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Article

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

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**Abstract:** For the transition toward a circular economy, it is essential that products are returned for reuse, refurbishing or recycling. In order to address the lack of literature on the topic from a user perspective, this paper explores how users can be stimulated to return used smartphones. Taking a Research through Design approach, we developed a novel set of “design for divestment” principles. Divestment is the process users experience when separating from a product. After introducing a conceptual model of divestment based on an extension of the Consumer Decision Process model by Blackwell, Engel, and Miniard, we describe seven empirical studies (i.e., design projects) into smartphone divestment. The studies explore factors that influence a successful divestment process. We report on a highly complex process with interrelated factors changing over time. While it is impossible to define a blueprint for an ideal divestment process, several patterns emerged such as the need to emotionally support users, to give them confidence regarding data security, and to provide information at the right moment. These unique insights contribute to consumer research (i.e., circular consumption); and by translating the insights to ten design principles for divestment, a novel contribution is made to the field of design research.

**Keywords:** circular economy; consumer behaviour; collection; end of use; end-of-life; design for a circular economy; divestment; disposition; detachment; user

## 1. Introduction

The circular economy (CE) is a promising approach towards sustainable development [1,2]. 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 [3]. In other words, products are looped back into the economy with minimum loss of value [4]. While the recovery of used products has been extensively addressed from a business perspective (e.g., references [5–7]) and technical perspective (e.g., references [8–10]), the user perspective has been relatively underexplored [11,12]. 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 [13]. 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 Gregson, Metcalfe, and Crewe [14] and Glover [15], 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 1). Divestment is depicted here as the combination of disposition (i.e., physical separation) and detachment (i.e., mental and emotional separation of the product).

**Table 1.** Descriptions of divestment, disposition and detachment.

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

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., references [16–18]). 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., references [11,19–22]). Selvefors et al. (2019) distinguish between design for post-use, 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 and 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 [23].

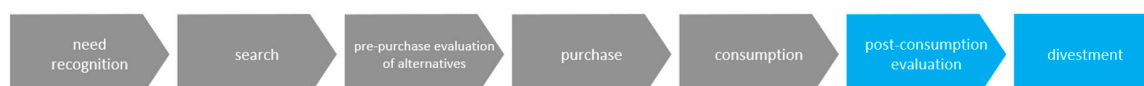
This study focuses on how the voluntary return of used smartphones can be stimulated in a product ownership context. Product ownership refers to a business model where the legal ownership of

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.

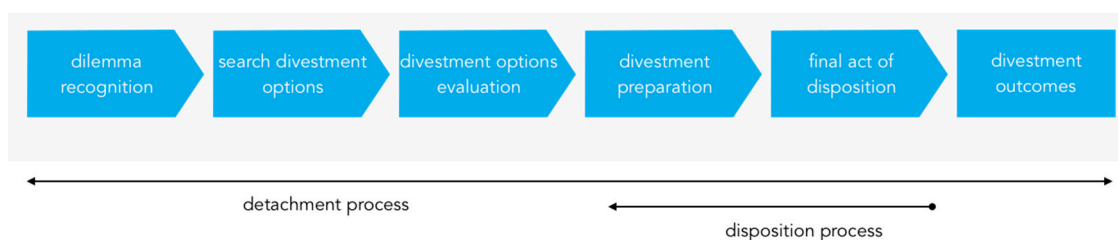
## 2. Background

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” [24]. It was originally introduced in 1968 and has evolved ever since. The most recent version of the model’s decision-making process [24] is visualized below in Figure 1. 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 1.** The decision-making process of the Consumer Decision Process (CDP) model by Blackwell et al. (2006) [24] 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., [24–27]), six stages were identified for the divestment phase (Figure 2). 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.



**Figure 2.** An analytical cognitive model of consumer behaviour for divestment based on [24–27].

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 [28]. 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 [25].

Following the stage of dilemma recognition, a search starts for “potential need satisfiers” [24] 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 [24]. 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" [25] 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.

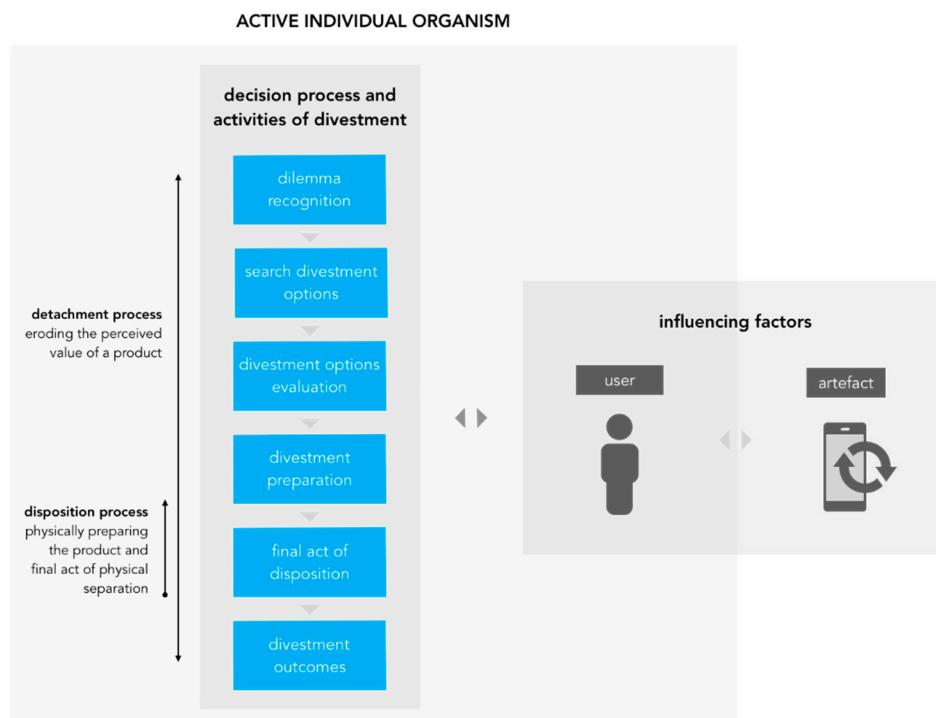
To help act on a divestment decision, the divestment preparation can "sooth" the detachment process, i.e., the process of mental and emotional separation [25]. Trial divestment (e.g., by storing it in a drawer), overexposure (e.g., forcing frequent confrontations), and cleaning (i.e., decontaminating 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" [29]. Gradual downgrading is adapted from "gradual garbaging" from Türe (2014) [29] 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 [30].

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 [31] and competences [29]), to that of the product service system (e.g., physical condition of the product [32], or perceived distance to the collection point [33]), the consumption context (e.g., moving [34] or a replacement opportunity [35]) and option-related factors (e.g., lack of awareness [36]). 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 3). Figure 3 shows the model of consumer behaviour for divestment (from Figure 2) and its influencing factors. Following Granberg's (2007) take on obsolescence [37], 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.



**Figure 3.** Conceptual model of divestment (the artefact is depicted as a mobile phone as our focus in this paper is on mobile devices.).

### 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.

#### 3.1. Research through Design approach

Designing is “changing existing situations into preferred ones” [38], 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” [39]. This approach gets insights from design practice to better understand complex problems in the field of design [40]. 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) [41]. 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” [41], 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.



### 3.2. Data Collection

Research through Design “employs methods and processes from design practice as a legitimate method of inquiry” [41] (p. 310). To access latent knowledge (i.e., deepest level of knowledge) [42] from designers, designers were invited to create divestment use experiences to express their thinking and emotions during generative sessions [42]. As shown in Table 2, 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.

**Table 2.** Overview of the empirical studies, their aims within the RtD approach (based on reference [40]), format, participants, and data collected [43–45].

Empirical Study	Aim of the Study: to Generate Knowledge	Format	Participants	Data Collected
Workshop DRS (resulting in four design projects)	<ul style="list-style-type: none"> <li>- Uncovering how we can make endings valuable and a real part of the consumption process</li> <li>- Creating divestment user experiences and reflecting on decisions of designers</li> <li>- Using the prototype as “physical hypothesis” to prove the feasibility of divestment experiences</li> </ul>	Four-hour workshop	18 participants in the workshop session	<ul style="list-style-type: none"> <li>- Audio recordings</li> <li>- Notes of the presentations</li> <li>- Break-up letters</li> <li>- Posters of journey maps</li> <li>- Posters of the design of off-boarding solutions</li> <li>- Group manifestos</li> </ul>
Design project Diede Mertens [43]	<ul style="list-style-type: none"> <li>- Uncovering how the data loss aversion barriers of users can be lifted or softened through design</li> <li>- Creating a divestment user experience and reflecting on decisions made throughout the project</li> <li>- Using the prototype as physical hypothesis to prove feasibility</li> <li>- Using the prototype as provocation for users</li> </ul>	Final project (30 ECTS) for an MSc degree at the faculty of Industrial Design Engineering (TUD)	One “Design for Interaction” MSc student	<ul style="list-style-type: none"> <li>- Notes of progress meetings</li> <li>- Final research report</li> <li>- Demonstration of the prototype</li> </ul>
Design project Esra Polat [44]	<ul style="list-style-type: none"> <li>- Uncovering how the relationship between the telecom provider and the user can be engaged in the process of divestment</li> <li>- Creating a divestment user experience and reflecting on decisions made throughout the project</li> <li>- Using the prototype as a “physical hypothesis” to prove feasibility</li> <li>- Using the prototype as provocation for users</li> </ul>	Final project (30 ECTS) for an MSc degree at the faculty of Industrial Design Engineering (TUD)	One “Integrated Product Design” MSc student	<ul style="list-style-type: none"> <li>- Notes of progress meetings</li> <li>- Final research report</li> <li>- Demonstration of the prototype</li> </ul>
Design project Jingwei Ren [45]	<ul style="list-style-type: none"> <li>- Uncovering how awareness and convenience barriers for users to bring back their products can be lowered through design?</li> <li>- Creating a divestment user experience and reflecting on decisions made throughout the project</li> <li>- Using the prototype as a “physical hypothesis” to prove feasibility</li> <li>- Using the prototype as provocation for users</li> </ul>	Final project (30 ECTS) for an MSc degree at the faculty of Industrial Design Engineering (TUD)	One “Design for Interaction” MSc student	<ul style="list-style-type: none"> <li>- Notes of progress meetings</li> <li>- Final research report</li> <li>- Demonstration of the prototype</li> </ul>

### 3.3. 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?

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 3 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 [46], as visualized below in Table 3.

**Table 3.** Overview of the main factors identified in the empirical studies.

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

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.

## 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.



#### 4.1. 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 4). This counsellor illustrates the two factors of an effortless collection procedure and clear communication to sooth negative emotions.



**Figure 4.** 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 5). 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).

The third group made a thought experiment by comparing the relationship between the phone and the user with a marriage (Figure 6). 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 5. Impression of group 2’s concept.



Figure 6. 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 7). 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 7. Impression of group 4’s concept.

4.2. Mertens: Data Concerns

During her user research, Mertens (2018) identified data concerns as a significant barrier for “letting go” of a device [43]. 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 8). 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.

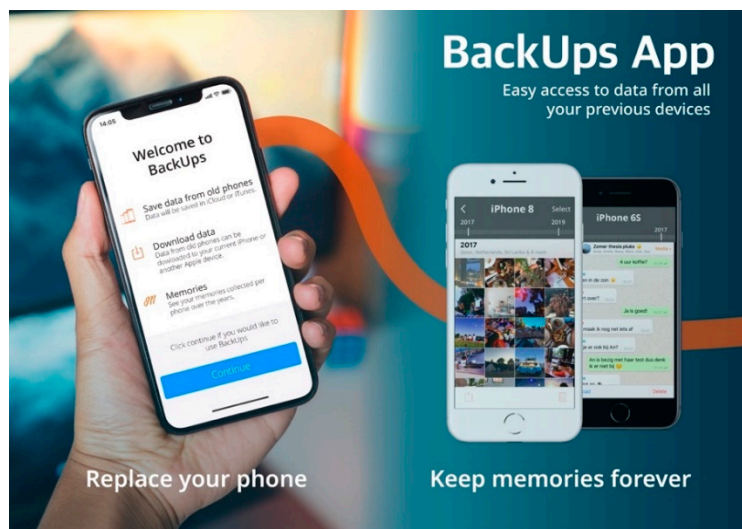


Figure 8. Impression of the BackUps app designed by Mertens (2018).

4.3. 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 9) [44]. 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 3.



Figure 9. Impression of the KPN Collect designed by Polat (2019).

#### 4.4. 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 [45]. He subsequently designed a trade-in app which would be activated at the moment of purchase of a new phone (Figure 10). 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 10. Impression of the Trade-In app designed by Ren (2018).



## 5. Discussion

We first reflect on the conceptual model of divestment (Figure 3) 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.

### 5.1. 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 11) are reflected in the literature. For instance, the lack of awareness of collection solutions is a prominent factor in publications [23,36,47–51]. 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 [45]. In another example, Huang, Yatani, Truong, Kientz, and Patel (2009) raised the issue of data privacy [52]. 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 [43].

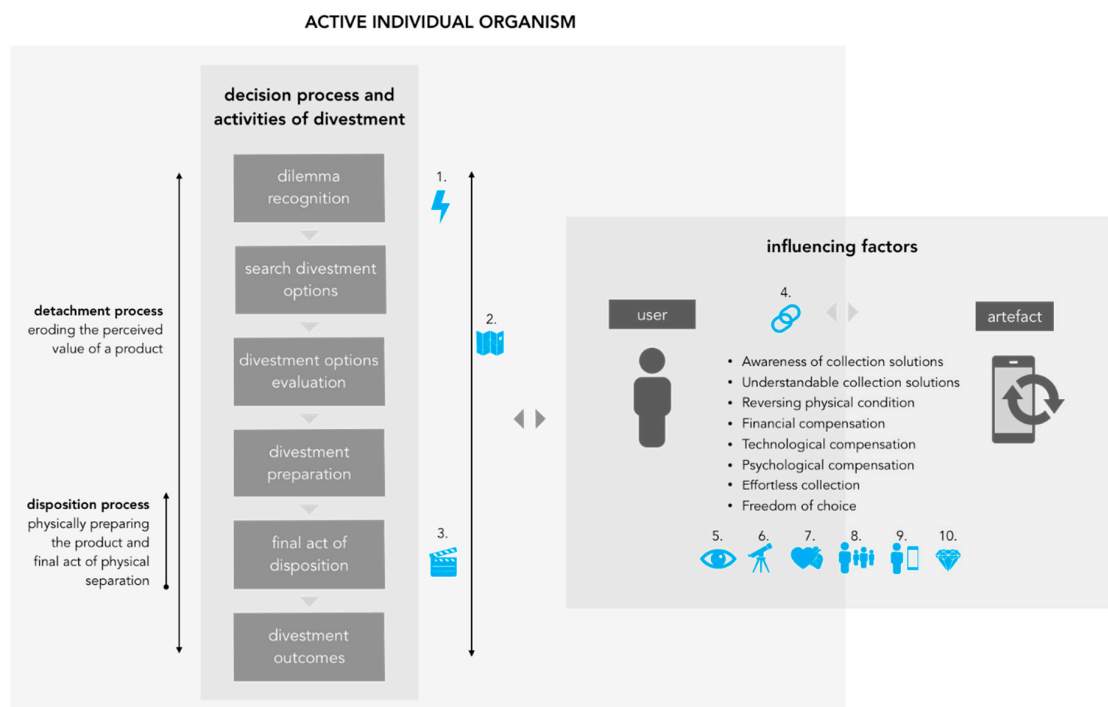


Figure 11. Conceptual model of divestment and the position of the design principles.

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 [25]. 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 [44].

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.

## 5.2. 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.

### 5.2.1. 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 [43,45]. 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).



### 5.2.2. 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 3 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).

### 5.2.3. 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 [53,54]. 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).

### 5.2.4. 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.

## 5.3. 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 11 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 12 provides an overview of designing for divestment and generates accessible insights for designers.



**Figure 12.** Design for Divestment design principles for smartphones.

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.

## 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 [13]. 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?

After introducing a conceptual model of divestment based on an extension of the Consumer Decision Process model [24], 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.

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