represents a leakage of the system.

Donating, returning and selling are options where consumers close the loop through enabling direct reuse or setting the product up for further circular processing. These three options are thus called responsible disposition options.

For the first three disposition options, to enable a “safe passage”, consumers can at the disposition conduct meaning transfer rituals by removing the consumer’s meaning by cleaning or transferring the meaning through contact with the next user.

- **Involuntary**

The ownership of a mobile device can be transferred involuntarily through (a) loss or (b) theft. Even though the new owner is not the legal owner, the product still goes into a new product use cycle. As the fate of the device is uncertain or illegal, these options are not considered circular.

Appendix B | List of theories and models

Referred to in Chapter 2.

More than 100 different theories and models conceptualising consumer behaviour were found during the literature review. These theories and models are listed in the table below.

Theories and models	Found in reviewed publications
Accessibility-diagnostics model (Feldman & Lynch, 1988)	Rucker et al. (2013)
Affect Heuristic (Slovic, 2002)	Darnton (2008)
Affective events theory (Weiss & Cropanzano, 1996)	Tombs & McColl-Kennedy (2003); Davis et al., (2014)
AIDS risk reduction model (Catania, 1990)	Davis et al. (2014)
Appraisal Theory	Rucker et al. (2013)
Approach-avoidance theory (Mehrabian & Russell, 1974)	Tombs & McColl-Kennedy (2003)
Approaches to social change (Kotler, 2013)	Brennan et al. (2014)
Associative-Propositional Evaluation model (Gawronski & Bodenhausen, 2006)	Rucker et al. (2013)
Attitude-social influence - efficacy model (DeVries, 1998)	Davis et al. (2014)
Attribute (Lancaster) Model (1966)	Jackson (2005)
Awareness Interest Decision Action (AIDA)	Darnton (2008)
Balance theory (Heider, 1958; Woodside & Chebat, 2001)	Brennan et al. (2014)
Barriers and facilitators model (Nguyen et al., 2014)	Brennan et al. (2014)
BCOS model (Andreasen, 2006)	Carvalho & Mazzon (2013)
Behavior setting theory (Barker, 1968)	Tombs & McColl-Kennedy (2003)
Behaviour change wheel (Michie et al., 2011)	Brennan et al. (2014)
Behavioural ecological model (Hovell et al., 2002)	Brennan et al. (2014); Davis et al. (2014)
Behavioural perspective model (Foxall, 1992)	Brennan et al. (2014)
Bounded model of social entrepreneurship (Weerawardena & Sullivan-Mort, 2006)	Brennan et al. (2014)
Bounded Rationality (Simon, 1955)	Darnton (2008)
Change Theory (Lewin, 1947)	Darnton (2008); Davis et al. (2014)
Chapman model (1984)	Vrontis et al. (2007)
Classical Conditioning (Pavlov, 1927)	Davis et al. (2014)
Clawson & Knetsch (1966)	Sirakaya & Woodside (2004)

Theories and models	Found in reviewed publications
Cognitive Dissonance Theory (Festinger, 1957)	Jackson (2005)
Collective intelligence conceptual framework (Smith, 1994)	Brennan et al. (2014)
COM-B system (Michie et al., 2011)	Brennan et al. (2014); Davis et al. (2014)
Community-based social marketing (McKenzie-Mohr, 2000)	Brennan et al. (2014)
Comprehensive model of behaviour change (Bagozzi et al., 2002)	Brennan et al. (2014)
Consumer Preference Theory (Begg et al 2003)	Jackson (2005)
Consumer socialization agency (Watne & Brennan, 2011)	Brennan et al. (2014)
Consumer socialization theory (Ward, 1974; Moschin, 1987)/ model of consumer socialization (Moschis & Churchill, 1978)	Brennan et al. (2014)
Containment theory	Davis et al. (2014)
Control Theory (Carver and Scheier, 1982)	Darnton (2008); Davis et al. (2014)
Corporate social marketing model (Inoue & Kent, 2014)	Brennan et al. (2014)
Cultural Capital Framework (Knott et al., 2008)	Darnton (2008)
Cultural Theory (Thompson et al.,1990)	Jackson (2005)
Department for Communities and Local	Darnton (2008)
Differential Association Theory (Sutherland, 1947)	Davis et al. (2014)
Diffusion of Innovations (Rogers, 1962)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Double Loop Learning (Argyris and Schon, 1978)	Darnton (2008)
Dual process theory	Rucker et al. (2013); Carvalho & Mazzon (2013); Darnton (2008); Davis et al. (2014)
Ecological model of diabetes preventions (Burnet, 2002)	Davis et al. (2014)
Economic models (Kortler & Fox, 1985; Hossler et al., 1999)	Vrontis et al. (2007)
Elaboration Likelihood Model of Persuasion (ELM) (Petty and Cacioppo, 1986) / Hovland et al's Persuasion Theory (1953)	Bredahl et al. (1998); Brennan et al. (2014); Darnton (2008); Jackson (2005); Rucker et al. (2013)
Empowerment (2008)	Darnton (2008)
Engel-Kollat-Blackwell (EKB) or Engel-Blackwell-Miniard (EBM)	Brennan et al. (2014); Vrontis et al. (2007); Sirakaya & Woodside (2004)
ESD1/ESD2 (Vare and Scott, 2007)	Darnton (2008)
Extended Parallel Process model (Witte, 1992)	Davis et al. (2014)
Feedback Intervention Theory (Kluger, 1996)	Davis et al. (2014)
Field Theory (Lewin,1951)	Jackson (2005)

Theories and models	Found in reviewed publications
Focus Theory of Normative Conduct (Cialdini, 1990)	Darnton (2008); Davis et al. (2014); Jackson (2005)
Four Es model (DEFRA, 2005)	Brennan et al. (2014); Darnton (2008)
Four Steps of Community Based Social Marketing (CBSM) (McKenzie-Mohr, 2000)	Darnton (2008)
Framework for Environmental Education Strategies (Monroe et al, 2006)	Darnton (2008)
General theory of crime (Goffredson, 1990)	Davis et al. (2014)
General theory of deviant behaviour	Davis et al. (2014)
Gilbert model (1991)	Sirakaya & Woodside (2004)
Goal Framing (Lindenberg, 2007) /Setting Theory (Locke, 1968)	Davis et al. (2014)
Government's Model of Community	Darnton (2008)
Hanson & Litten model (1982)	Vrontis et al. (2007)
Health action process approach (Schwarzer, 1992)	Davis et al. (2014)
Health behaviour goal model (Gerbhardt, 2001)	Davis et al. (2014)
Health behaviour internalisation model (Bellg, 2003)	Davis et al. (2014)
Health Belief Model (Rosenstock, 1974)	Brennan et al. (2014); Carvalho & Mazzon (2013); Darnton (2008); Davis et al. (2014)
Heuristic-Systematic Model (Chaiken et al., 1989)	Rucker et al. (2013)
Hierarchy of consumer emotions (Laros & Steenkamp, 2005)	Brennan et al. (2014)
Hierarchy of effects model (Lavidge & Steiner, 1961)	Brennan et al. (2014)
Implementation Intentions (Gollwitzer, 1993)	Darnton (2008)
Implications from Chapman's System Failure	Darnton (2008)
Information Deficit Models	Darnton (2008)
Information processing model (Bettman et al., 1998)	Sirakaya & Woodside (2004); Bredahl et al. (1998); Davis et al. (2014)
Information-Motivation-Behavioural Skills (IMB) Model (Fisher & Fisher, 1992)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Integrated theoretical model for alcohol and drug prevention (Gonzalez, 1989)	Davis et al. (2014)
Integrated Theory of drinking and behaviour (Wagennar, 1994)	Davis et al. (2014)
Integrative factors influencing smoking behaviour model (Flay, 1983)	Davis et al. (2014)
Integrative model for social marketing (Lefebvre, 2011)	Brennan et al. (2014)

Theories and models	Found in reviewed publications
Integrative model of behavioural prediction (Fishbein, 2000)	Davis et al. (2014)
Intervention Mapping (IM) (Bartholomew et al.)	Darnton (2008)
Jackson model (1982)	Vrontis et al. (2007)
Judgment Heuristics (Tversky and Kahneman, 1974)	Darnton (2008)
Main Determinants of Health Model (Dahlgren and Whitehead, 1991)	Brennan et al. (2014); Darnton (2008)
Mastery Modelling (Bandura, 1977)	Darnton (2008)
Mavens, Connectors & Salesmen (Gladwell, 2000)	Darnton (2008)
Means End Chain Theory (Peter & Olson, 1990)	Brennan et al. (2014); Bredahl et al. (1998); Jackson (2005)
Meta-cognitive model of attitudes (Petty, 2006; Petty & Briñol, 2006)	Rucker et al. (2013)
MODE Model (Fazio, 1986)	Brennan et al. (2014); Darnton (2008)
Model for health promotion (McGuire, 1984)	Brennan et al. (2014); Davis et al. (2014)
Model of activation and comparison (Albarracín et al., 2004)	Rucker et al. (2013)
Model of consumer action (Bagozzi et al., 2002) / Action model of consumption (Bagozzi, 2000)	Davis et al. (2014); Jackson (2005)
Model of Goal Directed Behaviour (Bagozzi, 1992)	Davis et al. (2014)
Model of Pro-Environmental Behaviour (Kolmuss and Agyeman, 2002)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Model of sustainable behaviour (Verdugo, 2012)	Brennan et al. (2014)
Motivation-Ability-Opportunity model (Olander and Thøgersen, 1995)	Brennan et al. (2014); Davis et al. (2014); Jackson (2005)
Multi-attribute attitude model (Fishbein, 1963)	Bredahl et al. (1998)
Multiple pathway anchoring and adjustment (Cohern & Reed, 2006)	Rucker et al. (2013)
Needs Opportunities Abilities (NOA) Model (Vlek et al., 1997)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Network Theory	Darnton (2008)
Nicosia model	Brennan et al. (2014); Sirakaya & Woodside (2004)
Norm Activation Theory (Schwartz, 1977)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014); Jackson (2005)
Norm Neutralization Theory (Sykes and Maza, 1957)	Darnton (2008)
Obesity System Map (Foresight, 2007)	Darnton (2008)
Operant learning theory (Skinner, 1954)	Davis et al. (2014)
Organisational Culture (Schein, 1985)	Darnton (2008)

Theories and models	Found in reviewed publications
Practice Theories (Bourdieu, 1990; Reckwitz, 2002; Spaargaren, 2000)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014); Jackson (2005)
Precaution Adoption Process Model	Brennan et al. (2014); Davis et al. (2014)
Pressure system model (Katz, 2001)	Davis et al. (2014)
PRIME theory (West, 2006)	Davis et al. (2014)
Principles for Intervening to Change Environmentally Destructive Behavior (Gardner and Stern, 1996)	Brennan et al. (2014); Darnton (2008)
Principles of Hyperbolic Discounting, Framing, Inertia	Darnton (2008)
Problem behaviour theory (Jessor, 1977)	Davis et al. (2014)
Prospect Theory (Kahneman and Tversky, 1979)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014); Sirakaya & Woodside (2004)
Protection Motivation Theory (Rogers, 1975)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Prototype/Willingness Model (Gibbons and Gerrard, 2003)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Rational addiction model (Becker, 1988)	Davis et al. (2014)
Rational Choice Theory (Elster, 1986; Homans, 1961) / Expected Utility (EU) Theory (von Neumann & Morgenstern, 1947) / Expectancy value theory (Bagozzi, 1981; Oliver, 1993)	Brennan et al. (2014); Darnton (2008); Jackson (2005); Sirakaya & Woodside (2004)
Regret theory (Bell, 1982)	Sirakaya & Woodside (2004)
Regulatory fit Theory (Higgins, 2000)	Davis et al. (2014)
Relapse Prevention Theory (Marlatt, 1980)	Davis et al. (2014)
Risks As Feelings Model (Loewenstein et al., 2001)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Runyon model (1980)	Sirakaya & Woodside (2004)
Satisfying theory (Simon, 1956)	Sirakaya & Woodside (2004)
Schematic Causal Model of Environmental Concern (Stern et al., 1995)	Darnton (2008)
Self Categorisation Theory (Turner, 1987)	Darnton (2008)
Self-Determination theory (Deci & Ryan, 1985)	Brennan et al. (2014); Davis et al. (2014)
Self-Discrepancy Theory (Higgin, 1987)	Jackson (2005)
Self-Perception Theory (Bem, 1967)	ackson (2005)
Seven doors to social change model (Robinson, 2013)	Brennan et al. (2014)
Six Stage Model of Social Marketing (Andreasen)	Brennan et al. (2014); Darnton (2008)
Six staged model of communication effects (Vaughan, 2000)	Davis et al. (2014)
Social action theory (Ewart, 1991; Weber, 1991)	Davis et al. (2014)

Theories and models	Found in reviewed publications
Social behaviour influence (Lafreniere & Deshpande, 2013)	Brennan et al. (2014)
Social Capital (Mc Michael 2007)	Darnton (2008)
Social change model for leadership development (Wagner, 1996)	Brennan et al. (2014)
Social change theory (Thompson, 1990)	Davis et al. (2014)
Social Cognitive Theory (Bandura 1986)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Social Comparison theory (Festinger, 1954)	Rucker et al. (2013)
Social consensus model of health education (Romer, 1992)	Davis et al. (2014)
Social Development model (Hawkins, 1985)	Davis et al. (2014)
Social dominant logic (Andreasen, 2012)	Brennan et al. (2014)
Social ecological model of behaviour change (Panter-Brick, 2006)	Davis et al. (2014)
Social ecological model of walking (Alfonzo, 2005)	Davis et al. (2014)
Social Facilitation theory (Zajonc, 1965)	Tombs & McColl-Kennedy (2003)
Social Identity Theory (Turner and Tajfel, 1979)	Brennan et al. (2014); Davis et al. (2014)
Social influence model of virtual community participation (Dholakia, 2004)	Davis et al. (2014)
Social Judgement Theory	Bredahl et al. (1998)
Social Learning theory (Miller, 1941)	Davis et al. (2014)
Social marketing planning process (Lee, 2014)	Brennan et al. (2014)
Social Norms Theory (Perkins, 1986)	Davis et al. (2014)
Stimulus-(Organism)-Response model	Brennan et al. (2014); Tombs & McColl-Kennedy (2003)
Strategic model of communication for social change (UNICEF, 2011)	Brennan et al. (2014)
Symbolic Interactionism	Jackson (2005)
Symbolic self-completion Theory	Jackson (2005)
Systems model of health behaviour change (Kershell, 1985)	Davis et al. (2014)
Systems Thinking	Darnton (2008)
Targeting outcomes of programs model (Rockwell & Bennett, 2004)	Brennan et al. (2014)
Technology acceptance (Venkatesh, 1989)	Davis et al. (2014)
Terror management (Goldenberg, 2008; Greenberd, 2008)	Davis et al. (2014)
the nine Ps model of organizational sustainability (Brennan & Binney, 2011)	Brennan et al. (2014)
The Value Action Gap (eg. Blake 1999)	Brennan et al. (2014); Darnton (2008)
Theories of self-regulation (Kanfer, 1970)	Davis et al. (2014)

Theories and models	Found in reviewed publications
Theory of Buyer Behaviour model (Howard-Sheth, 1969)	Brennan et al. (2014); Jackson (2005); Sirakaya & Woodside (2004)
Theory of Fear Appeals (Hovland, 1957)	Darnton (2008)
Theory of grassroots (Carrigan et al., 2011)	Brennan et al. (2014)
Theory of Interpersonal Behaviour (TIB), (Triandis, 1977)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014); Jackson (2005)
Theory of Normative Social Behaviour (Rimal et al., 2005)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Theory of Planned Behaviour	Bredahl et al. (1998); Brennan et al. (2014); Carvalho & Mazzon (2013); Darnton (2008); Davis et al. (2014); Jackson (2005); Sirakaya & Woodside (2004)
Theory of Reasoned Behaviour/Action	Brennan et al. (2014); Darnton (2008); Jackson (2005); Sirakaya & Woodside (2004)
Theory of Self Efficacy (Bandura, 1977)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014)
Theory of Structuration (Giddens, 1984)	Darnton (2008); Jackson (2005)
Theory of Triadic influence (Flay, 1994)	Davis et al. (2014)
Theory U (Scharmer, 2007)	Brennan et al. (2014); Darnton (2008)
Transcontextual model of Motivation (Hagger, 2003)	Davis et al. (2014)
Transtheoretical Model of Health Behaviour Change ('Stages of Change' Model) (Prochaska and Di Clemente, 1983)	Brennan et al. (2014); Carvalho & Mazzon, 2013); Darnton (2008); Davis et al. (2014)
Tripartite model (Snitow & Brennan, 2009)	Brennan et al. (2014)
UNIDO model of corporate social responsibility	Brennan et al. (2014)
Value-Belief-Norm (VBN)/ attitude-behaviour-context (ABC) (Stern)	Brennan et al. (2014); Darnton (2008); Davis et al. (2014); Jackson (2005)
VANES model of behaviour change	Brennan et al. (2014)
Wheel of wellness model (Myers et al., 2000)	Brennan et al. (2014)

Table B1. List of theories and models based on the literature review in section 2.2

Appendix C | Further reflection on the stages of the divestment model

Referred to in Chapter 6.

The stages of divestment found in literature in Chapter 5 can be recognized in the design projects in Chapter 6. A comparison of the stages of divestment is made in Table C1.

Table C1 includes one extra design project that was not included in the paper (i.e. Timmerman, 2019). Master student Hanna Timmerman also received the same graduation project brief as Mertens, Polat and Ren, however she did not create a solution for a valuable divestment experience for users. Timmerman (2019) developed a tool for designers to support them in understanding the divestment process and design solutions for it.

Most of the stages found in literature could be recognized in the empirical studies.

Even though the stages were not all explicitly named in the DRS workshop, several stages of the decision process and activities were mentioned by participants in the team pitches and break up letters. The different events such as break or attractive potential replacement sparking the process on the decision of ending the use cycle could be identified. Multiple options for disposition (e.g. donation, drawer, hand-over, selling for components, or trade-in) were discussed during the brainstorming and could be seen as options considered during the decision of the divestment option. The factors stimulating or postponing the decisions to end the use cycle and which disposition option to choose from were considered. Several practices prepare the final act of disposition through for example a decluttering process, reincarnation and a goodbye ceremony. The final act of disposition of the current product and the replacement product are interconnected according to some break up letters. Some post-disposition evaluation like a feeling of guilt or relief were also discussed.

Although not bundled in one single model of divestment, several stages of divestment could be identified in Mertens work (Mertens, 2018). The two first stages were not explicitly mentioned in Mertens' conceptualisation. However, the preparation stage was studied in details by elaborating how users could back up their data, transfer it to their replacement device and finally erase it from the old device. Then the final act of disposition stage followed when users return the device.

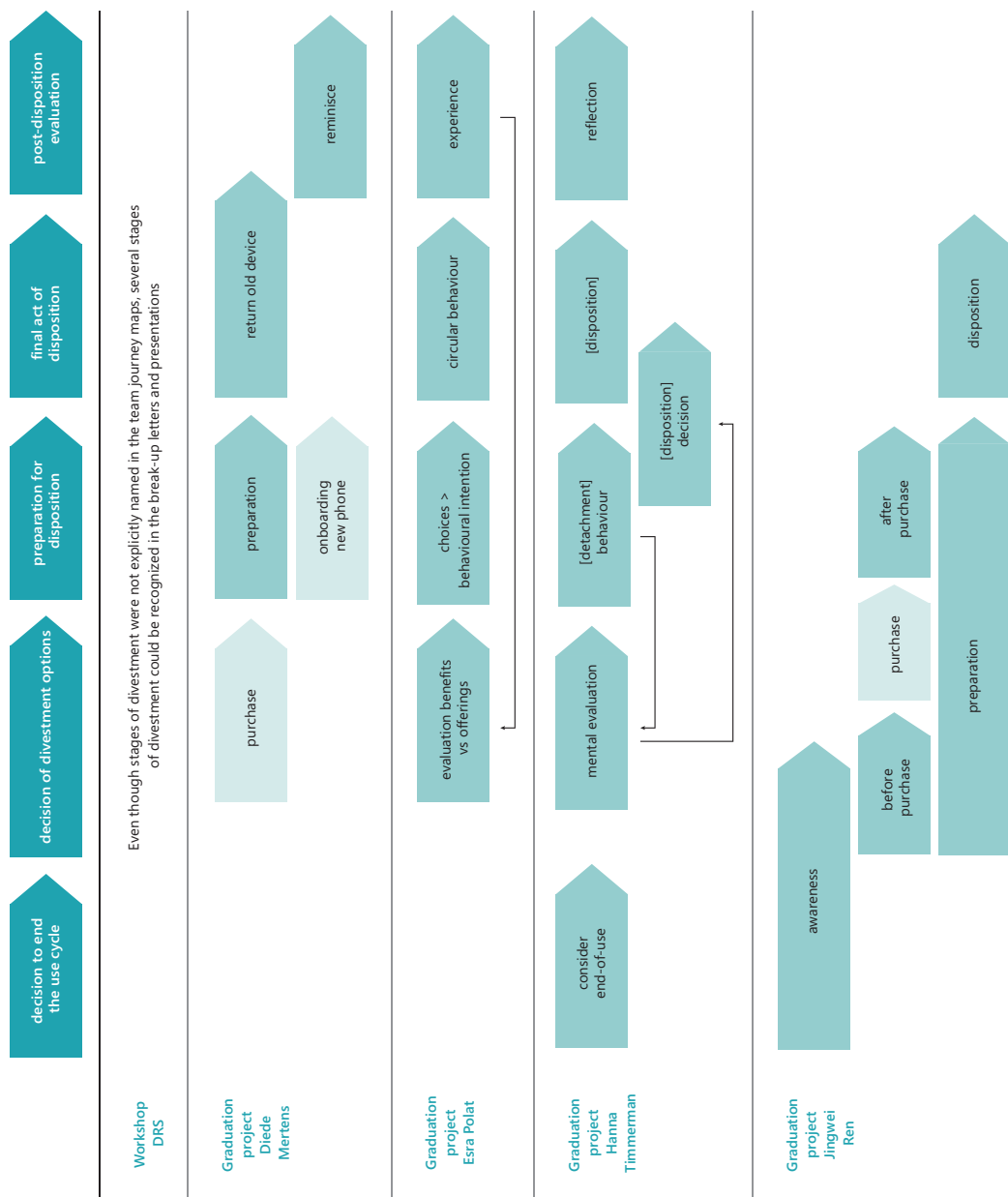


Table C1. Overview of divestment stages identified in the empirical studies

The post-disposition evaluation of this return was considered through the received reward and the reminiscing of the times using the previous phone by

scrolling through memories made during that period of use.

Polat based her conceptual model of divestment on the Theory of Planned Behaviour by Fishbein & Ajzen (1985) (Polat, 2018, p. 47). The first stage was not mentioned in her conceptual model. However, the decision of the divestment option is considered in detail: first the benefits and offerings are evaluated by the users resulting in the users' perceived value and an actual choice of which circular disposition option to use (i.e., 'behavioural intention'). The 'circular behaviour' is then expressed during the final act of disposition stage. The 'experience' of this process later feeds into a next decision process (i.e., post-disposition evaluation) including shared group benefits.

Timmerman explicitly approached the divestment experience from the design research perspective and focused on modelling the consumer divestment process. She defined six stages of her Framework of Detachment (Timmerman, 2018, p. 129) (comparable to this paper's term 'divestment'): first, the dispossession process (comparable to this paper's term 'detachment') including (1) consider end-of-use and (2) mental evaluation of the product (i.e., decision of ending the use cycle), (3) dispossession behaviours to sooth separation anxiety such as cleaning (i.e., preparation for disposition), and (4) decision making (comparable to this paper's term 'disposition') (i.e., combination of the decision of endings the use cycle and the decision of the divestment option); followed by (5) the separation (i.e., final act of disposition), and (6) reflection on the success of the divestment (i.e., post-disposition evaluation). Reminiscing post-disposition opportunities are specifically relevant because both Timmerman and Polat identified that lingering values of the devices pushes users to keep their device longer or store it without use.

Ren considered all the stages identified in literature to some extent in his customer journey map (Ren, 2018, p. 58). The consultation done during Ren's stage of 'awareness' (i.e., during which the user explores whether a phone can be repaired or when a new phone is released) is included in the stages of the decision of ending the use cycle and the decision of the divestment option. His stage of 'before purchase' (e.g. going to stores and researching second hand replacement phones) represent the search focusing on the decision of ending the use cycle. Ren's stage of purchase is left out of considerable as it does not handle divestment. Stages of 'after purchase' and 'trade-in preparation' and 'trade-in' all fit in the final act of disposition stage. The 'trade-in' stage also considers the post-disposition evaluation of for example reward.

Most of the empirical studies established a connection between the

divestment stages and the parallel replacement purchase stages. On top of this, several feedback loops were noted within the divestment stages (e.g. Timmerman's detachment behaviours influencing the mental evaluation).

This comparison permitted to show that the stages identified from the marketing (i.e., Roster (2001)), consumer economics (i.e., Cruz-Cárdenas and Patricio Arévalo-Chávez (2017)) and business administration (i.e., Hanson (1980)) literature can also be recognized in design projects.

Samenvatting

Het probleem

De circulaire economie (CE) biedt een veelbelovende benadering om de negatieve impact van de productie en consumptie van elektronische en elektrische apparatuur op het milieu, de economie en de menselijke gezondheid te verzachten. Voor een succesvolle overgang naar een CE is het essentieel dat producten aan het einde van hun gebruik worden ingeleverd voor hergebruik, reconditionering, herfabricage en/of recycling. Met andere woorden, producten moeten terug in de kringloop komen met minimaal verlies van waarde en bruikbaarheid. Voor mobiele telefoons in de business-to-consumer (B2C) markt wordt de overgang echter bemoeilijkt door gebruikers die hun toestel vaak in lades opbergen of na gebruik zelfs weggooien. Na twee tot drie jaar gemiddeld gebruik (Manhart et al., 2016), werd bijvoorbeeld in het VK meer dan de helft van de vervangen mobiele telefoons bewaard door hun eigenaren (Wilson et al., 2017). Telefoons bleven twee keer zo lang in laden dan dat ze aanvankelijk in gebruik waren (Wilson et al., 2017). In Frankrijk blijven naar schatting 54 tot 113 miljoen telefoons ongebruikt in de huizen van hun eigenaren (Rochat et al., 2019).

Het hoofddoel van dit onderzoek

Om een minimaal verlies van waarde en bruikbaarheid te garanderen, is het essentieel dat producten terug in het systeem komen. Vanuit het oogpunt van bedrijven moeten de inzamelingspercentages worden verbeterd en moet het aantal producten dat door gebruikers wordt bewaard, worden verminderd. Dit betekent dat gebruikers moeten worden gestimuleerd om hun producten tijdig en in zo goed mogelijke staat in te leveren. Dit proefschrift richt zich op het sluiten van de kringloop van mobiele telefoons vanuit de gebruiker. Het hoofddoel van dit onderzoek is het vinden van mogelijke oplossingen om het inleveren van mobiele telefoons na gebruik te verhogen en zo een overgang naar een CE te bevorderen.

Dit onderzoek behandelt twee vormen van consumptie om het inleveren van mobiele telefoons te bereiken: (A) het contractueel inleveren aan het einde van het contract bij *op toegang gebaseerde consumptie (access-based consumption)*, en (B) vrijwillig inleveren na gebruik bij *op eigendom gebaseerde consumptie (ownership-based consumption)*. Bij op toegang gebaseerde consumptie is de gebruiker geen wettelijke eigenaar van het product en moet deze voldoen aan de contractvereisten voor het inleveren van het apparaat na gebruik. Bij op eigendom gebaseerde consumptie wordt het wettelijke eigendom van het product overgedragen aan de gebruiker, die vervolgens het lot van het product kan bepalen.

Onderzoeksopzet

Dit onderzoek wordt geleid door het onderzoeksparadigma constructivisme, abductief redeneren en kwalitatieve methoden. Aangezien sociale verandering begint bij het individu, werd de individuele gebruiker aangewezen als hoofdacteur om de beoogde gedragsverandering te benaderen (versus een collectief niveau of andere belanghebbenden). Het Consumer Decision Process (CDP)-model van Blackwell et al. (2006) werd geselecteerd als de basis van het conceptuele model voor dit onderzoek om de concepten, relaties en actoren te structureren die relevant worden geacht voor het bereiken van de doelstelling. Het nieuwe conceptuele model bouwt voort op dit CDP-model en biedt verdere details op basis van literatuur en empirische studies om onderzoeksvraag OV1 te beantwoorden.

Het eerste deel van dit proefschrift focust op de acceptatie van op toegang gebaseerde consumptie. Het beantwoordt OV2 door middel van systematische literatuuronderzoeken en diepgaande semigestructureerde interviews.

Het tweede deel van dit proefschrift heeft betrekking op het vrijwillig inleveren van apparaten bij op eigendom gebaseerde consumptie. Dit deel beantwoordt aan OV3 door middel van literatuuronderzoeken en volgt een Research through Design (RtD) -benadering om nieuwe kennis te genereren rondom afdanken voor ontwerpers en onderzoekers.

Belangrijkste bevindingen: Het contractueel inleveren aan het einde van het contract bij op toegang gebaseerde consumptie

Vanuit een CE-perspectief lijkt op toegang gebaseerde consumptie een interessante weg om te verkennen. In deze consumptiemodus blijft het wettelijke eigendom van een product in handen van de dienstverlener, die het gebruiksrecht van een fysiek product voor een beperkte periode verkoopt (bijv. door middel van lease of pay-per-use). Door op deze manier de controle over hun producten te behouden, kunnen bedrijven zorgen voor gesloten kringlopen en zorgen voor een gestage stroom gebruikte producten die kunnen worden hergebruikt, gereconditioneerd, gereviseerd en/of gerecycled. Desalniettemin is de acceptatie van op toegang gebaseerde consumptie beperkt, aangezien op eigendom gebaseerde consumptie de dominante consumptiemethode blijft.

OV1: Welk conceptueel model kan worden gebruikt om de interactie tussen gebruikers, mobiele telefoons en dienstverleners te begrijpen voor zowel (A) de acceptatie van op toegang gebaseerde consumptie als (B) het inleveren van mobiele telefoons bij op eigendom gebaseerde consumptie?

OV2: Welke ontwerpinterventies zouden gebruikers in staat kunnen stellen om toegang tot mobiele telefoons te accepteren in plaats van ze te bezitten?

OV3: Welke ontwerpinterventies zouden gebruikers ertoe kunnen brengen hun mobiele telefoons af te danken en deze vrijwillig in te leveren?

Om het gebrek aan acceptatie aan te pakken, werden factoren onderzocht die van invloed waren op de afwijzing van toegangsdiensten voor mobiele telefoons op basis van interviews met adopters en niet-adopters. Deze bevindingen werden vervolgens vergeleken met die van toegangsdiensten voor auto's om verbeterpunten te identificeren. Tijdens de adoptiefase (dat wil zeggen, tot de aanschaf van de dienst op basis van verwachtingen) waren de factoren die leidden tot de afwijzing van

smartphonetoegangsdiensten als volgt: de onbekendheid van de diensten, het waargenomen slechte imago van de dienstverlener, de onbevredigende compensatie voor het opofferen van bezit, zorgen over duurzaamheid en de gewoonte om producten te bezitten. Tijdens de acceptatiefase (dat wil zeggen, na de aanschaf van de dienst op basis van feitelijke ervaringen met de diensten), belemmerden factoren zoals het verkeerd begrijpen van de toegangsdienst, de waargenomen wurggreep van de dienstverlener en de waargenomen ondermaatse dienst door de dienstverlener de acceptatie van de dienst.

Er is een sociale en business logic verandering nodig om over te stappen van de industriële uitwisselingslogica van waardecreatie waarbij fabrikanten waarde creëren en hun klanten deze tijdens gebruik vernietigen, naar een nieuwe logica van co-creatie waarbij alle belanghebbenden bijdragen aan waardecreatie. De interviews met toegangsdiensten voor auto's toonden de noodzaak aan voor dienstverleners om vertrouwen te wekken door verwachte risico's en onzekerheden te verlagen, risico's en pijnpunten van eigendom over te nemen met een allesomvattende service en in te gaan op het onderbuikgevoel van gebruikers (versus rationele besluitvorming). Op basis van deze inzichten zijn ontwerpinterventies die de adoptie en acceptatie van toegangsdiensten voor smartphones stimuleren geïdentificeerd. Zo zou heldere en homogene communicatie misverstanden en negatieve repercussies tijdens de gebruiks- en afdankfasen kunnen helpen voorkomen. Door de pijnpunten van eigendom over te nemen met behoud van het plezier, kan voor gebruikers een gewenste ervaring worden gecreëerd. Speciale aandacht moet worden besteed aan het ontwikkelen van een zorgeloos reparatieproces.

Belangrijkste bevindingen: Het vrijwillig inleveren na gebruik bij op eigendom gebaseerde consumptie door middel van afdanken

Hoewel op toegang gebaseerde consumptie in opkomst is op de B2C-markt, is het bezitten van een product nog steeds de dominante vorm van consumptie. Bij op eigendom gebaseerde consumptie zijn gebruikers niet contractueel verplicht om hun mobiele telefoon na gebruik in te leveren. Het product is van hen en ze hebben het recht om ermee te doen wat ze willen. Zoals eerder geïllustreerd, zijn de inzamelpercentages van mobiele telefoons relatief laag, ondanks de vele inzamelingsopties (bijv. gemeentelijke afvalinzameling, inruilprogramma's of donaties aan goede doelen).

De verkenning van hoe het inleveren van deze producten na gebruik kan worden gestimuleerd, begon met het bestuderen van de literatuur om een beter begrip te krijgen

van het concept van afdanken voor ontwerpers en onderzoekers. De term 'afdanken' verwijst naar de laatste fase van de consumptiecyclus na de aanschaf- en de gebruiksfase. Afdanken is de combinatie van het 'disposition process' waarbij de gebruiker zich fysiek van het product scheidt, en het 'detachment process', waarbij de gebruiker zich mentaal en emotioneel van het product scheidt. Ondanks het belang voor een CE, krijgt afdanken weinig aandacht in vergelijking met de aanschaf- en gebruiksfase. Om deze onbalans te verhelpen, werd de afdankfase gestructureerd in zes verschillende fasen. (1) Er is sprake van een dilemma wanneer de gebruiker overweegt het product in de huidige gebruikscyclus te houden of juist de gebruikscyclus te beëindigen. (2) De gebruiker begint te zoeken naar afdankopties (d.w.z. een manier om zich van het product te scheiden). (3) Deze afdankopties worden gewogen volgens de behoeftes en wensen van de gebruiker en een afdank-intentie wordt geformuleerd. (4) De gebruiker bereidt zichzelf en het product voor op de scheiding zowel op fysiek als op mentaal/emotioneel vlak. (5) Wanneer de gebruiker zover is, acteert zij/hij op de afdank-intentie door fysiek te scheiden van het product via de gekozen afdankoptie. (6) De fysieke scheiding resulteert in verschillende objectieve en subjectieve uitkomsten.

Talrijke factoren die van invloed waren op de stadia van afdanken, werden in de literatuur gevonden. Er kunnen verschillende parallellen worden getrokken met eerdere bevindingen over de acceptatie van toegangsdiensten. Gebruikers zijn bijvoorbeeld ook niet op de hoogte van en zijn niet bekend met afdankopties voor mobiele telefoons, zoals inruilprogramma's. Gebruikers weten niet zeker wat ze met hun ongebruikte apparaten moeten doen en wat er met hun producten (en gegevens) gebeurt wanneer ze worden ingeleverd. Bovendien kunnen gebruikers niet genoeg geprikkeld worden door de vergoeding die in ruil voor het product wordt geboden. De waargenomen inspanning om de apparaten in te leveren via de inzamelingsopties draagt niet positief bij aan de inzamelingspercentages. Daarbij, hier weer, lijken gebruikers vast te zitten in een gewoonte; ze hebben de gewoonte om passief het besluitvormingsproces van afdanken te doorlopen, wat ertoe leidt dat het leeuwendeel van de mobiele telefoons in de lades belandt.

Om het gebrek aan designliteratuur over het onderwerp afdanken vanuit het perspectief van gebruikers aan te pakken, werd een Research through Design (RtD) -benadering gehanteerd. Zo zijn zeven projecten met ontwerpprofessionals en studenten over het ontwerp van een afdankervaring voor smartphones bestudeerd. De empirische studies concentreerden zich op welke factoren werden overwogen tijdens het maken van ontwerpinterventies, en ook op welke ontwerpinzichten en ontwerpprincipes daaruit konden worden afgeleid. Uit de literatuur en empirische studies kwamen verschillende patronen naar voren. Deze ontwerpinzichten werden samengevat in een voorstel van tien afdankontwerpprincipes om ontwerpers en onderzoekers te helpen bij het creëren van oplossingen voor een waardevollere en gewaardeerde afdankervaring. De ontwerpprincipes zijn weergegeven in figuur A1.



Figuur A1. Voorstel van ontwerpprincipes voor het afdanken van mobiele telefoons

Bijdragen aan de wetenschap en de praktijk

Om mogelijke oplossingen te vinden om het inzamelpercentage van mobiele telefoons na gebruik te verhogen, heeft dit onderzoek gedragswetenschap en design research samengebracht door de gebruikerskant van Design for Circular Economy te benadrukken en kennis over afdanken te brengen in design research.

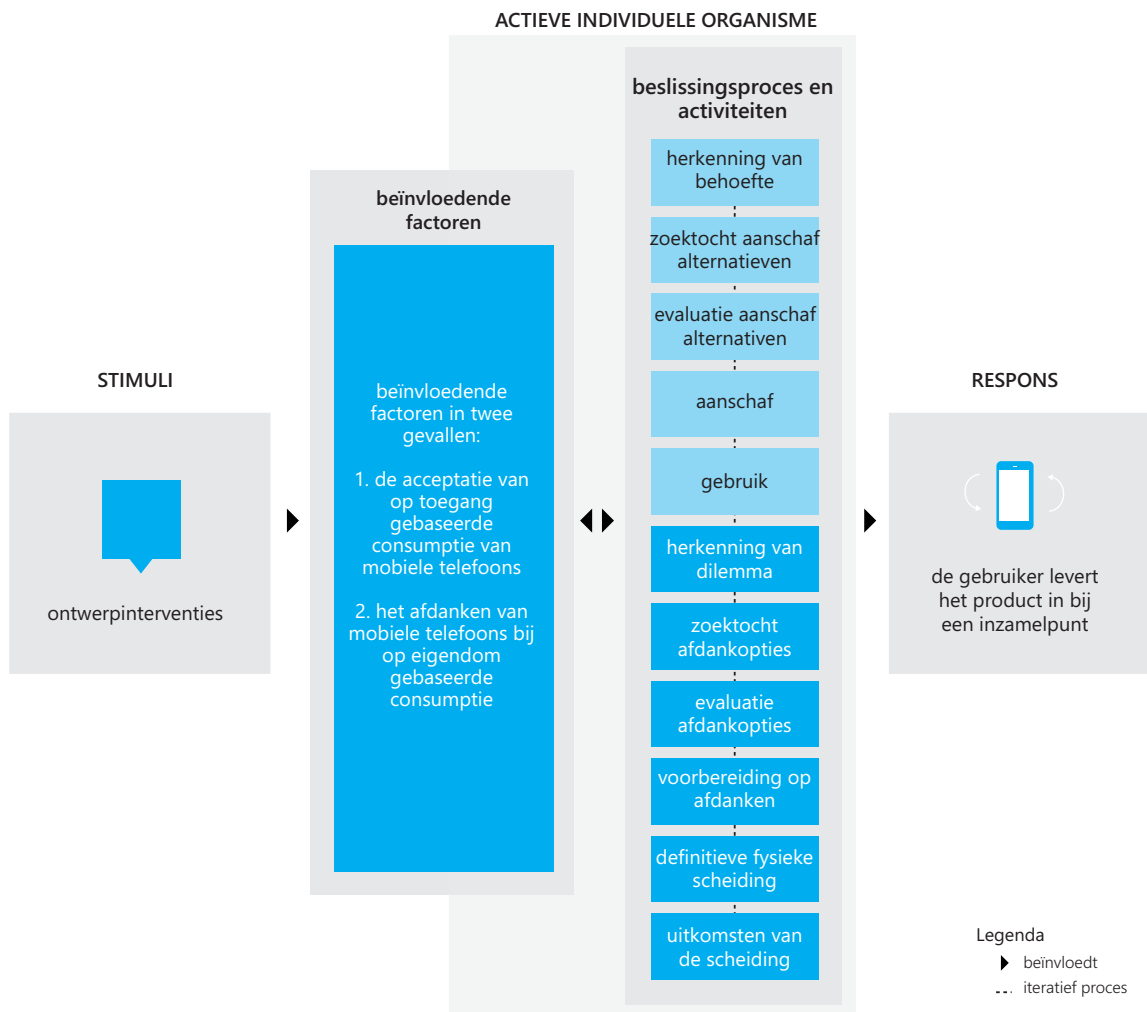
Tijdens het onderzoeksproces werd het conceptuele model verrijkt op basis van de inzichten uit de literatuur en empirische studies. Dit wordt weergegeven in figuur A2. Het uiteindelijke conceptuele model geeft een passend beeld van het gebruikersgedrag met betrekking tot het inleveren van mobiele telefoons. Omdat het besluitvormingsproces zelf niet lineair is, is het procesmodel iteratief en geeft het de situatie weer nadat deze zich heeft voorgedaan.

OV1

Om de acceptatie van op toegang gebaseerde consumptie te verbeteren, werden toegangsdiensten voor mobiele telefoons onderzocht vanuit gebruikers door middel van een veldonderzoek. Het droeg bij aan het onderzoeksveld van op toegang gebaseerde consumptie door beïnvloedende factoren en ontwerpinterventies te identificeren om de acceptatie van diensten voor smartphones te verbeteren. Aangezien deze manier van consumeren nog in de kinderschoenen staat, ondersteunen deze bevindingen de praktijk bij de ontwikkeling van toegangsdiensten.

Om de inzamelpercentages bij op eigendom gebaseerde consumptie te verhogen, werd het gebrek aan aandacht voor de laatste fase van de consumptiecyclus - namelijk het afdanken - aangepakt. Het nieuwe onderzoeksgebied Design for Divestment (ontwerpen voor afdanken) werd verkend met de nog steeds formaliserende benadering van Research through Design (RtD). Het onderzoek heeft wetenschappelijk bijgedragen door een beter begrip van afdanken te geven, door het inleveren van mobiele telefoons na gebruik te

bestuderen. In dit proefschrift werd het concept van afdanken in het ontwerp gedefinieerd, werd de afdankfase in zes stappen gestructureerd, werden inzichten van ontwerpprojecten over ervaringen met het afdanken van smartphones verschaft en werden ontwerpprincipes voor het afdanken voorgesteld. Naast de wetenschappelijke bijdragen laat deze nieuwe Design for Divestment -kennis praktijkmensen zien hoe het gebruikersperspectief kan worden overwogen (in plaats van alleen te focussen op de technologische en zakelijke aspecten) om de inzameling van producten te verbeteren.



Figuur A2. Conceptueel model gebruikt voor dit onderzoek (gebaseerd op het CDP-model van Blackwell et al., 2006).

Résumé

La problématique

L'économie circulaire (EC) offre une approche prometteuse pour atténuer l'impact négatif de la production et de la consommation d'équipements électriques et électroniques sur l'environnement, l'économie et la santé humaine. Pour une transition réussie vers une EC, il est essentiel que les produits soient retournés dans le système à leur fin d'utilisation pour être réutilisés, reconditionnés et/ou recyclés. En d'autres termes, les produits doivent être réintroduits dans l'économie avec une perte minimale de valeur et d'utilité. Cependant, dans le cas des téléphones portables sur le marché business-to-consumer (B2C), la transition est entravée par les utilisateurs qui stockent souvent leurs appareils dans des tiroirs ou même les jettent après les avoir remplacés. Par exemple, au Royaume-Uni, plus de la moitié des téléphones portables remplacés sont restés inutilisés par leurs propriétaires (Wilson et al., 2017), s'empilant après deux à trois ans d'utilisation moyenne (Manhart et al., 2016). Les téléphones ont été conservés deux fois plus longtemps dans les tiroirs qu'ils n'étaient utilisés (Wilson et al., 2017). En France, entre 54 et 113 millions de téléphones au total seraient laissés inutilisés chez leurs propriétaires (Rochat et al., 2019).

L'objectif principal de cette recherche

Pour garantir une perte minimale de valeur et d'utilité, il est important que les produits réintègrent le système. Du point de vue des entreprises, les taux de collecte devraient être améliorés et le nombre de produits conservés par les utilisateurs devrait être réduit. Du point de vue des utilisateurs, les utilisateurs doivent être encouragés à retourner leurs produits en temps opportun dans le plus bon état possible. Cette thèse se concentre sur la fermeture de la boucle pour les téléphones portables du point de vue de l'utilisateur. L'objectif principal de cette recherche doctorale est de trouver des solutions potentielles pour augmenter le retour des téléphones portables après utilisation afin de favoriser une transition vers une EC.

Cette thèse aborde deux modes de consommation pour parvenir au retour des téléphones portables: (A) le retour contractuel à la fin du contrat dans le cas de consommation basée sur l'accès de produits, et (B) le retour volontaire après utilisation dans le cas de consommation basée sur la propriété de produits. Dans la consommation basée sur l'accès, l'utilisateur n'a pas la propriété légale du produit et doit se conformer aux exigences du contrat en retournant l'appareil après utilisation. Dans la consommation basée sur la propriété, la propriété légale du produit est transférée à l'utilisateur, qui peut alors contrôler son destin.

Plan de recherche

Cette recherche doctorale est guidée par le constructivisme, le raisonnement abductif et des méthodes qualitatives. Comme le changement social commence avec l'individu, l'utilisateur individuel a été désigné comme agent pour aborder le changement envisagé du comportement de l'utilisateur (plutôt que d'aborder ce sujet à un niveau collectif). Le modèle du Consumer Decision Process (CDP) de Blackwell et al. (2006) a été choisi comme base du modèle conceptuel de cette recherche pour structurer les concepts, les relations et les acteurs jugés pertinents. Le nouveau modèle conceptuel s'appuie sur ce modèle du CDP et fournit des détails supplémentaires basés sur la littérature et des études empiriques pour répondre à la question de recherche QR1.

QR1: Quel modèle conceptuel pourrait être utilisé pour comprendre l'interaction entre les utilisateurs, les téléphones portables et les fournisseurs à la fois pour (A) l'acceptation de la consommation basée sur l'accès et (B) le retour des téléphones dans la consommation basée sur la propriété?

QR2: Quelles interventions de design pourraient permettre aux utilisateurs d'accepter d'accéder aux téléphones portables au lieu de les posséder?

QR3: Quelles interventions de design pourraient inciter les utilisateurs à se départir de leurs téléphones portables et à les retourner volontairement?

La première partie de cette thèse de doctorat se concentre sur l'acceptation de la consommation basée sur l'accès. Elle répond à QR2 par des revues systématiques de la littérature scientifique et des entretiens semi-structurés approfondis.

La deuxième partie concerne le retour volontaire des appareils dans le cas de la consommation basée sur la propriété. Cette partie répond à QR3 par le biais de revues de la littérature scientifique et adopte une approche de Research through design (RtD) pour générer de nouvelles connaissances sur le concept de *divestment* pour les designers et les chercheurs.

Principaux résultats: Le retour contractuel en fin de contrat dans le cas de la consommation basée sur l'accès

Du point de vue de l'EC, la consommation basée sur l'accès semble être une piste intéressante à explorer. Dans ce mode de consommation, la propriété légale d'un produit reste entre les mains du prestataire de services, qui vend le droit d'utilisation d'un produit physique pendant une période limitée (par exemple, par le biais de la location ou du pay-per-use). En conservant le contrôle de leurs produits de cette manière, les entreprises pourraient garantir des boucles bouclées et garantir un flux constant de produits usagés à réutiliser, reconditionner et/ou recycler. Néanmoins, l'acceptation de la consommation basée sur l'accès est limitée car la consommation basée sur la propriété reste le mode de consommation dominant.

Pour remédier au manque d'acceptation, les facteurs influençant le rejet des

services d'accès pour les téléphones portables ont été explorés sur la base d'entretiens avec des adoptants et des non-adoptants. Ces résultats ont ensuite été comparés à ceux des services d'accès de voiture pour identifier les domaines à améliorer. Lors de la phase d'adoption (c'est-à-dire jusqu'à l'achat du service, donc basée sur des attentes), les facteurs conduisant au rejet des services d'accès de smartphone ont été : la méconnaissance de ces services encore inhabituels, la mauvaise image du prestataire, la compensation

QR2

insatisfaisante pour le sacrifice de la possession du produit, les soucis de durabilité et l'habitude innée de posséder des choses. Pendant la phase d'acceptation (c'est-à-dire après l'achat du service, donc basée sur l'expérience des services), des facteurs tels que la mauvaise compréhension du service d'accès, la mainmise perçue du fournisseur de services et le service perçu comme médiocre ont entravé l'acceptation .

Un changement de logique sociale et des affaires est nécessaire pour passer d'une logique d'échange industriel de création de valeur où les industriels créent de la valeur que leurs clients détruisent lors de la consommation, à une nouvelle logique de co-crédation où tous les acteurs contribuent à la création de valeur. Les entretiens concernant les services d'accès de voitures ont démontré la nécessité pour les prestataires de services de susciter la confiance en réduisant les risques et les incertitudes attendus, de prendre en charge les risques et les problèmes de propriété avec un service tout compris et de tirer parti de l'intuition des utilisateurs (par rapport à une prise de décision rationnelle). Sur la base de ces informations, les interventions de design incitant à l'adoption et à l'acceptation des services d'accès pour les smartphones comprendraient une communication claire et homogène pour éviter les malentendus et les répercussions négatives pendant les phases d'utilisation et de *divestment*. En reprenant les problématiques propres à la propriété tout en conservant son plaisir, une expérience souhaitable pourrait être créée pour les utilisateurs. Une attention particulière doit être accordée au développement d'une procédure de réparation sans soucis.

Principaux résultats: Le retour volontaire par *divestment* après utilisation dans le cas de la consommation basée sur la propriété

Même si la consommation basée sur l'accès émerge sur le marché B2C, posséder un produit reste la manière dominante d'utiliser un produit. Dans le cas de la consommation basée sur la propriété, les utilisateurs ne sont pas contractuellement tenus de rendre leur téléphone portable après utilisation. Le produit leur appartient et ils ont le droit d'en faire ce qu'ils veulent. Comme illustré ci-dessus, les taux de retour des téléphones portables sont relativement faibles malgré la gamme d'options de retour (par exemple, les sites de collecte des déchets municipaux, les programmes de reprise ou les dons à des œuvres caritatives).

L'exploration des façons de stimuler le retour de ces produits après leur utilisation a commencé par l'analyse de publications scientifiques afin de créer une meilleure

compréhension du concept de *divestment* pour les designers et chercheurs. Le terme *divestment* désigne la phase finale du cycle de consommation, intervenant après les phases d'achat et d'utilisation. Le *divestment* est la combinaison du processus de disposition au cours duquel l'utilisateur se sépare physiquement du produit et du processus de détachement, au cours duquel l'utilisateur se sépare mentalement et émotionnellement du produit. Malgré son importance pour une EC, le concept de *divestment* reçoit peu d'attention par rapport aux phases d'achat et d'utilisation. Pour y remédier, la phase de *divestment* a été structurée en six étapes distinctes. (1) La reconnaissance du dilemme se produit lorsque l'utilisateur envisage de remplacer le produit, de mettre fin à son cycle d'utilisation ou de garder le produit en utilisation. (2) L'utilisateur commence à rechercher des options de *divestment* (c'est-à-dire un moyen de se séparer du produit). (3) Ces options de *divestment* sont évaluées et l'utilisateur en choisit une à poursuivre. (4) Le produit et l'utilisateur sont préparés pour la séparation. (5) L'utilisateur agit sur son intention de *divestment* en effectuant l'acte final de disposition, en se séparant physiquement avec le produit via l'option de *divestment* choisie. (6) L'utilisateur se retrouve avec les résultats des actions entreprises au cours des étapes précédentes.

De nombreux facteurs influençant les étapes du *divestment* ont été recueillis dans des publications scientifiques. Plusieurs parallèles pourraient être établis avec les conclusions précédentes sur l'acceptation des services d'accès. Par exemple, les utilisateurs ne sont pas familiers avec les options de *divestment* spécifiques aux téléphones portables, telles que les programmes de reprise. Les utilisateurs ne savent que faire de leurs appareils inutilisés et ce qu'il advient de leurs produits (et données) lorsqu'ils sont retournés.

QR3

De plus, les utilisateurs ne sont pas suffisamment stimulés par la compensation offerte en échange du produit (par exemple, une remise ou le sentiment de faire une bonne action). L'effort perçu pour retourner les appareils via les options de retour ne contribue pas positivement aux taux de retour. Enfin, là encore, les utilisateurs semblent emprisonnés dans une habitude. Ils ont l'habitude de suivre passivement le processus de décision de *divestment*, ce qui conduit à ce que la majorité des téléphones portables se retrouve dans les tiroirs.

Pour remédier au manque de littérature scientifique sur le design sur le thème du *divestment* du point de vue de l'utilisateur, une approche de Research through Design (RtD) a été adoptée. Sept projets de conception d'expériences de *divestment* pour smartphones ont par conséquent été conduits avec des professionnels du design et des étudiants. Les études empiriques se sont concentrées sur les facteurs pris en compte lors de la création des interventions, ainsi que sur les idées et principes de conception qui pourraient en découler. Plusieurs motifs ont émergé des publications scientifiques et des études empiriques. Ceci résulte dans une suggestion de dix principes de Design for *Divestment* pour aider les designers et les chercheurs en design à créer des solutions pour une expérience de *divestment* plus valorisée et prisée. Les principes sont illustrés dans

figure S1.

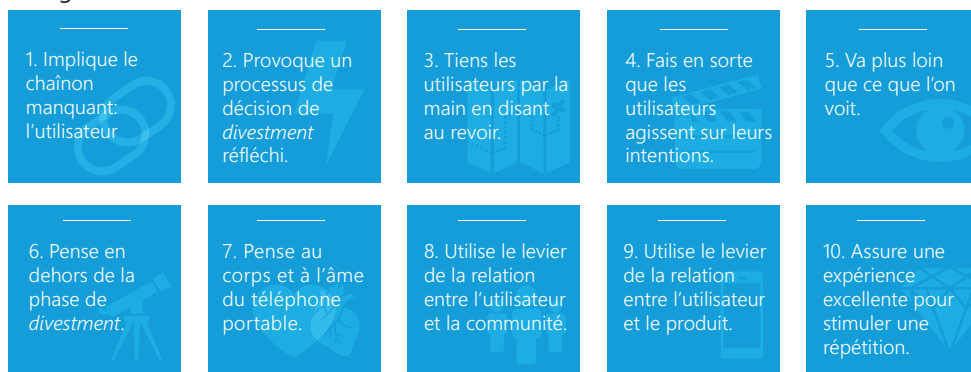


Figure S1. Proposition de principes Design for Divestment pour téléphones portables

Contributions à la science et à la pratique

Pour trouver des solutions potentielles pour augmenter le retour des téléphones portables après utilisation, cette recherche doctorale a réuni la science du comportement et la recherche en design en mettant l'accent sur le point de vue de l'utilisateur dans le Design pour l'Économie Circulaire et en intégrant les connaissances de *divestment* dans la recherche en design.

Tout au long de la recherche, le modèle conceptuel a été enrichi des connaissances venant de publications scientifiques et des études empiriques. Ceci est présenté dans la figure S2. Le modèle conceptuel qui en résulte conceptualise convenablement le comportement des utilisateurs lors de retour des téléphones portables. Comme le procédé de décision lui-même n'est pas linéaire, le modèle du procédé est itératif et représente la situation une fois qu'elle s'est produite.

QR1

Pour améliorer l'acceptation de la consommation basée sur l'accès, les services d'accès pour les téléphones portables ont été explorés du point de vue de l'utilisateur à travers une étude de terrain approfondie. Elle a contribué au corpus d'œuvres sur la consommation basée sur l'accès pour les smartphones en identifiant les facteurs d'influence et en concevant des interventions pour améliorer leur acceptation. Ce mode de consommation en étant encore à ses débuts, ces constats soutiennent la pratique dans le développement des services d'accès.

Pour augmenter les taux de collecte dans le cas de la consommation basée sur la propriété, le manque d'attention pour la dernière phase du cycle de consommation - notamment le *divestment* - a été rectifié. Le nouveau domaine de recherche du Design for Divestment a été exploré en utilisant l'approche toujours

formalisante de Research through Design (RtD). La recherche a contribué scientifiquement en apportant une meilleure compréhension du concept de *divestment* en étudiant le cas du retour du téléphone portable après utilisation. Cette thèse de doctorat a défini le concept de *divestment* dans le monde du design, a structuré la phase en six étapes, a fourni des nouvelles connaissances fondées sur le design d'expériences de *divestment* pour smartphones et a proposé des principes de Design for divestment. En plus des apports scientifiques, ces nouvelles connaissances sur le Design for divestment montrent aux designers comment le point de vue de l'utilisateur pourrait être pris en compte (au lieu de se concentrer uniquement sur les aspects technologiques et commerciaux) pour améliorer les taux de reprise des produits.

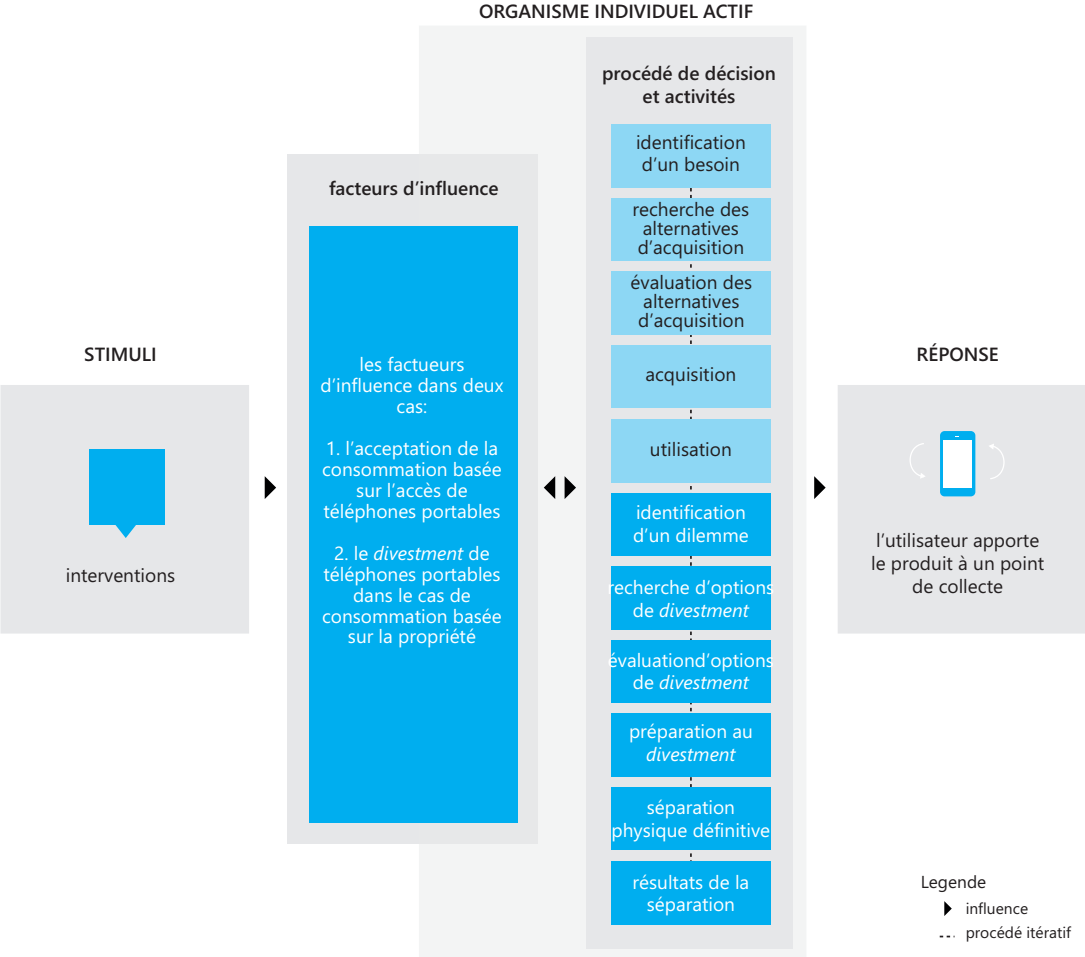


Figure S2. Modèle conceptuel utilisé pour la recherche doctorale (basé sur le modèle de CDP par Blackwell et al., 2006)

About the Author

Flora Poppelaars was born in Alphen aan den Rijn (the Netherlands) and grew up in France within a bilingual family. She moved back to the Netherlands to follow the Industrial Design Engineering bachelor programme and, later, the Integrated Product Design master programme at the Delft University of Technology. She nourished her strong affinity for sustainability with a semester at the Technical University of Denmark, courses from the Industrial Ecology master programme and specialised electives. Flora was admitted to the Honours Programme for which she researched the use of Ecodesign and Cradle-to-Cradle in product development. She was also selected to represent the TU Delft in the very first cohort of the Schmidt-MacArthur Fellowship organized by the Ellen MacArthur Foundation. For her master graduation project in collaboration with Vodafone, Flora studied the technological aspects of circular economy by developing a circular mobile phone and the system around it.

Fascinated by the tension between carefully engineered circular products and the lack of participation from users in closing the loop, Flora began her PhD research on how to get users involved in the transition towards a circular economy in the case of the return of mobile phones. She explored new fields of science, deepened her knowledge of social sciences, and dived into philosophy of science. Next to her research, Flora participated in the faculty's education, helped the organization of the PLATE conference held at the TU Delft in 2017, and shared her findings at various international events.

In parallel, she gained experience as a consulting researcher within a multidisciplinary team at a multinational. While finalizing her dissertation, she started as circular economy consultant at Partners for Innovation in Amsterdam (the Netherlands) advising and supporting companies, organizations and governmental agencies in their circular endeavours.

Next to her research, Flora enjoys roller derby, growing her 1m² garden, listening to all sorts of music, and learning about wine.

Publications

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Epilogue

The title of this dissertation 'Let it go' came both from the fact that users are keeping their mobile phones in their drawers without using them anymore, and from the notion that users could loosen their habit of owning products. It reflects the titles of the seminal work of Roster (2001) 'Letting go: The process and meaning of dispossession in the lives of consumers' and the dissertation by Glover (2012) 'Should it stay or should it go? Negotiating value and waste in the divestment of household objects'. However, it broadens the focus of "letting it go" from solely ownership-based consumption to also include access-based consumption. The phrase is addressed to everyone, as we are all users. The title is also a tribute to the amazing Disney song that appeared a year before the start of my Ph.D. research. It has been excessively blasted through my Gerrard Street headphones over these past years to the point that it became the soundtrack of these trying times.

I hope you felt taken by the hand through this dissertation. You now have a better understanding of the stakes of closing the loop from a user perspective. Regarding the contractual return of mobile phones, you received an overview of factors influencing the acceptance of access-based consumption and read how barriers could be overcome with a combination of design interventions. Concerning the voluntary return of mobile phones in ownership-based consumption, you have gained a clear overview of the concept of divestment and its stages, know the factors influencing them, and are better equipped to design product service systems for more effective divestment experiences.

I am curious to hear if and how this research has inspired you to think differently, to behave responsibly with your unused products and services, and to develop your own circular solutions.

To close this loop, share your valuable feedback with me:

let-it-go@protonmail.com

In a circular economy, the collection of devices is essential to enable reuse, refurbishment, remanufacturing and/or recycling at a system level. Yet, even though collection programmes are in place, users often store their mobile phones after use. This dissertation provides a better understanding of closing the loop from a user perspective in both access-based consumption and ownership-based consumption. It studies how to potentially enhance collection rates.

The research first results in a conceptual model conceptualizing the user behaviour regarding the return of mobile phones in these two consumption modes.

As the return of phones is contractual in access-based consumption, influencing factors and design interventions were identified to improve the user acceptance and support practitioners in the development of access services.

To increase the collection rates in ownership-based consumption (i.e., where the return is voluntary), the lack of attention for the last phase of the consumption cycle – called divestment – is addressed. This dissertation explores the new research field of design for divestment. It defines the concept of divestment in design, structures this phase in six stages, offers design insights on smartphone divestment experiences, and proposes design for divestment principles.