Strategic Product Design
Delft University of Technology

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Design of Philips' Sonicare Divestment Towards Return Practice

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Preface & Acknowledgements

Before embarking on this project, my interest in the topic was sparked by an elective course I took called *Sustainable Consumer Behaviour*. I was fascinated by the potential of design to influence consumer behaviour towards sustainable practices.

With the increasing trend of consumption and waste generation, which greatly influenced by how things are designed, my personal goal as a designer is to be involved in creating strategies that are more responsible for the environment. This project has been a meaningful step in serving this personal vision.

I would like to express my deepest gratitude to my main supervisory team: Ruth, Sonja, and Flora.

To Ruth and Sonja, thank you for your continuous encouragement to voice my perspective as a designer while challenging me to remain critical and reflective in my thought process. Your guidance has been truly instrumental in shaping my work and skills.

To Flora, I am deeply thankful for your trust. Your introduction to the practice theory and divestment opened my knowledge horizon and perspective on consumer behaviour. Your encouragement and support, especially during moments of doubt, have been invaluable throughout this journey.

I would also like to extend my sincere thanks to *Thanyawan*, the representative from Philips, for providing relevant data and feedback that greatly contributed to the development of the final concept.

Additionally, I want to thank all the participants involved in the study. Your time and valuable insights have been integral to my work.

Finally, this work would be impossible to finisih without the extended support from my family (especially *Ibu*, *Ayah, and Abang*) and all my beloved friends.

I hope that the time and effort dedicated to this project offer valuable insights to the reader.

Hauri Zafirah

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Abstract

This project addresses the question of how Philips can design and implement an effective divestment experience for Sonicare electric toothbrushes to facilitate and enhance practices in formal collection. Using practice theory as a guiding framework, with practice-oriented design methods as actionable steps, this project explores the divestment of electric toothbrushes as a target practice.

The process began with literature and desk research to understand the broader context, followed by a deep dive into the target practice through historic career analysis, exploration of Philips' current practices, competitor landscape, and in-depth interviews. Mapping the target practice revealed opportunities for reconfiguration, which were then explored through co-creation sessions with electric toothbrush consumers.

The design concept evolved through one exploration phase and two ideation phases, incorporating consumer feedback at the later stage. The final concept proposes a Philips take-back service consisting of three key intervention stages: Inform & Trigger, Facilitate & Support, and Acknowledge.

The interventions work to reshape the practice of divesting from electric toothbrushes, integrate divestment into the early stages of the purchase and use phases. They ensure that information is provided across multiple touchpoints, collection is facilitated through specially designed packaging and waste storage bags, and consumers' contributions are acknowledged. This holistic approach aims to make divestment an integrated and rewarding experience, encouraging sustainable behavior through design.

Glossary

EEE	According to the WEEE Directive 2012/19/EU, EEE or electrical and electronic equipment is defined as any devices that needs electricity or electromagnetic fields to function properly, including devices used to generate electricity, transfer it, or measure it.
Divestment	Divestment is a phase that consumers engage during product end-of-use, “the process user experience when separating from a product” (Poppelaars et al., 2020).
OEM	Original Equipment Manufacturer
WEEE / e-waste	WEEE or waste electrical and electronic equipment, is defined as any EEE that has become waste, including not only the main product itself but also all components, sub-assemblies, and consumables that are part of the product at the time it is discarded. In this project, except referring to the EU’s regulation, the term “e-waste” will be used.

Chapter 1:

Introduction

This chapter introduce this graduation project by first outlining the broader context of circular economy transition, which informs the project's objectives for Philips Sonicare. Secondly, the context and goal of this study is explained to set up a starting point for the reader. Lastly, the scope and stakeholders involved in this project is also introduced.

1.1 Background: Transition to Circular Economy

The escalating consumption that we see today are intensifying production demands. This trend raises significant concerns, as it leads to relentless extraction of limited natural resources and an increasing amount of waste being sent to landfills. The linear economy, which involves making, using, and discarding products, has sbecome unsustainable. This model not only depletes resources but also generates a growing volume of waste that negatively impacts the environment.

In light of this issue, the circular economy offers a more sustainable approach by extending the value of products and materials through practices such as reuse, remanufacturing, refurbishment, and recycling. By keeping products and resources in circulation, the circular economy seeks to minimize landfill waste and reduce environmental impact, as well as ensuring that valuable materials are reintroduced back to the system.

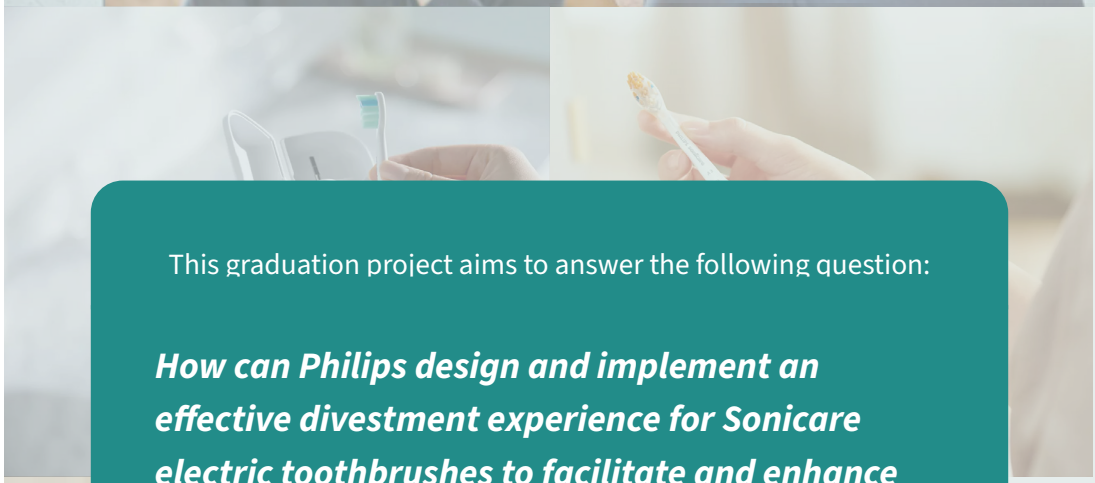
Photo by Possessed Photography on Unsplash.

1.2 Context and Goal

Oral hygiene is one of the most important health aspects in the 20th century. This is reflected through various oral health care products offered in the market, along with the advancement of their technology. One of the most notable development from the oral health care product category is electric toothbrush, which now come with various brush heads types, multiple power speed settings, and Bluetooth connectivity to sync with mobile apps, catering to consumers' needs.

The use of electric toothbrush is becoming a new norm of oral hygiene due to its argued effectiveness in oral hygiene. Unfortunately, it also has the greatest environmental impact compared to other conventional toothbrushes (Lyne et al., 2020). With this risk, ensuring that used electric toothbrushes are circulated back in the system is important.

The Philips Sonicare electric toothbrush is at heart of this project. The goal is to understand consumers' practice in divesting from electric toothbrushes, including the journey and process involved, and propose solution in the form of a design concept that encourage a shift in practices towards voluntary return, thus enhancing the goal of circular economy. Here, divestment is understood as a phase consumers go through during products' end-of-use phase and will be detailed further in detailed in 3.2.



This graduation project aims to answer the following question:

How can Philips design and implement an effective divestment experience for Sonicare electric toothbrushes to facilitate and enhance practices in formal collection?

Photo by Philips.

1.3 Scope and Stakeholder

As shown by Figure 1, this project is focused on the scenario where consumers want to end the use of their electric toothbrush device. Reason for ending the product use can be varied from malfunction, technological obsolesce, and demand for additional features. The case where consumers want to extend product life cycle by repairing, selling, or giving is exempted from this project.

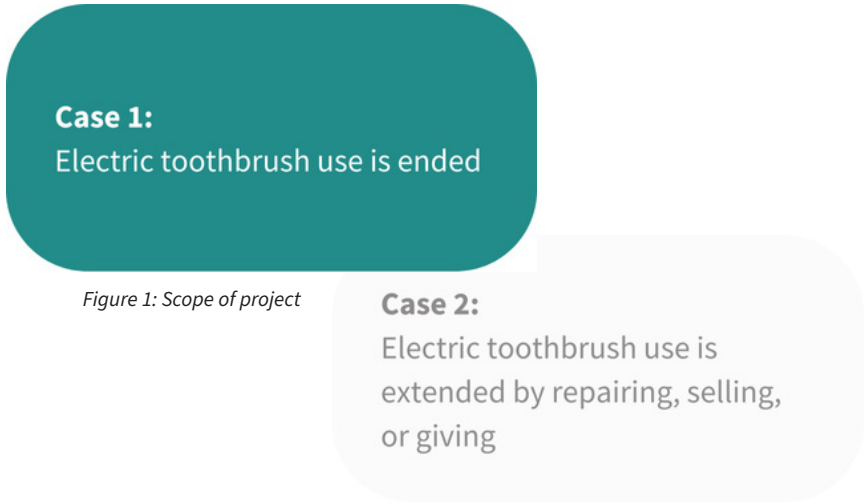


Figure 1: Scope of project

This project is being conducted as a part of research initiative under INCREACE consortium, which is funded by the European Health and Digital Executive Agency (HADEA) under the Horizon Cluster 4 program (INCREACE, n.d.). This graduation project is part of Work Package 5 (WP5) within INCREACE: Circular Society: Empowering People and Communities in a Circular Plastic Transition.

As a part of EU-based consortium, this project began with a literature review and desk research, initially drawing on data and examples from the European context. The scope then narrowed to the Netherlands, which is chosen for ease of data gathering and immersion in existing local collection services.

Partners for Innovation

Partners for Innovation is an independent consultancy specializing in sustainable innovation (Partners for Innovation, n.d.). In the context of INCREACE project, Partners for Innovation acted as the leader of WP5. This project operates under a formal agreement with Partners for Innovation, who provide direct guidance and support throughout the project.

Philips

Philips is a company that focused on supporting people's health and well-being through innovative health technology, aiming to improve 2.5 billion lives per year by 2030 (Philips, n.d.-a). Philips' products covered both personal home care category such as electric toothbrush and professional healthcare solutions like ultrasound devices.

As an Original Equipment Manufacturer (OEM), Philips supports the principle of Individual Producer Responsibility (IPR) regulated by the Waste Electrical and Electronic Equipment (WEEE) Directive on Article 12.3 (Philips, n.d.-c), which suggests that producer is responsible to financing the operations related to waste from its brand through individual arrangement or collective scheme such as Producer Responsibility Organisation (PRO) (European Union, 2012).

Chapter 2:

Methodology

This chapter explains the methodology used for this project. It starts with the explanation of social practice theory for behaviour change. Then, practice-oriented design is briefly discussed, followed up by the explanation how it is applied and adopted to the overall design process.

2.1 Social Practice Theory for Behaviour Change

The behaviour change approach from psychology, focusing on individuals–such as theory of planned behaviour–has been widely used as an approach to sustainability challenges. In the context of this graduation project, changing behaviour from disposing used electric toothbrush to returning it responsibly involves layer of changes, such as product interaction, individual motivation, social norms, facilities (e.g., collection points), to environmental awareness. Due to the complex nature of behaviour change in the context of this project, focusing only on individuals or product-level might overlook other important factors that come into play.

For this, social practice theory, an alternative approach to behaviour change, is adopted for this project. The key reason for this choice is its shift from individual-centred focus to practice-centred focus, acknowledging the complexity of behaviour change and enabling a more holistic approach. As (Welch, 2017) noted, using the social practice theory lens changes the question from "How do we change individuals' behaviours?" to "How do we change practices and their performance?". However, to make it clear, it is worth to note that individuals are not gone from the frame, but is situated within a broader context where their attributes such as attitudes, values, emotions, and motivations are understood as integral components of practice.

2.1.1 Practice Elements

In social practice theory, practice is seen as a configuration of three interlinked elements: skills, stuff, and images (Kuijer, 2014). Skills encompass the know-how and competencies needed to perform a practice. Stuff includes resources essential for the practice. Images represent the social meanings and values associated with a practice, influencing how it is perceived and motivating participation. Together, they form the entity of practice which is carried and performed by individuals, as shown by Figure 2.

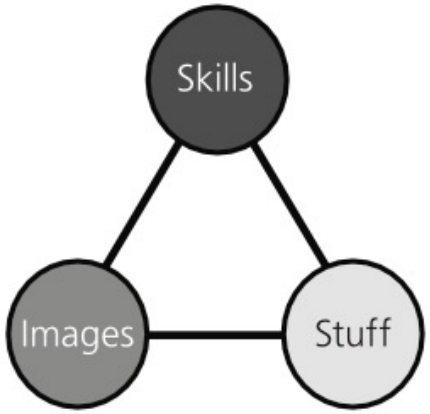


Figure 2: Elements configuration of practice (Kuijer, 2014)

2.1.2 Practice-Oriented Design

To make social practice theory actionable for this project, a practice-oriented design approach, drawing on Kuijer (2014), is adopted. It consists of two phases: practices as a unit of analysis and practices as a unit of design.

Practice as unit of analysis

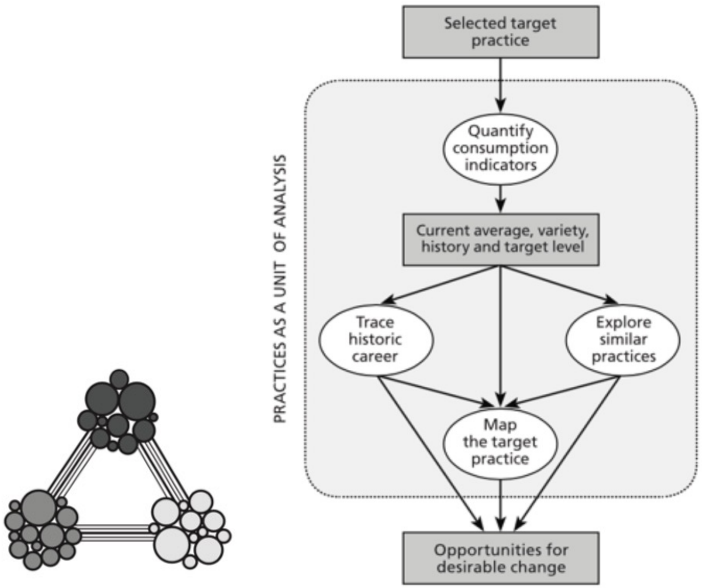


Figure 3: Practice as a grouping of elements connected by links (left), Practice-oriented design phase one–practice as unit of analysis (right) (Kuijer, 2014)

As changing a practice involves reconfiguring these elements, the first phase of practice-oriented design focuses on understanding the practice itself. Shown by Figure 3, this starts with selecting the target practice, tracing historic career, exploring similar practices, and mapping the target practice. Identifying opportunities for desirable change is the final intend of this phase.

Practice as unit of design

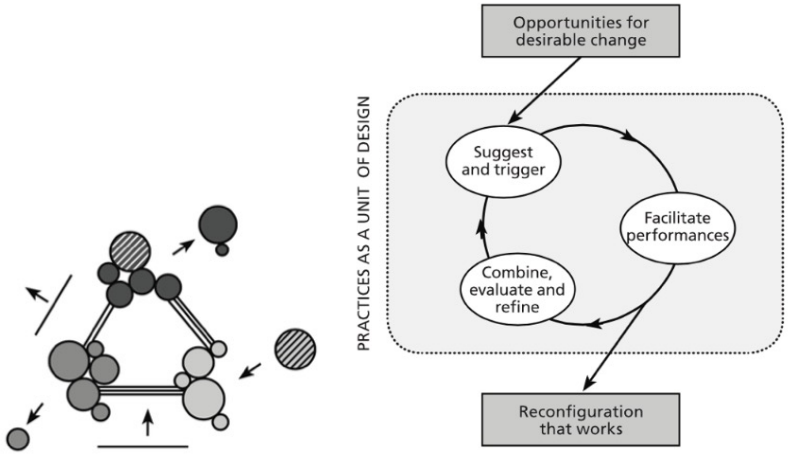
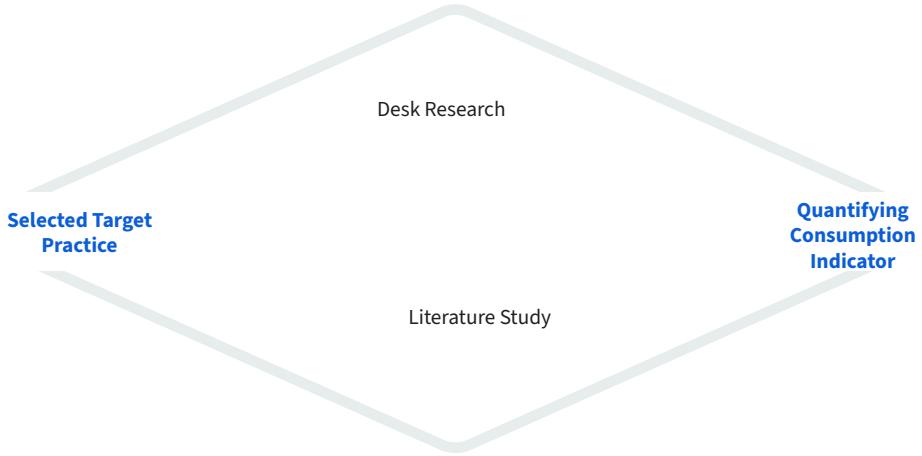


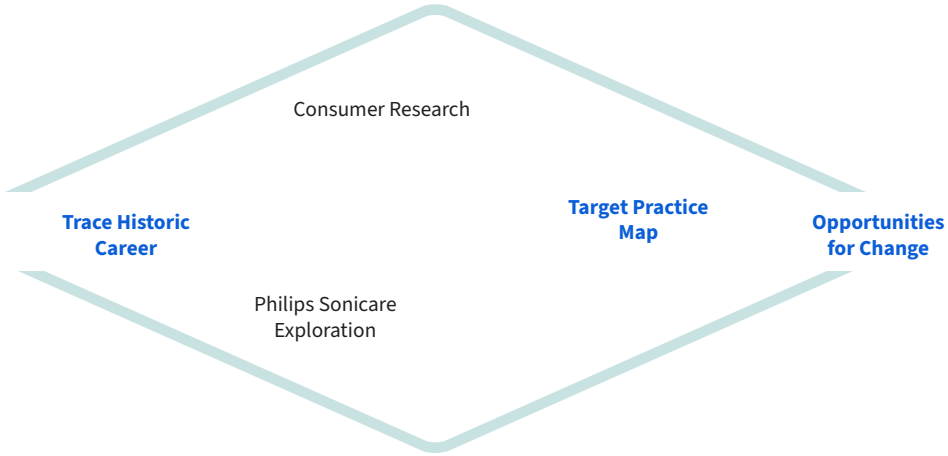
Figure 4: Reconfiguration of practice (left) Practice-oriented design phase one–practice as unit of design (right) (Kuijer, 2014)

The second part of practice-oriented design focuses on designing the change of practice by reconfiguring its elements and their links. This may involve introducing new elements, removing existing ones, or combining them in a new ways to disrupt the current practice, as shown by Figure 4. The goal of this phase is to achieve a reconfiguration that works to transform the practice.

2.2 Design Process

The practice-oriented design, keeping its sequential steps, is further mapped with other research activities into a double diamond design framework. Shown below is the design process of this project, which consists of three diamond blocks (blue text indicates the steps adopted from the practice-oriented design).





Chapter 3

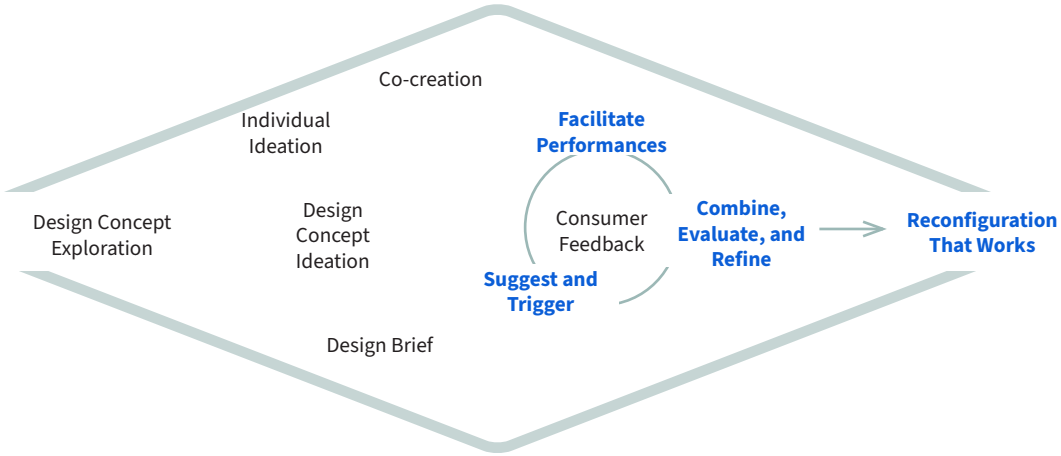
Understanding Bigger Picture

The first diamond block starts with the framing of target practice of the project. Then, a mix of literature review and desk research on a more broader context relevant for the project, such as circular economy, product lifecycle and e-waste is done. Electric toothbrushes as the main focus of this project is also explored. This block concludes with a converging of several findings into a change desired for this project.

Chapter 4

Understanding Target Practice

The target practice: divesting from electric toothbrushes, is further explored in the second diamond block. Multiple activities are done, including historic career trace, Philips Sonicare exploration, similar practices exploration, and consumer research. The findings are narrowed down into the mapping of target practice, and identification of opportunities for change.



Chapter 5

Designing Reconfiguration

The last diamond block focuses on designing the reconfiguration of target practice, which includes the design concept exploration and design brief creation. The design concept is iterated through consumer feedback sessions by embodying the concept through scenario building and prototypes. Insights and inputs from the testing are combined, resulting in the final reconfiguration that works for the target practice (final design concepyt).

Selected Target Practice

In practice-oriented design, selecting and framing the target practice–main action or routine aimed to be understood, improved, or transformed–is essential (Kuijer, 2014).

The project goal is to create a design concept that shift practices during electric toothbrushes divestment towards voluntary return. To capture the broader context, the target practice is framed as **‘divesting from electric toothbrushes’**, encompassing not only the act of returning itself but the entire divestment process, including elements that may shape the final act of disposal.

Chapter 3:

Understanding Bigger Picture

This chapter begins with a discussion of the circular economy and how it is relevant in the context of this project. It is followed by a discussion on product and consumer lifecycle with an emphasis on the end-of-use phase, where consumers engage in divestment. Then, insights into electric toothbrush disposal are explored. Lastly, electric toothbrush, as the main object of this study, is discussed.

3.1 Circular Economy for Electric Toothbrush

To understand the concept of circular economy, it is useful to briefly discuss about the linear economy. Linear economy can be understood as a system where resources are extracted, used to make products, consumed, and disposed–'take-make-consume–throw away' approach (European Parliament, 2023). Shown by Figure 5, in linear economy, products' value peaks during the use phase, and 'going down the hills' in the post-use phase, where products are ultimately discarded (Achterberg et al., 2016).

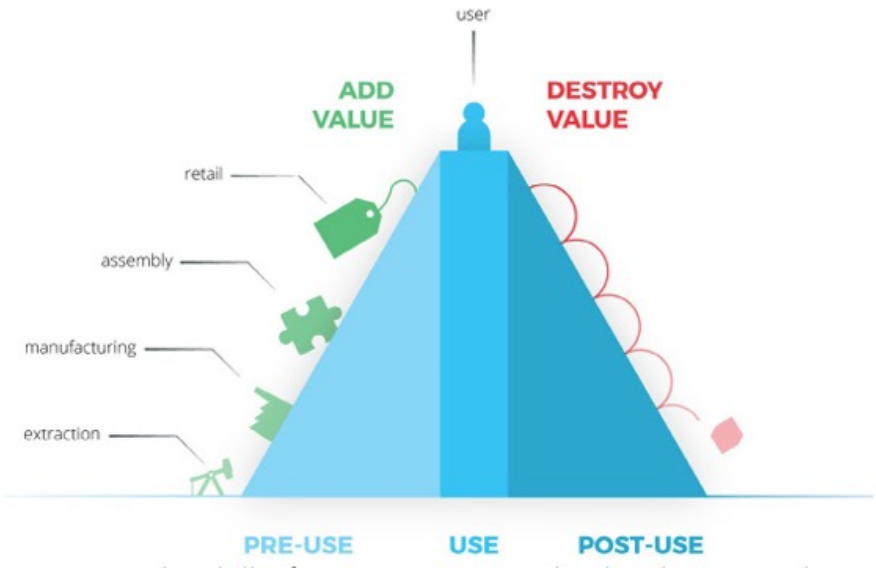


Figure 5: The value hill of a linear economy (Achterberg et al., 2016)

E-waste Issue

The Global E-waste Monitor 2024 by Baldé et al. (2024) provides data related to global e-waste from 2022:

- About **62 billion kg** of e-waste was generated worldwide.
- Small appliances, including medical devices like electric toothbrushes, comprise the largest share by weight, totalling **20 billion kg**–nearly one-third of the world's total.
- Europe leads the world in e-waste generation per capita, with each person contributing to **17.6 kg** on average—more than double the global average.
- **22.3%** of e-waste was formally documented as properly collected and recycled, while the rest remains unaccounted for.

The low e-waste collection is concerning, considering the risks from improper disposal. For instance, landfilling, water dumping, and manual disassembly of electronic equipment can release up to 1,000 different chemicals to the environment, including neurotoxicants like lead (World Health Organization, 2024). Additionally, treatment such as open burning produces toxic fumes that can travel long distances, putting vulnerable groups like pregnant women and children at the greatest risks of exposure (World Health Organization, 2024).

Electric Toothbrush

Precise data on electric toothbrush waste generation is currently unavailable, nevertheless, its usage continues to rise. By 2020, around 67% of adults in the UK—an estimated 34 million people—used electric toothbrushes, marking a 52% increase over the last five years (Oral Health Foundation, 2020). Within the EU, while exact figures are lacking, market growth suggests the increasing trend of electric toothbrush usage, with Germany's market projected to reach $401.9 million by 2030, while France is expected annual growth rate of 7.1% from 2023-2030 (KBV Reseaarch, n.d.).

While seen as more durable, electric toothbrushes pose significant environmental challenges compared to other types of toothbrushes. A life-cycle assessment comparing four types of toothbrushes: plastic manual, bamboo manual, plastic manual with replaceable head, and electric, found that electric toothbrushes consistently had the greatest impact in 15 out of 16 environmental categories, except for water scarcity (Lyne et al., 2020). From this study, it is estimated that climate change impact of electric toothbrush is over 11 times greater than bamboo toothbrush. Furthermore, when considering land use and the consequential reduction in biodiversity and habitat, the negative impact of electric toothbrush is over 36 times than bamboo manual toothbrush.

Transition to Circular Economy

Based on these findings, the linear system is both problematic and unsustainable for electric toothbrush, highlighting the need for a shift toward a circular economy approach. As illustrated by Figure 6, in circular economy, products that have been used are reintegrated into the system through repair/maintain, reuse/redistribute, refurbish, remanufacture, or recycle (Achterberg et al., 2016). This continuous loop not only retains products' value, but also enables reduction of waste to a minimum, leading to a positive environmental impact.

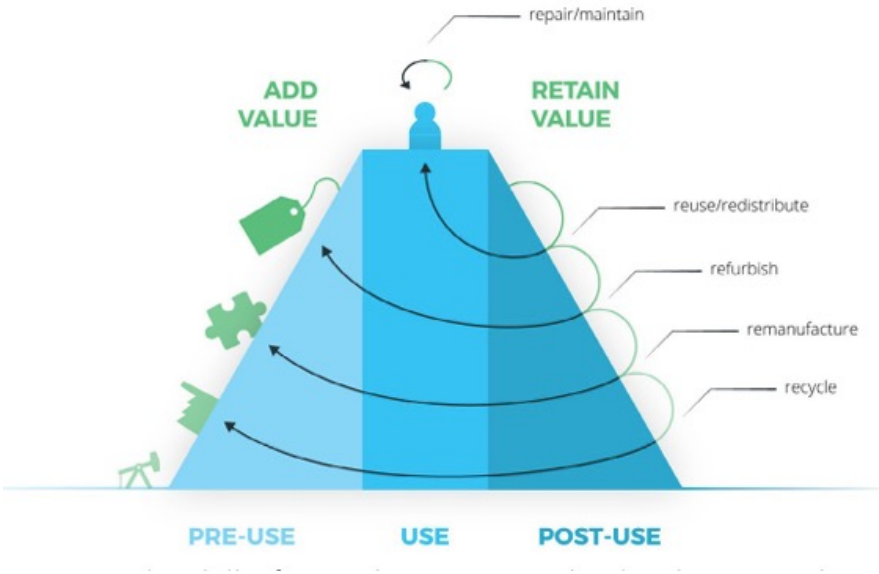


Figure 6: The value hill of a circular economy (Achterberg et al., 2016)

In the context of electric toothbrush, the circular economy can be translated in many ways, such as designing toothbrushes using environmentally friendly materials, making them easy to repair to extend their lifespan, or incorporating long-lasting batteries to reduce frequency of charging. This project aligns with the circular economy for by focusing on shifting consumer practices towards responsible disposal, ensuring that used Philips Sonicare toothbrushes are correctly treated at the end of their lifecycle.

Photo by John Cameron on Unsplash

3.2 Product and Consumer Lifecycle

Product lifecycle refers to the stages a product undergoes from its initial development, use, to its end-of-use. Parallel to product lifecycle phases, consumers also undergo their own lifecycle, as illustrated by Figure 7.

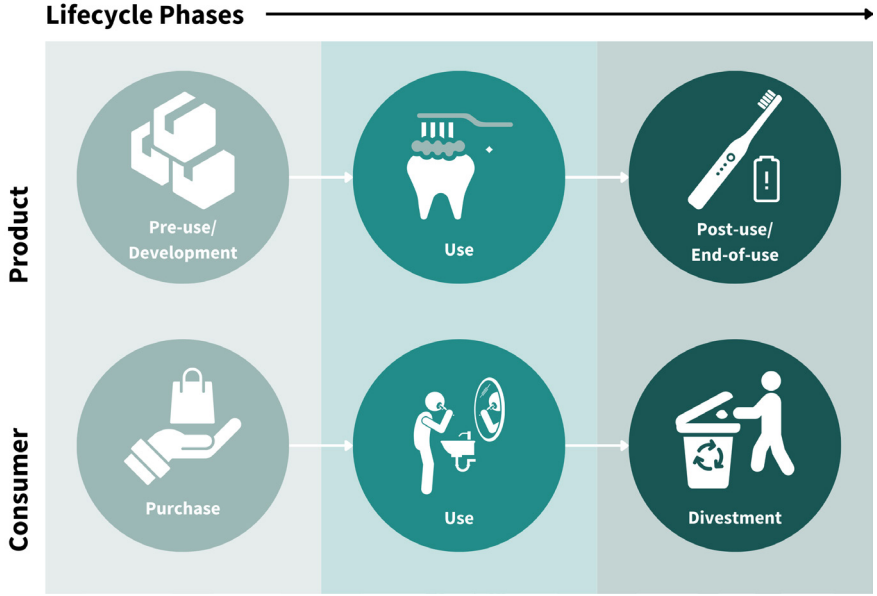


Figure 7: Product and consumer lifecycle phases (illustration by Canva)

The circular economy has altered the product and consumer lifecycle from the previous linear system. With the circular economy, the post-use phase has become equally significant as the pre-use phase. Companies committed to the circular economy, including Philips, can no longer focus solely on attracting consumers through new products; they must also encourage consumers for responsible actions at the product end-of-use.

3.2.1 Divestment

During the product end-of-use, consumers engage in a phase called as divestment, 'the process user experience when separating from a product' (Poppelaars et al., 2020). Divestment is highly relevant to this project, as it is the phase where consumers decide whether to discard their electric toothbrush in the bin, contributing to waste, or responsibly disposing it.

Shown by Figure 8 is the cognitive model of consumer behaviour during divestment. This model illustrates multiple steps consumers go through during the divestment phase, both requiring mental and physical effort, from considering whether to end the product's use to the final action of disposing the product. Reviewing these steps provides a basic understanding of what may happen behind product disposal. In subchapter 4.4, insights specific to the electric toothbrush divestment are discussed.

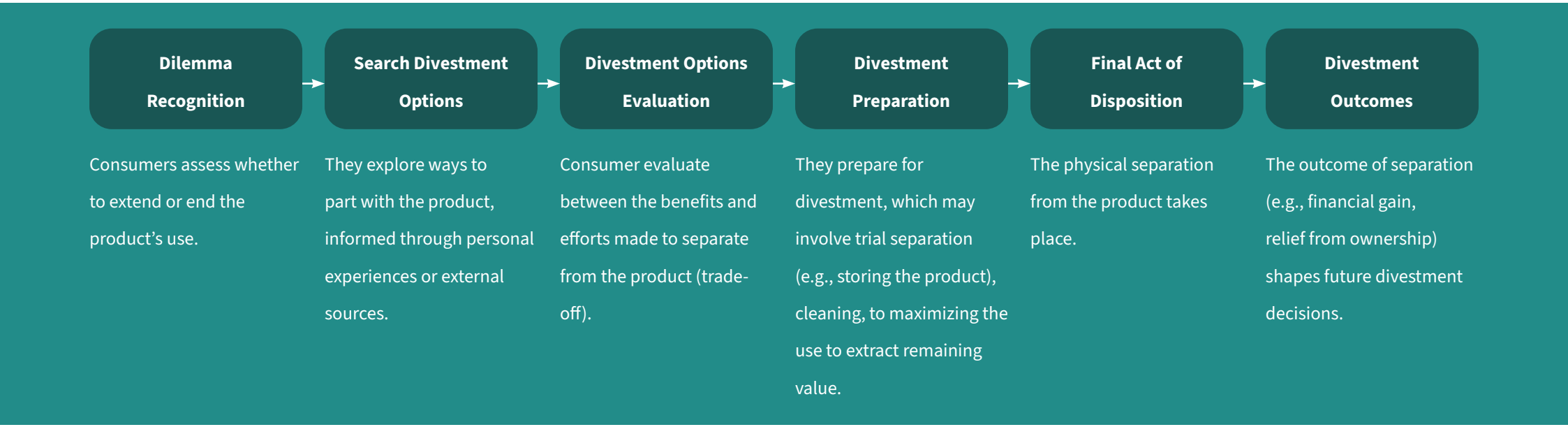


Figure 8: Cognitive model of consumer behaviour during divestment (Poppelaars et al., 2020).

3.3 Insights into Electric Toothbrush Disposal: Perceptions, Behaviours, and Influences

This subchapter explores the existing perception of electric toothbrush and consumer behaviour surrounding small e-waste that might affect the practice of divesting from electric toothbrush. Lastly, factors influencing e-waste disposal are identified and elaborated for the context of electric toothbrush.

3.3.1 Perceived Image of Electric Toothbrush

Previous study conducted by Carter et al. (2013) on electric toothbrush domestication reveals that these devices carry an element of intimacy. Within the study, it was found that brushing with an electric toothbrush is associated with aesthetic considerations—specifically how one might 'look' during use. The study also highlights a reluctance to share electric toothbrushes, even with different brush heads, reflecting the boundaries of 'mouth rules', where the mouth is considered a private space, and what comes from it is seen as 'matter out of place'. Similarly, on a more recent study, Mugge et al. (2017) found that the refurbishment of electric toothbrushes tend to be viewed negatively due to hygiene and contamination risk concerns, adding another layer to the perceived intimacy and privacy associated with these devices.

Moreover, with recommendations to replace brush heads every 3-4 months or when bristles wear out (American Dental Association, 2022), electric toothbrush may inherit the image of consumables, 'goods that people buy regularly because they are quickly used and need to be replaced often' (Cambridge Business English Dictionary, n.d.). This image could influence how consumers treat their electric toothbrushes at the end-of-use.

3.3.2 Consumer Behaviour on Small E-Waste

Small electronic appliances waste are generally existing in the house in an unnoticeable and scattered manner, commonly described as 'laying somewhere in the house' (Casey et al., 2019 as cited in Islam et al., 2021). This less visible nature of small e-waste has consequently resulted in a storing behaviour of small e-waste. A survey by Baldé et al. (2022) across several EU countries' households, including the Netherlands, showed that four items per household are 'hoarded and not in use'. When measured by count (rather than weight), majority of these items fall into the categories of 'small IT equipment' and 'small equipment'. Meanwhile, in Poland, it is revealed that an average of 1.5 small e-waste items are stored per household, compared to only one medium appliance per two households (Nowakowski, 2016 as cited in Islam et al., 2021).

Depending on their types and sizes, disposal on electronic appliances may be varied. In a study by Darby & Obara (2005), it is revealed that due to the different size, householders may discard electric toothbrushes with regular waste, but are more inclined to sell or give away a stereo. In other words, the compact nature of electric toothbrushes makes bin disposal more convenient, whereas bulkier size of stereos encourages alternative disposal methods.

3.3.3 E-waste Collection Influencing Factors

Some factors that influence consumers decision on e-waste disposal has been identified by Islam et al. (2021, p19). In the practice theory, these factors could be understood as the elements constituting a practice. The relevant influencing factors for electric toothbrush divestment are selected and interpreted as follows:

Availability and convenient access to recycling facilities and service

In the context of electric toothbrush collection, this could be understood as having collection points in close proximity to consumers' residences or locating points in public places.

Availability of information regarding formal collection channels

Consumers' practice in collecting used electric toothbrush must be supported with sufficient and easy to find information. This may involve putting information on strategic touchpoints (e.g., product packaging) or on key moments (e.g., purchase phase).

Lack of product-related information

Consumers may not always have the skill to identify product type, such as if their electric toothbrushes should be considered e-waste, particularly if this information is not prominently communicated.

Environmental concerns

The shared social image that e-waste contributes to environmental harm could drive consumers to dispose of their electric toothbrushes responsibly through formal collection.

Pro-environmental behaviour - recycling habits and practices

This factor reflects the degree where consumers are accustomed to sorting and recycling their daily waste. Consumers who already engage in recycling behaviours may be more likely to collect electric toothbrushes as part of their broader waste management practices.

Economic benefits

Incentives, such as discounts or rewards could be integrated as part of the stuff structure of the electric toothbrush return practice, reinforcing collection as a valued and recognized contribution to sustainability.

Cost of disposal

Other than financial, in practice theory, cost could encompass time, effort, and knowledge needed to perform the return or responsible disposal of electric toothbrush. High costs, posing as frictions, arise when infrastructure is difficult to access, information is unclear, or action feels meaningless.

3.4 Electric Toothbrush

Electric toothbrush has emerged as a tool for oral hygiene, with several studies showing its effectiveness in removing plaque compared to manual toothbrush (Adam et al., 2020; Anas et al., 2018; Davidovich et al., 2021). This subchapter takes a closer look at electric toothbrush by first examining their lifespan. Then, components of Philips Sonicare are briefly analysed, along with the potential environmental risks they pose. Lastly, overview of the current collection system for electric toothbrush components is briefly introduced.

3.4.1 Product Life Span

Research specific to electric toothbrush life span is currently unavailable and Philips does not disclose this information as well. According to online articles, including ones published by electric toothbrush companies such as Oral-B (Oral-B, n.d.-a) and Boka (BOKA, 2024), electric toothbrushes is expected to last for 3–5 years before the battery performance is declining. This is in line with previous study, which indicates that small work or personal care appliances remain in use for around four years before they are 'discarded in disrepair' (Cooper, 2004). Nevertheless, electric toothbrush life span would depend on the model, how often it is used, and how individuals take care of it.

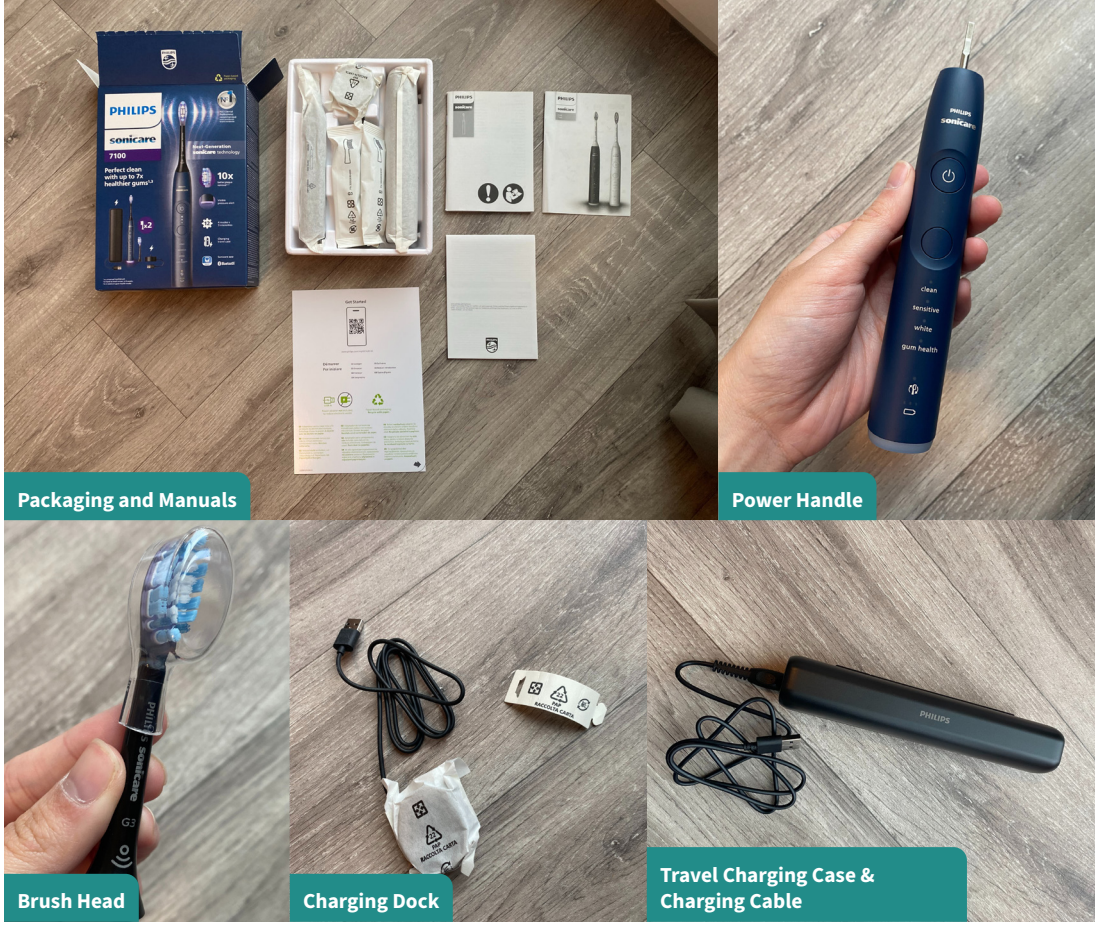


Figure 9: Philips Sonicare 7100 product components (photo by author)

3.4.2 Components Analysis

The simplest model of rechargeable electric toothbrush consists of three easily identified components: power handle, brush head, and charging dock. With the progression of technology, more accessories are being added to these devices. For instance, as shown by Figure 9, Philips Sonicare 7100–one of Sonicare's most advanced models, provides additional accessories of travel charging case along with its charging cables.

Power Handle

The power handle is arguably the most complex component of an electric toothbrush. As the power handle is battery-powered, it can be simply classified as e-waste once discarded. A tear down on Philips Sonicare kids' electric toothbrush illustrated by Figure 10 shows that power handle consists of various components such as outer case (2), charging coil (3), induction charger coil (4), oscillating brush head (5), screws (6), motor (7), torsion bar (8), magnet (9), shaft (10), circuit board (11), power button cover (12), thumb grip (13), and lithium (Li-Ion) battery (14) (Holmes, 2023).

Looking closer at the material-level, these components contain materials that are harmful to the environment when improper disposal is done. For instance, Li-Ion batteries are fire hazard, and can be dangerous when disposed together with household goods (Gross & Coi, 2024). Hence, in recycling facilities, manual pre-sorting is done to remove batteries manually from a device. Moreover, when corroded, Li-Ion batteries can also contaminate soil and water (Hoey, 2024). Other components, such as plastic from the outer case, power button cover, and thumb grip contribute to plastic pollution, though they are not as immediately hazardous as the battery.

Figure 10: Tear down on Philips Sonicare kids' electric toothbrush (Holmes, 2023)

Brush Head

Upon quick observation, the brush head materials can be identified as consisting of bristles made from nylon and the case composed of plastic. However, the Brush Sync feature adds an electrical component to the brush head, allowing the power handle to detect brush head usage and remind consumers when it is time for a replacement through a light indicator (Love, 2024). As shown from Figure 11, the Philips Sonicare A3 Premium All-in-One includes small metal ring, which consists of RFID chips (Love, 2024) and copper wires. Illustrated by Figure 12, the e-waste classification of Philips Sonicare brush heads is confirmed through the e-waste label ( ) on the brush head packaging, suggesting that 'product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling' (Your Europe , n.d.).

Figure 11: Philips Sonicare A3 brush head electrical component (photo by author)

Brush head materials like nylon and plastic are not biodegradable, but the option of recycling is currently challenging due to different components that needs harvesting (Baker, 2024) and the risk of small parts clogging the recycling machinery (Borunda, 2019). Although an assessment of the environmental risks from RFID chip disposal is not available, the e-waste label on the brush heads packaging suggests that disposing the brush head with household waste should be avoided as it poses environmental risks to some extent.

Figure 12: Philips Sonicare A3 brush head packaging (photo by author)

Charging Dock and Other Electronic Components

Charging dock, travel charging case, and cables are also classified as EEE due to their function of transmitting electricity and classified as e-waste once they are discarded. E-waste with plug, including charging dock, is considered ‘health and environmental hazard’, containing toxic substances which can damage human brain and coordination system (United Nations Institute for Training and Research, 2024).

A tear down of electric toothbrush charging dock is found for Oral-B brand (Dipert, 2023), which shows that it contains a circuit board. Containing heavy metals and chemicals, improper disposal of these components, especially when incineration is done, potentially releasing toxic fumes to the air.

Overview of Collection Options

To close the analysis of electric toothbrush, a brief desk research on the current collection options is done. In the Netherlands, e-waste should be collected by consumers through the WeCycle collection box. Upon arrival in the factory, batteries as the fire hazard component are manually removed from a device, then devices are shredded into small pieces. Then iron is extracted using a magnet, while a machine with vibrators and sensors separates raw materials like aluminium, stainless steel, and plastic. Precious metals such as gold, silver, and palladium are also recovered from circuit boards for reuse in new products (WeCycle, n.d.-a).

It is also discovered that Philips has established a collection program with TerraCycle, where consumers can collect oral health care products from any brands, including Sonicare brush heads. After collection, waste is sorted, then sent to a third-party recycling partner to be processed into usable forms (TerraCycle, n.d.-a). A service safari of both WeCycle and TerraCycle is further detailed in 4.2.4.

Key Takeaways: Understanding Bigger Picture

Disposal emerges as the likely divestment option for electric toothbrush, highlighting the importance of collection efforts

Previous research suggests that electric toothbrushes are associated with intimacy, privacy, and hygiene concern. The need for regular brush head replacement may further reinforce their consumable image. As a result, consumers are likely to dispose of their electric toothbrushes rather than repair, sell, or give them away. This highlights the importance of divestment phase in ensuring proper disposal through formal collection channels.

Electric toothbrush small size poses risks of hibernation or bin disposal

Electric toothbrush components previously observed are relatively small in size, making them easy to store in a drawer once end-of-use is decided. Alternatively, instant disposal may be chosen, prompted by the existing hygiene concern. In such case, the small size of electric toothbrush makes disposal with household waste a more convenient option than putting effort into proper disposal.

E-waste collection rates are currently low, but improvements are possible by reconfiguring elements of practice

Early findings in this chapter indicate that the current global e-waste collection rate is low, pointing to potential for improvement. Accessibility to services, clear information, and lowering the effort-related cost, have been identified as some factors influencing e-waste disposal. Leveraging these combination of skills, stuff, and images could help shift consumer practices from potentially hibernating or disposing of electric toothbrush in the bin to participating in formal collection.

Quantifying Consumption Indicators

According to Kuijer (2014), quantifying consumption indicators involves measuring aspects of a practice to provide a picture of the resources being consumed and set a ‘target level of reduced consumption’. For instance, litres of water used per individuals for ‘bathing’ serves as an indicator, with lower usage levels set as a target of intervention.

In the case of ‘divesting from electric toothbrush’, quantifying consumption indicators is tricky for multiple reasons. Unlike practices with clear, quantifiable inputs like water in bathing, divestment does not consume resources in a way that can be easily measured. Resource consumed in the context of divestment is more abstract and indirect, with aspects not quantifiable at the individual level. Importantly, divesting centres on reducing waste rather than consuming a specific resource.

The author decided to reframe this particular step to define broader goals for the target practice. Based on previous analysis on consumer behaviour with small e-waste, two critical objectives for electric toothbrush divestment are identified: avoiding long-term storage and increasing participation in formal collection systems. These serve as practical indicators for the author to guide the project moving forward.

Chapter 4:

Understanding Target Practice

This chapter delves deeper into the target practice of this project. It first starts with revisiting the historic career of waste management. Then, the current condition of Philips and how it might influence the target practice is detailed. Furthermore, similar practices are explored, including analysis on competitors. Lastly, in-depth-interviews insights are explained. This chapter concludes with the mapping of target practice, along with identified opportunities for change.

4.1 Historic Career of Managing Waste

Understanding the history of practice provides insight into how it changes or persists over time. Ideally, the analysis focuses on the selected target practice. However, specific historical data regarding the practice of divesting from electric toothbrush is not available. Thus, a brief analysis of the historic career of managing waste in general is conducted, drawing from the work of Poppelaars & Azad (2024), which builds upon Barles (2014) and Macleod (2017).

14th-17th Century

Photo by Gabriel Jimenez on Unsplash

In the 14th to 17th centuries, waste handling and management is fairly simple, as most waste generated was organic. Food scraps from individuals were reused to feed animals, and animal waste was then used as fertilizer for crops. Waste was seen as valuable; waste is 'food'. The key to waste management during this time was that individuals had control over the materials cycle, which was visible and tangible. For instance, broken products were repaired, dismantled and repurposed, or sold to rag-and-bone men. These activities required specific skills that helped prolong the value of materials.

18th-19th Century

Photo by Ricardo Gomez Angel on Unsplash

During this period, rising population density and industrialisation triggered changes in waste management. As waste volume and variety increased, better organisation became necessary. What was once a personal responsibility gradually shifted to authorities, distancing people from waste they created in the first place. Despite this shift, waste was still largely managed by manufacturers. Relying on waste from the cities for production, waste is seen as both profitable and useful by industries. However, the skills individuals once had—dismantling and repurposing products, and the perception that used items are valuable, began to fade during this time.

20th Century

Photo by Pawel Czerwinski on Unsplash

Production of goods and treatment of waste became completely out of sight from consumers. Garbage collection shifted from maximizing waste's value to minimizing disposal cost, with landfilling and incineration became the common practices. In parallel, environmental awareness and concerns about the planet's limits began to grow during this period. For the first time in centuries, people were asked to participate in segregating their waste. However, after years of being disconnected from waste management, this new practice was often seen as a burden.

Key Takeaways: Historic Career of Managing Waste

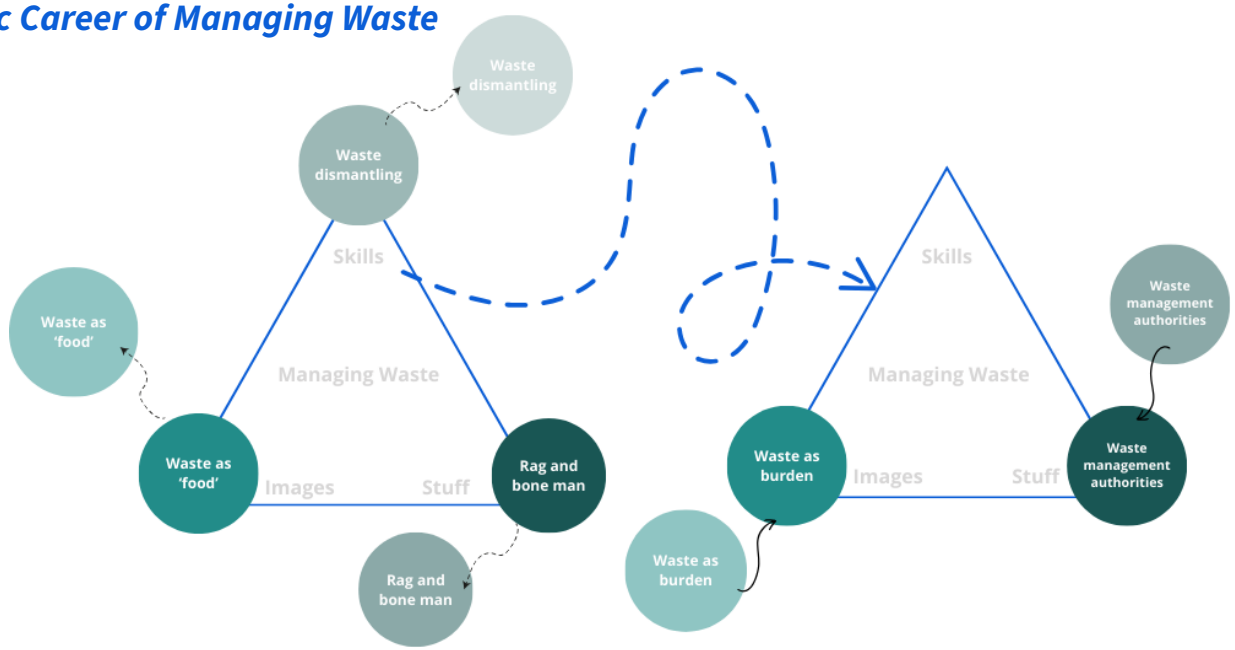


Figure 13: Managing waste practice reconfiguration over time

Figure 13 provides a simple illustration of how changes in the elements of managing waste practices over time leads to the shift in behaviour. For instance, the introduction of waste management authorities disrupted the existence of rag-and-bone man and removed the common skills of waste dismantling. Consequently, waste is distanced from everyday life, and the image of waste as 'food' is replaced by the perception of waste as burden. Eventually, the practice of managing waste, from what used to be environmentally sustainable, now transformed into disengaged and less sustainable process, focusing primarily on disposal rather than resource recovery.

For this project, this brief historical overview reveals the potential for change when new elements are introduced to a practice. By identifying, for instance, which elements have been lost or weakened, it is possible to ideate ways to reintroduce or adapt these elements to shift a practice. The learnings from this subchapter informs the later stage in 5.1, where elements of the target practice are identified, opening a room for reconfiguration opportunities.

4.2 Philips Exploration

Within the practice of divesting from electric toothbrush, information or services provided by the brand can be classified as *stuff*, which further support and enable the divestment process, leading to a proper disposal decision at the end of product use. How brand address divestment can also enforce *images* and *skills* among the consumers. This section provides the result and insights from the author's observation on Philips.

4.2.1 Methodology

The exploration is conducted using service safari, a research method used by designers to walk in customers' shoes by going out in the wild and experience the service first hand (Interaction Design Foundation, n.d.). A service safari is not necessarily about success or failure, but about gaining insights by identifying gaps, pain points, and opportunities for improvement.

The service safari started with the purchase phase, where the author explored Philips Sonicare products web page and concludes at checkout. Then, the author engage in the use phase which includes the product's arrival, unboxing, and first use. Lastly, the divestment phase is enacted, and two existing collection services are explored.

As shown by Figure 14, observations are made throughout the journey and several touchpoints with particular focus on information or interventions Philips currently provided, potentially influencing the divestment phase.

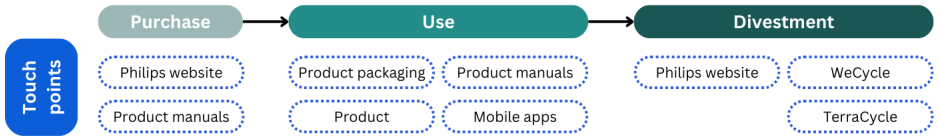


Figure 14: Philips touch points explored during service safari

The activities carried out on this subchapter aims to answer these following research questions:

- *RQ1: How does Philips Sonicare currently address divestment during the purchase and use phases?*
- *RQ2: What divestment options are currently available to Philips Sonicare consumers, and how they might experience them?*
- *RQ3: What are the identified gaps and opportunities from Philips Sonicare purchase, use, and divestment phases?*

4.2.2 Purchase Phase

The purchase phase starts with the author's exploration on Philips Sonicare products, including the toothbrush set and the brush head webpages. The Sonicare 7100 toothbrush set and Sonicare A3 brush head were purchased. Since Philips lacks a dedicated physical store, the purchase was made through Philips online store.

Touchpoint: Toothbrush Set Webpage

Information at glance focused on product benefit and features, guidance on recycling is lacking

Shown by Figure 15, observation on Philips Sonicare 7100 webpage revealed that most information provided at glance is highlighting the product's benefits and features. No visible information on product disposal recommendations was found on the page.

After spending some time exploring the product page, information about disposal was finally located within the product support page, inside the user manual document (Figure 16). Aside from informing that products with e-waste label cannot be disposed of with household waste and that collection must comply to each country's regulations, further guidance, such as how and where e-waste shall be disposed is not provided. Consequently, the author, and possibly other consumers, are left to complement these information independently.

Figure 15: Philips Sonicare 7100 web page (Philips, n.d.-e)

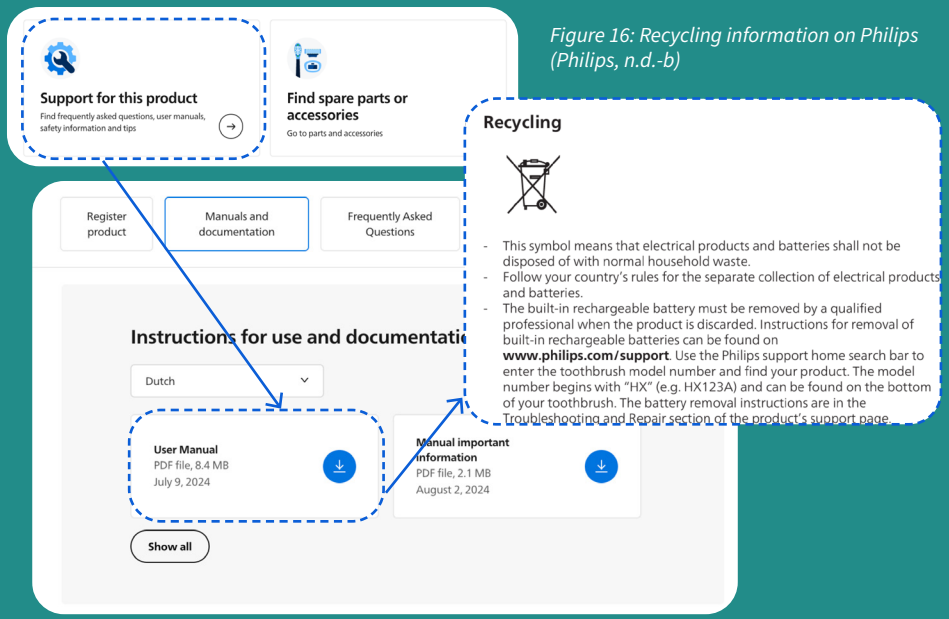


Figure 16: Recycling information on Philips (Philips, n.d.-b)

Touchpoint: Brush Head Webpage

Poor visibility and lack of information on existing brush head collection program

Information about Philips Sonicare brush head collection program with TerraCycle was found on the brush head product web page, as illustrated by Figure 17. However, consistent with previous insight, the section dedicated to this initiative differs significantly from the product features. It took a while to realize that this section exists within the page. Furthermore, key information about the collection program—such as its benefits, further treatment of collected brush heads, and collection methods—is not integrated to this page. Separate exploration on TerraCycle website has to be done to gain further information.

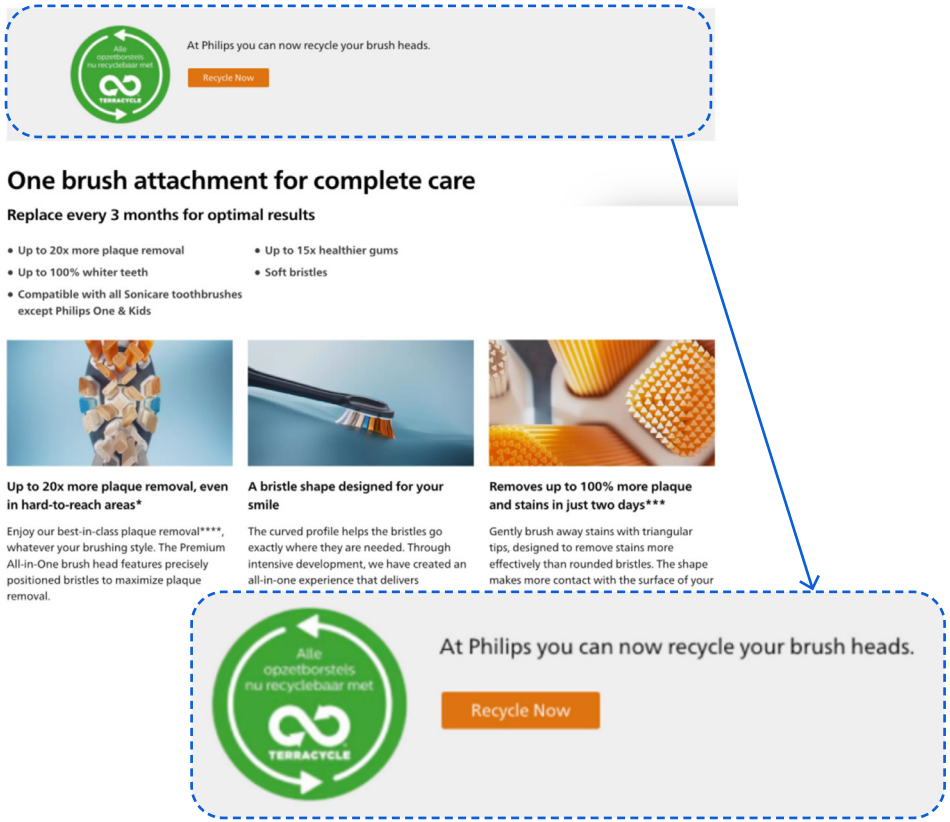


Figure 17: Information about TerraCycle brush head collection on Philips Sonicare brush head web page (Philips, n.d.-d)

4.2.3 Use Phase

During the use phase, the author receive the product, unbox it for the first time, and interact with it. The touch points observed includes the product packaging, manuals, the products themselves, as well as the mobile apps provided for the particular model of Sonicare 7100.

Touchpoint: Packaging and Products

Lack of e-waste label on brush head body

Shown by Figure 18, observation on the product packaging revealed that information of product end-of-use is provided through labels. The e-waste label, previously found during the purchase phase, was found on both the electric toothbrush set and brush head packaging.

Figure 18: (a) Philips Sonicare electric toothbrush set
(b) Brush head replacement (photo by the author)

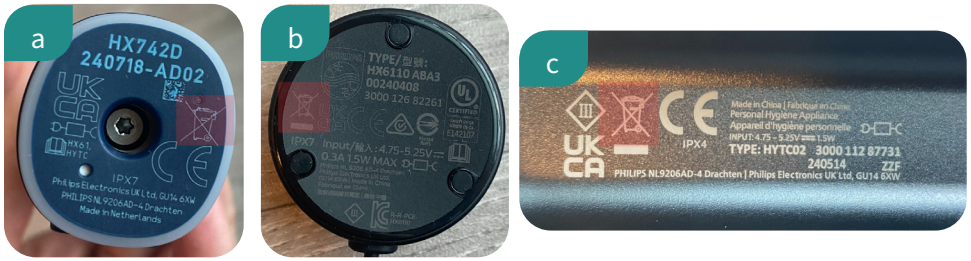


Figure 19: (a) Label found on the power handle
(b) Label found on the charging dock (middle)
(c) Label found on the charging case (photo by the author)

As illustrated by Figure 19, the e-waste label consistently present on the products' exterior body, including the power handle, charging dock, and travel charging case. However, this is not the case for the brush head. Upon closer observation, the e-waste label is missing from the brush head body, as shown on Figure 20.

Figure 20: Front and back side of Philips Sonicare brush head (photo by the author)

Touchpoint: Manuals

Extra effort required to find the e-waste label meanings

While consistent e-waste label is provided on the packaging and the products (excluding the brush head), extra effort is required to find what the labels actually meant for the product, possibly influencing the overall cost to dispose of the products responsibly.

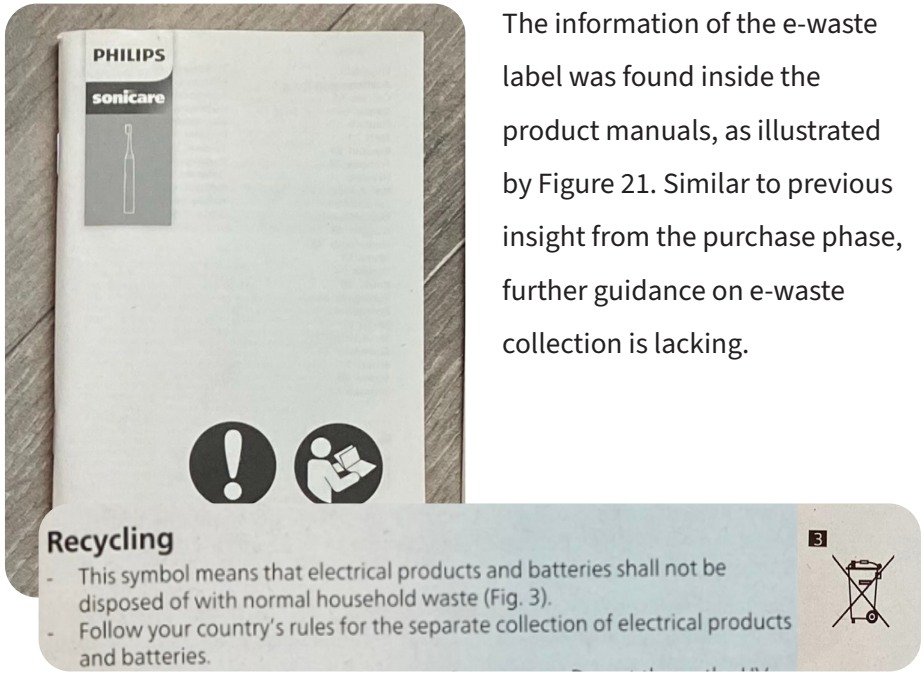


Figure 21: Recycling information found on Philips Sonicare manuals (photo by author)

The information of the e-waste label was found inside the product manuals, as illustrated by Figure 21. Similar to previous insight from the purchase phase, further guidance on e-waste collection is lacking.

Figure 22: Brush head disposal direction on Philips Sonicare manual (photo by author)

Contradictory guidance on brush head disposal

One leaflet that came with the packaging, illustrated by Figure 22, shows a direction to dispose of used brush heads in what seems to be the general waste bin. This is contradictory to the information previously found during the purchase phase, which is to return used brush heads to TerraCycle.

Touchpoint: Mobile Apps

Lack of divestment integration

Philips offers a mobile app that can be connected via Bluetooth to certain model of Sonicare device, including the 7100 model. Within this app, consumers can monitor their brushing behaviour and receive tips on proper dental care, as illustrated by Figure 23.

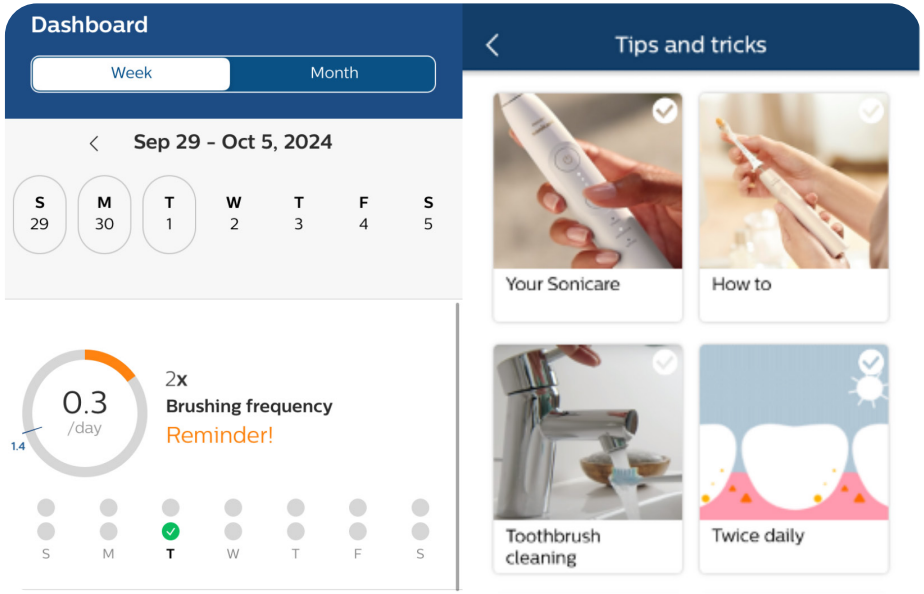


Figure 23: Brushing frequency track and dental care tips and tricks within the Philips Sonicare mobile application

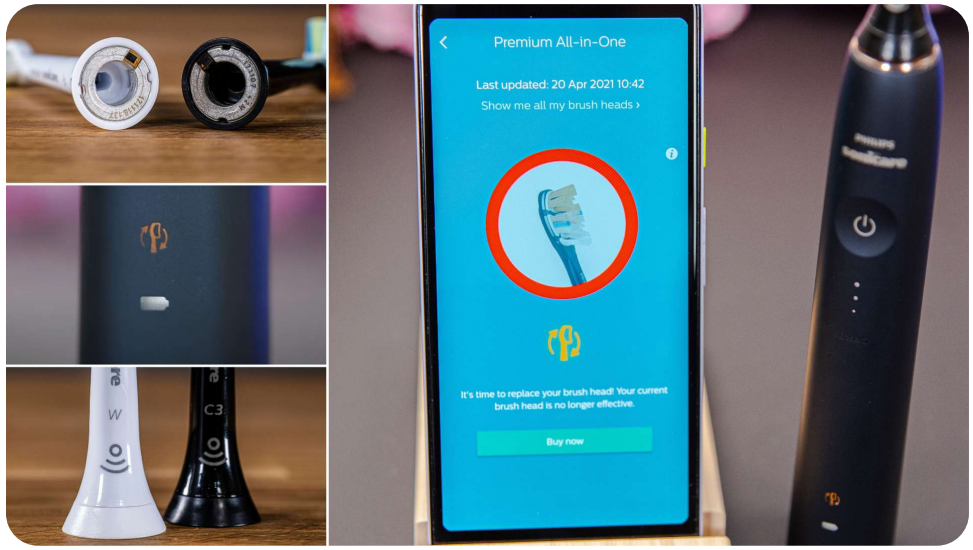


Figure 24: Philips Sonicare mobile app during brush head end of use (Love, 2024)

During brush head end-of-use, the app notifies consumers to replace their brush head, with a provision of direct link to purchase a replacement, as illustrated by Figure 24. However, despite the smart recognition on brush head replacement, there is no further information or guidance on how to dispose of the used one responsibly.

4.2.4 Divestment Phase

Lastly, the author engaged in the enactment of divestment phase of Philips Sonicare. As mentioned in 1.3, this project focuses on electric toothbrush that the use is ended by consumers, which may occur due to product malfunction, technological obsolesce, or demand for additional features. During this phase, the author imagined a situation where product use is ended, with one particular question kept in mind: *"How do I, as a consumer of Philips Sonicare, should separate from the products?"*.

Philips Sonicare Existing Divestment Options

The author's desk research on existing Philips Sonicare divestment options primarily based on purchases made through the Philips webstore in the Netherlands, where product returns follow a '30-day policy'. Within this period, consumers can change their minds and return the product to Philips for a refund. As shown by Figure 25, return reasons vary, including product damage or changes in consumer preferences.

After this period, consumers experiencing product defect can claim a warranty to Philips for up to two years. A discussion with Philips' representative revealed that after warranty claim is validated, a new product replacement will be sent. However, how consumers divest from their old devices is not a straightforward matter, as it depends on the terms and conditions of the retail channel and the country of purchase.

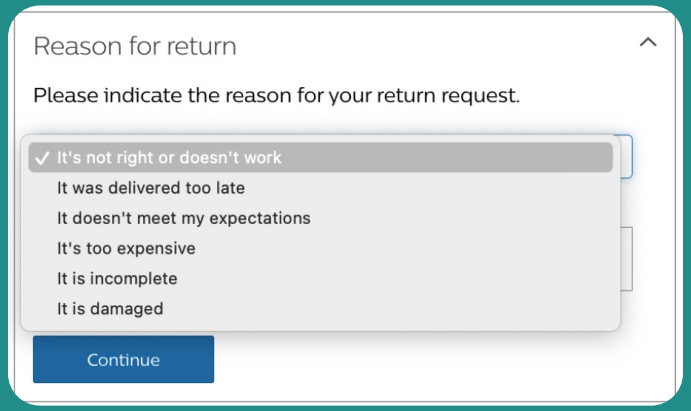


Figure 25: Reasons for Philips Sonicare product return within 30-days policy

In the Netherlands, ways to properly divest from Philips Sonicare components are through WeCycle or TerraCycle collection. Each of these options was tried out by the author and detailed in the next sections.

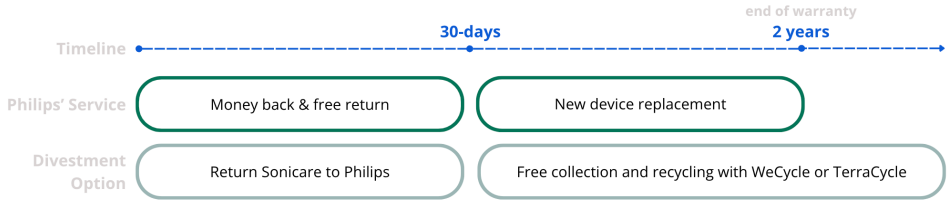


Figure 26: Illustration of Philips divestment option according to purchase timeline.

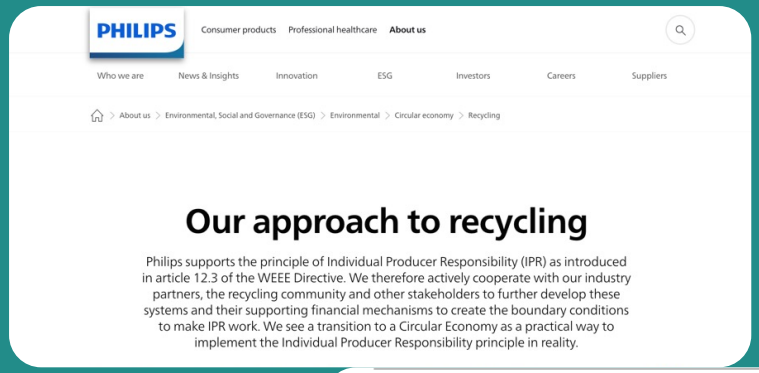


Figure 27: Philips recycling information per country (Philips, n.d.-c)

WeCycle Collection

Throughout the purchase and use journey, Philips only provides general information on recycling without giving further instruction. The author conducted additional research to find information about specific regulation on e-waste collection. Shown by Figure 27, detail about e-waste collection in the Netherlands being managed by WeCycle is only available on a separate page (Philips, n.d.), unintegrated to both the purchase and use journey.

Stiching OPEN and WeCycle

Stichting OPEN (The Organisation for Producer Responsibility for E-waste Netherlands) is the organisation responsible for e-waste collection in the Netherlands on behalf of all producers. It operates under the customer-facing name of WeCycle and has approximately 13,000 collection points throughout the Netherlands (Stichting OPEN, n.d.).

Collection Program

There are two ways of collection found during the desk research. First, WeCycle's 'old for new' program was identified, where consumers can return both large and small e-waste when purchasing a new appliance through certain online stores (WeCycle, n.d.-b). However, through contact with two stores, detailed in Appendix B, it is revealed that ordering new electric toothbrush alone does not allow consumers to return an old one, as deliveries are handled by third-party carriers like DHL and PostNL. Returning small appliances seems possible only when a large appliance is ordered, as delivery is directly handled by the store. For this reason, this first collection option was not explored.

The other method widely known–drop-off collection points, was explored by the author and detailed in the next sections.

Service Safari: WeCycle Drop-off Collection

The service safari to WeCycle box began with a desk research to identify nearby locations, followed by a field visit. Delft was chosen for the service safari, as it is the city where the author resides.

Extra effort required to check product acceptance, as not all collection boxes eligible for small electronic devices

Within the WeCycle website, six collection points were found in a familiar shopping area within 5-minute walk from the author's home. Upon arriving at the area, two collection boxes were easily found. However, through observation, it seemed that these boxes only accepted lamps and batteries, as shown from the labels provided (Figure 28).

Feeling confused and unsure if small e-waste can be collected here, the author decided to return home. The WeCycle website was then rechecked more thoroughly, where it turned out that not all collection points accept small appliances, which explained the earlier confusion.

Figure 28: Visited WeCycle collection points (photo by the author).

TerraCycle Collection

Throughout the purchase journey, a brief mention of TerraCycle was found on the brush head product web page, but Philips does not actively prompt consumers to explore it further. As a result, consumers must independently visit the TerraCycle website to find more details about the program.

Figure 29. Philips and TerraCycle collection program poster (Priory Dental Care, n.d.).

TerraCycle

TerraCycle is a recycling company that specializes in recycling hard-to-recycle materials that local centres usually don't accept, ranging from beauty product packaging, toys, crips packets, contact lenses, to dental care products (TerraCycle, n.d.-b). Collected waste are extruded into plastic pellets, which then used to create new products from outdoor furniture, flooring tiles, to playground surface covers (TerraCycle, n.d.-a).

Collection Program

As illustrated by Figure 29, in the context of Sonicare, only brush head is eligible for collection. Individuals can either dispose of their waste physically by visiting nearby collection point or send their waste via mail. Additionally, individuals can become public collection points by registering their address (TerraCycle, n.d.-b). Reward is offered for individuals collecting via mail or for those who become a public drop-off. For every kilogram, 100 points are earned (1 point is equivalent to €0.01), which can be redeemed for charitable donations. (TerraCycle, n.d.-b).

Service Safari: TerraCycle Drop-off Collection

Similar to the WeCycle's drop-off collection service safari, this service safari started with checking the nearest collection points and followed up by direct visit. Delft area was also chosen, with dental practice located at Kampveld specifically visited.

As shown by Figure 30, the materials used for this service safari included one manual toothbrush and one brush head. During this phase, the waste was prepared by a quick rinse–which was performed intuitively–and then sealed in a plastic zip lock bag to prevent any residue from leaking.

Figure 30: Prepared waste for TerraCycle service safari (photo by the author)

Limited collection points located in less strategic places

Despite having 73 collection points in the Netherlands, only two were found in Delft, both located at dental practices. Unlike WeCycle, where collection points are located near grocery stores or other frequently visited spots, TerraCycle points are not located in convenient areas, which makes it difficult for the author to combine the trip with daily errands.

Lack of support for collection: absence of collection box and poor staff knowledge on programs

Upon arriving at the destination, the author started with a search for the TerraCycle box near the entrance. Since no box was found, the search continued to the second floor, where the dentist practice is located. Unfortunately, as shown in Figure 31, no collection box was available there either.

Not wanting to bring the waste back home, the author decided to ask the front desk person who turned to be unfamiliar with the program. After a call is made, it was discovered that the dentist is familiar and knows the program. However, with the collection box not provided, the waste was handed over manually to the nurse.

Figure 31: TerraCycle drop-ff collection point– dental practice waiting room (photo by the author)

Service Safari: Mail Collection

The process of mail collection starts with an account creation on TerraCycle website, followed by a request for shipping label creation, and shipment.

Necessity to print out shipping label: additional effort potentially delaying collection

After account is created, the author requested for a free shipping label which lasts for 14 days. Up to this point, the process was quite smooth and easy. However, the requirement to print the label adds an extra step to the process. For those without access to a printer at home, including the author, this step may involve going to an office, university, or another location with printing facilities, making the process less convenient and potentially causing delays in return.

Delayed reward points: intangible incentive reduces motivation

According to TerraCycle website, after being sent, it took up to 30 business days for mailed waste to be processed and for reward points to be credited to the account. With such a long wait and no immediate tangible benefit, the incentive feels abstract and unmotivating.

Key Takeaways: Philips Exploration

RQ1: How does Philips Sonicare currently address divestment during the purchase and use phases?

From the author's observation, it is clear that Philips primarily focus on engaging consumers during the purchase and use phase. Properly disposing Sonicare is not prompted nor triggered by Philips. The divestment of Philips Sonicare is thus detached from the other phases, with information on proper product disposal limited to the use of e-waste label.

RQ2: What divestment options are currently available to Philips Sonicare consumers, and how they might experience them?

Currently, Sonicare collection is facilitated through WeCycle and Terracycle. However, the overall disposal process of Philips Sonicare components requires significant effort, from finding relevant information (which often times not easily accessible), printing shipping labels, and navigating to collection points. The location of collection points is also a critical factor, with limited numbers and poor accessibility force an additional effort of managing the trips to collection points. Due to this, storing items in a drawer or disposing them in the bin may become a more convenient alternative for divesting from Sonicare.

RQ3: What are the identified gaps and opportunities from Philips Sonicare purchase, use, and divestment phases?

Aside from providing collection services and reward points offered by TerraCycle, looking back to the discussion in 3.3.3 on disposal influencing factors, Philips is currently lacking on multiple factors:

- Information about product collection is not readily available. The mental burden of figuring out 'how to' and 'where to' participate in collection is placed on the consumers.
- Inconsistency in product-related information (disposal recommendation for Sonicare brush heads).
- The environmental impact from careless disposal is not highlighted.

Summing up, the cost needed for consumers to practice the proper disposal of Sonicare is high. Without prior knowledge, skills are needed to identify waste types, collection programs, collection points, and so on. This presents an opportunity for Philips to came up with a practice reconfiguration that provide consumers with thorough support. Further activities in this project will uncover more insights about the practice and inform how a reconfiguration can work for Philips Sonicare.

4.3 Similar Practices Exploration

This subchapter first explores how other electric toothbrush brands are addressing divestment (e.g., options, strategies) and how they might align with previous influencing factors identified. To seek for more inspiration, an exploration to a different setting is done by briefly exploring Malaysia's social enterprise.

4.3.1 Competitor Exploration

Brands that are analysed for the competitor exploration are Oral-B, Boombrush, and SURI. Oral-B was chosen due to its head to head competition with Philips in electric toothbrush market, while the other brands were chosen for their commitment to sustainability, which suggests they may have a more environmentally friendly approach to product disposal.

The exploration was conducted primarily through online sources, including brand websites, FAQs, and user reviews. Additionally, data from a Philips representative's analysis of a purchased SURI toothbrush was utilized. To gain firsthand experience, the Boombrush brush head subscription was also tried.

This subchapter aims to answer the following question:

RQ4: What are the current strategies of other electric toothbrush brands in supporting consumers' divestment phase?

Product take-back is offered as an option for divesting from product

First, all the brands explored offer a product take-back strategy, allowing consumers to return used items directly to them. This includes broken products that are still under warranty, which partly differs from Philips' current approach (only higher-priced products requires return).

Compared to the sustainable brands, Oral-B's approach in product take-back remains largely manual. As shown in Figure 32, Oral-B only provides an address for product return, meaning that consumers are responsible for selecting a courier, preparing the package, and arranging the shipping label themselves.


They recycle your old electric toothbrush including charger into new raw materials if you hand it in at a Wecycle drop-off point. You can find a drop-off point near you **here .**

You can also send us your old electric toothbrush and we will ensure that the electric toothbrush is recycled correctly.

The address is:

Oral-B Netherlands
attn. Recycle Oral-B
Reply number 184
3000 VB Rotterdam

Thanks for recycling!

Wecycle & Oral-B

Figure 32: Oral-B recycling information page (Oral-B, n.d.-b)

Environmental impact from irresponsible disposal of product is communicated to consumers

SURI consistently communicates the environmental risks associated with improper disposal of toothbrush. Shown by Figure 33, within the product page, SURI displayed an information and video illustration regarding the considerable number of toothbrushes that will be thrown away this year.

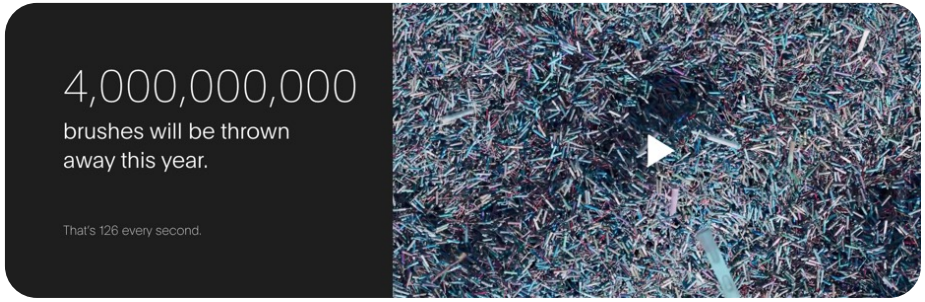


Figure 33: Toothbrush waste generation information on SURI product page (SURI, n.d.).

Consistent message is also communicated through SURI's actual product. As illustrated by Figure 34, SURI's electric toothbrush came with one leaflet that encourage consumers habit in taking care of the device, including properly disposing of the used parts. Moreover, words such as "you're part of the solution" is used by SURI, potentially prompting consumers to be aware of their actions during the divestment.

Figure 34: SURI's product leaflet (photo by Philips representative).

Free shipping and simplified return packaging

In terms of the take-back shipping cost, Boombrush and SURI (UK and US) offer free shipping, enabling consumers to return products at no cost.

As shown by Figure 35a, SURI provides a pre-paid mailer bag (US and UK only) for brush heads collection (SURI, n.d.). Similarly, Boombrush offers a pre-paid bag from (Figure 35b), which is given within the first purchase of the electric toothbrush or through the brush head subscription (Boombrush, n.d.). If consumers wish to return used brush heads, they can place them in these bags and send them back via the partnered courier service. For Boombrush, return is done via PostNL mail box.

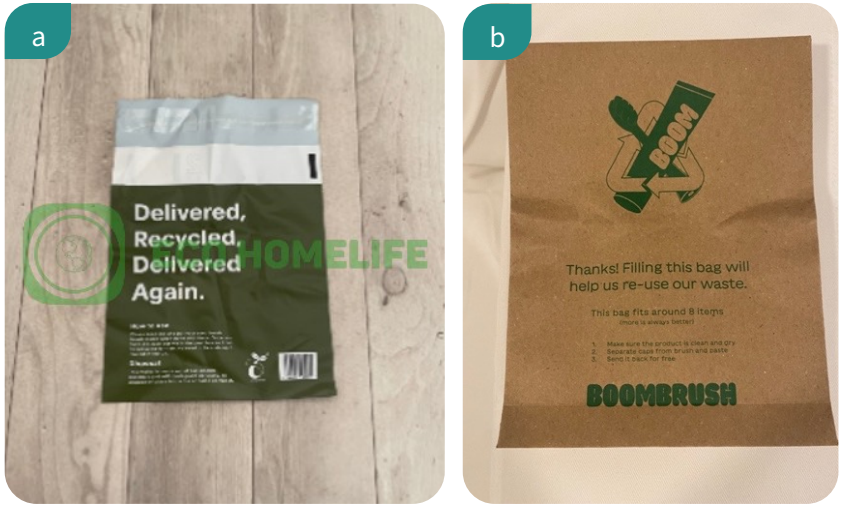


Figure 35: (a) SURI pre-paid mailer bag (Eco Homelife, 2024)
(b) Boombrush pre-paid mailer bag by (photo by author)

Trade-in for a discount

Boombrush introduced a trade-in initiative, allowing consumers to return their old electric toothbrush (regardless of the brand) in exchange for a discount on a new Boombrush product. This campaign was run in November 2024 and called as 'Green Friday' as opposed to 'Black Friday'.

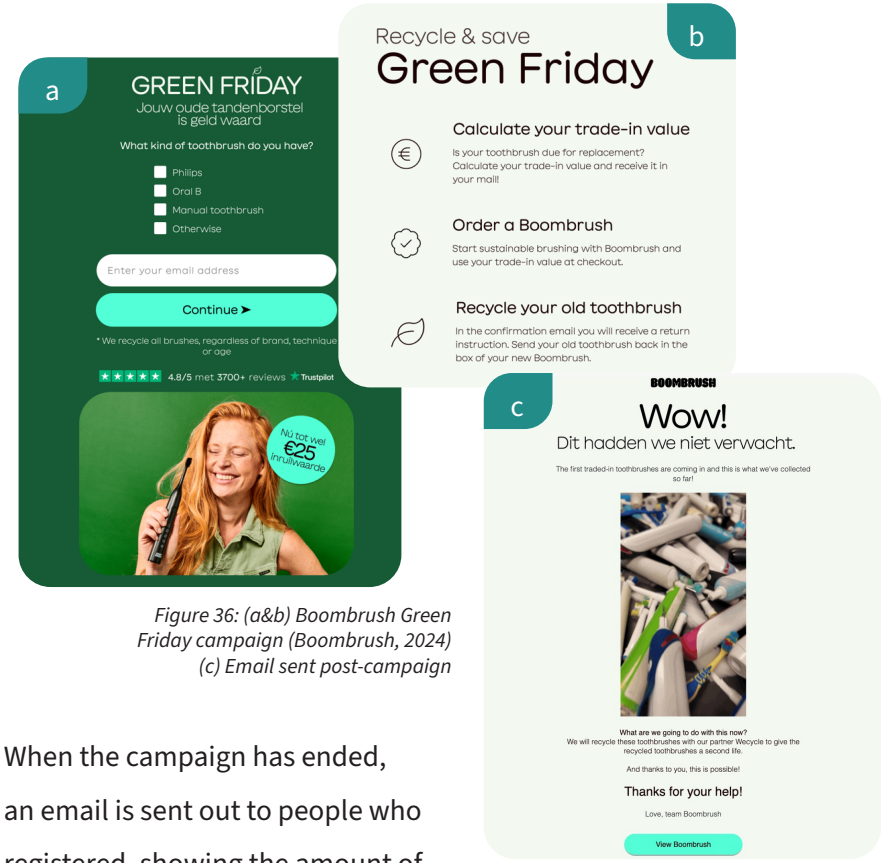


Figure 36: (a&b) Boombrush Green Friday campaign (Boombrush, 2024)
(c) Email sent post-campaign

When the campaign has ended, an email is sent out to people who registered, showing the amount of waste collected and informing that further recycled would be done through WeCycle (Figure 36c).

4.3.2 Other Practice: Malaysia's E-waste Recycling Through Heroes (ERTH)

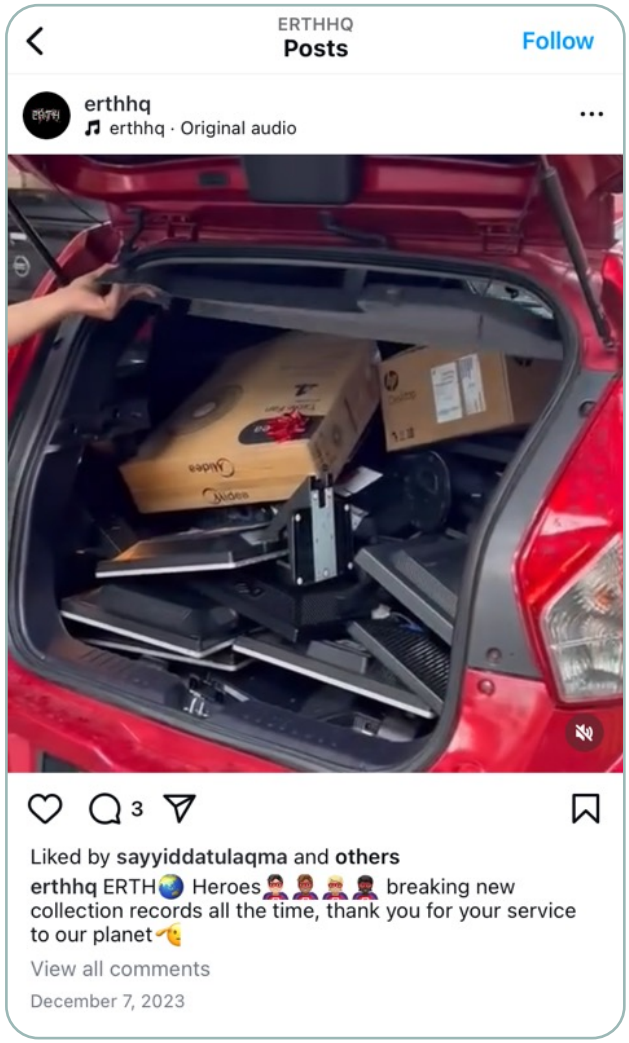


Figure 37: Electronic devices transported by ERTH's heroes (ERTH, 2023).

ERTH, which stands for E-waste Recycling Through Heroes, is a social enterprise based in Malaysia that is focused on collecting e-waste from homes and businesses from ending up in the landfills or informal sectors. Though Malaysia has an existing collection and recycling system, 'the gap between suppliers and recycling factories remains a problem' (Tatler Gen.T, 2022). Since 2019, ERTH diverted more than 1 million kilograms of e-waste from the landfills (Invest KL, n.d.).

ERTH reintroduce traditional rag-and-bone collector in a modern, digitalized way, through pickup service mediated by local freelancers called as 'heroes'. After pickup request is made, a hero then do a home visit, meet citizens in person, and transport the e-waste to ERTH's sorting facility.

Monetary incentive is offered, which encourages participation. However, this might not be the sole influencing factor. It is worth to highlight the other senses built by ERTH. The term 'heroes' used suggests that participants are part of a meaningful, larger mission. Collecting e-waste not only financially benefits citizen but also save the environment and supports local freelancers by providing them job opportunities. Additionally, the involvement of human during collection turns out to be meaningful, as citizen often mentioned having a pleasant interaction with the heroes, leading to consideration of using ERTH in the future days.

Key Takeaways: Similar Practices Exploration

Key Takeaways from Competitors

RQ4: What are the current strategies of other electric toothbrush brands in supporting consumers' divestment phase?

From the observation, it is clear that other electric toothbrush brands, particularly the sustainable ones, have implemented strategies to address the divestment phase of electric toothbrushes:

- All brands have implemented a take-back collection system, allowing consumers to return used products back. While the effectiveness of such program is yet to be known, a take-back system allows the brands to tailor the divestment experience and interventions for their consumers.
- The purchase and use phase are utilized by the brands as a point to engage consumers in the divestment process (e.g., sending return bag along with the new product).
- The brands have tackled several influencing factors, such as highlighting the environmental risks associated with improper disposal, simplifying packaging to make collection more convenient, offering cost-free collection options, and providing economic incentive.

Collectively, these approaches could encourage consumers to collect their old electric toothbrushes rather than leaving them unused or disposing them in general waste.

Key Takeaways from Other Practice

Learning from ERTH, the reintroduction of the modern rag-and-bone man to the frame of e-waste collection practice brings back the human touch element that is missing from simply collecting e-waste in a box. Moreover, the sense of community and a part of something bigger fostered through the program creates a new image surrounding e-waste collection, from a potentially burdensome task into a meaningful activity that benefits both the community and environment.

4.4 Consumer Research

To gather more comprehensive insights to the practice of divesting from electric toothbrushes, in-depth interviews were conducted. This chapter aims to provide analysis of the findings from these interviews, mapping them to the cognitive model of divestment.

The overarching question to be answered is:

RQ5: How do consumers currently experience the divestment from electric toothbrushes?

4.4.1 Online Questionnaires

Initially, an online questionnaire was distributed within the author's closest network, serving as a tool to grasp an overview of consumer behaviour related to the divestment of electric toothbrush, identify in-depth-interviews direction, and find potential participants for further study. It covered questions about demographics, electric toothbrush usage (e.g., brand, duration), and replacement and disposal practices (narrowed to the brush head and power handle).

A total of 62 people responded to the questionnaire, all of whom were electric toothbrush users from various brands, with Oral-B and Philips being the most common. Most respondents belong to the age group of 20-29 years old, with electric toothbrush usage period ranging from 1-2 years to over 10 years.

Power Handle Replacement and Disposal

Most respondents have not yet replaced their power handle. Among those who have, the primary reasons for replacement were product malfunction or a noticeable decline in function. Other reasons included the need for an upgrade or issues such as the handle becoming too dirty or sticky. In terms of disposal behaviour, while some mentioned recycling or categorizing the power handle as e-waste, this was not a strong emphasis. A notable number of respondents admitted to storing the old power handle or forgetting about it entirely, suggesting that it often remain unused rather than being properly disposed of.

Brush Head Replacement and Disposal

Respondents noted that their decision in replacing brush heads was often influenced by the appearance of the bristles. Some also mentioned time-based approach, with three months being a common interval, consistent with the general recommendations. For disposal, almost all indicated that they discarded together with household waste. A few participants took step to dispose of the used heads in the plastic category (recycle), which is unfortunately incorrect since current disposal must be done together with regular household waste (The Hague International Centre, n.d.).

4.4.2 In-depth Interviews

Participants & Set Up

Seven interviews were conducted with participants recruited through the survey and personal network. Participants' ages range from 20-24 to 30-34 years old, with 25-29 being the average. This represents Philips' Sonicare focus segment–younger-skewing. All participants currently live in the Netherlands and have been residing here for at least one year.

All participants are currently using electric toothbrush with usage periods ranging from 1-2 years to more than 5 years. Since the aim of the in-depth interview is to understand the practice of divestmenting from electric toothbrush, participants were not limited to Philips Sonicare users.

From seven participants, three have gone through the divestment phase, two is currently in the process, and the remaining two have not yet reached it. To address this gap, participants who have not yet experienced the divestment phase is asked to reflect on their last divesting experience from small electronic device and consider how they might respond if the same situation occurred with their electric toothbrush.

The complete set of questions are detailed in Appendix C.

Data Analysis

Data were captured through audio recordings and transcribed into text. The transcriptions were reviewed multiple times, then key insights and patterns are abstracted as a statement card. Lastly, the insights are clustered into the cognitive model of divestment stages.

Divestment Mapping

Six divestment phases, previously explained in 3.2, are simplified by the author into four, as illustrated in Figure 38.

In the context of electric toothbrush divestment, the author observed that the search for and evaluation of divestment options occurred almost at the same time. Unlike mobile phone divestment, where the search and evaluation phases tend to be more deliberate and time-consuming, these steps are comparatively brief for electric toothbrushes. Thus, the second and third stages were combined. Additionally, the fifth and sixth stages were merged based on the author's prior service safari, which revealed that the overall impression of the divestment outcome was formed at the moment of final separation from the product.

Overall, the simplification of these steps allows for a more focused analysis of insights without becoming too preoccupied with the specific categorization of each step.

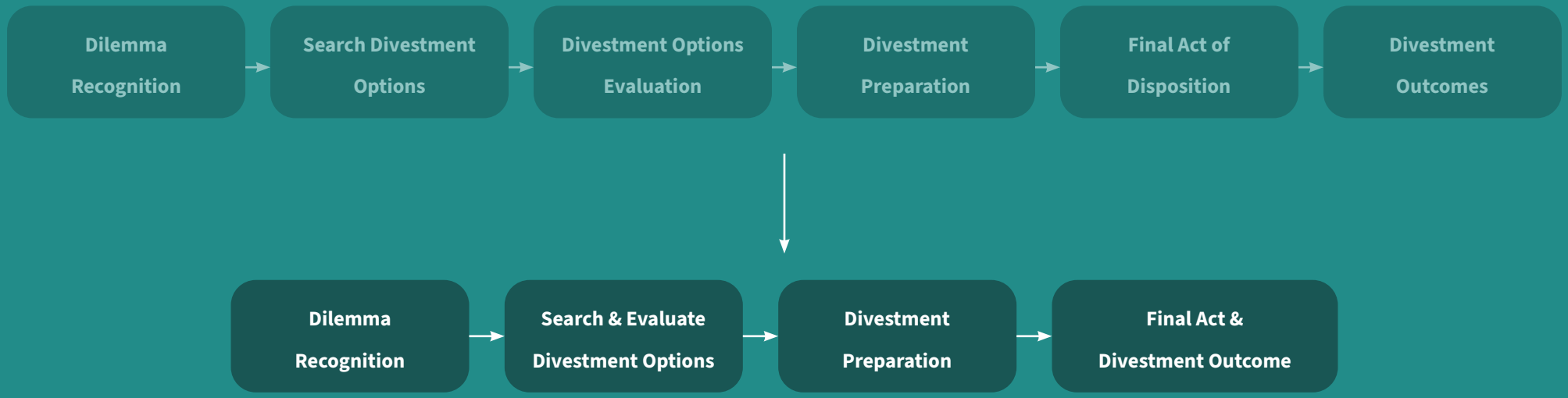


Figure 38: Cognitive model of divestment steps simplification

Dilemma Recognition

This section starts with discussing the varied timing and reasons behind ending the use of electric toothbrush. It then delves closely into participants' perceptions of electric toothbrushes.

Different Timing and Reasons for End-of-use

Distinct reasons for ending the use of electric toothbrush was revealed. For the main power handle, the primary replacement trigger is product malfunction–once it no longer functions as expected (significantly disturbs their routine), it is discarded. One participant noted that despite battery life decline, leading to frequent charging, they plan to continue using the electric toothbrush until it fully dies. Upgrading due to weak motor was also mentioned, but this appears less common.

Meanwhile, brush heads are treated more like consumables, with appearance as the primary replacement reason. Some participants using other brand take the colour change in bristles (green to yellow) as the indicator for replacement. Additionally, two participants using Philips Sonicare noted reliance on light indicator provided by the power handle to prompt for brush head replacement.

None of the participants reported issue with additional accessories (e.g., charging dock), which may suggest that these components are generally durable and less likely to require replacement.

Associated Negative Emotions & Practical Role of Electric Toothbrush

From the online questionnaires result and conversation with Philips representative, it appears that once individuals switch to electric toothbrush, they tend to stick with it and rarely go back to the manual.

Since brushing teeth is a daily, often automated task, a malfunctioning device feels particularly intrusive. A participant described their experience of a malfunctioning electric toothbrush button as frustrating:

> *"It kind of broken gradually, I think it's the button kind of stopped working, and I got a bit **frustrated**, and I think I just decided to get a new one"*

Despite the lock-in effect, electric toothbrush does not seem to carry significant emotional attachment. They are primarily seen as practical items. When end-of-use is decided, individuals are likely to make an immediate replacement to restore routine stability, without hesitation or delay. Compared to phones, which may hold a certain emotional value and often involve a more considered decision due to their higher price, replacing an electric toothbrush involves no lengthy decision-making process or waiting for a better deal:

> *"Even if it's like something that I have to wait a week and then I get a better deal, **I wouldn't wait**, I would just get it because it doesn't matter to me. Versus like if it was a phone, I would wait, like I will just manage somehow, because also the price difference and also the urgency I think would be different."*

Search & Evaluate Divestment Options

The discussion of findings from this stage starts with how waste management habit influences consumers in divesting from electric toothbrush. It then goes deeper into insights about the importance of waste type awareness, barriers to collection, and influence of divestment integration into the purchase phase.

Influence of General Waste Management Habit on E-Waste Divestment

For those who regularly manage waste by regulation, divesting from electric toothbrushes and other electronics felt both conscious and natural. They have the capability to dispose e-waste responsibly, including the knowledge of collection programs, drop-off points, and environmental benefit. They also recognize that responsibly disposing e-waste may not be the most convenient option, but willing to do so, which likely influenced from their routinized behaviour of separating and throwing household waste per category.

Importance of Waste Type Awareness

Search on how to divest from electric toothbrushes is inseparable with the awareness of the waste type itself. In other words, knowing what to do with the waste starts from knowing what type of waste it is. During the interviews, participants recognized that power handle is classified as e-waste without relying on labels, as it is dependable on electricity to work.

However, when it comes to brush heads, some participants were uncertain whether it falls under the same classification. As a result, some participants still kept their used brush heads at home, waiting for clarity on how they should be disposed of.

> *"I think I have two used brush heads at home I have not disposed it yet … I do have a thought in my head, like, where should I dispose this? Is it considered as e-waste?"*

Barriers to Electric Toothbrush Collection

The Need to Visit Collection Points

It is revealed that one participant has kept their broken electric toothbrush at home for about four years without disposing it. The participant expressed that while they recognize the importance of proper e-waste disposal, the perceived effort and inconvenience of doing so, notably the need to visit specific collection points, holds them from taking action:

> *"As I said before, electronic waste, I do not throw them easily into the general waste … but **you don't have those points everywhere**, so I just got lazy, so I didn't actually go to an electric waste…"*

This insight is in line with previous findings noted in 3.3.3, where convenience, including accessible collection points, plays an influencing factor in e-waste disposal choice.

Environmental Risk Awareness

A lack of awareness regarding the risks of careless disposal is found to be another barrier. One participant expressed uncertainty about potential hazards, revealing contrasting views on larger and smaller e-waste appliances. They voiced some concern about disposing of their used air fryer in the general waste, wondering if it might 'explode' or cause harm, yet they felt no such concern for smaller items like batteries:

> *"Or let's say with the air fryer, what would go wrong if I put it on the general container? Will it explode? But for small items like batteries, if they explode, you know… I don't think it will be that bad."*

Expectation for 'Something in Return'

During the interviews, participants' opinions were asked about a take-back service for electric toothbrushes. Surprisingly, compared to general household or e-waste disposal, some participants perceive the concept of take-back service as an exchange rather than a mere disposal process. Expectations of receiving something in return—such as monetary gain—often arise:

> *"If there's no incentive for me, I think I would less likely participate in the program. But if there is a benefit for me let's say an incentive or a discount then it might be interesting. It's not the amount of money, but, you know, having something in return."*

This expectation of something in return may stem from a desire to offset the effort involved in the return process, creating a feeling that the action is 'worth it'. Additionally, participants may perceive the value of used electric toothbrushes differently once the brand expresses interest in taking them back (a sign that the items still hold some worth). One participant mentioned that an incentive would help offset the annoyance of dealing with defective product that is no longer under warranty:

> *"But I think that assuming it's not my fault, it just broke out of warranty, I would feel a bit annoyed, so I would want something in return."*

Additionally, since all participants are living in the Netherlands, this expectation could also stem from their familiarity with the Statiegeld program, a deposit-return system that adds a small fee to beverage containers and refundable when returned (Statiegeld Nederland, n.d.), creating a sense of monetary reward. However, when asked directly about monetary gain, their responses were somewhat more reserved, showing that convenience and receiving something in return (non-monetary) as stronger motivators:

> *"I think monetary is not something that will drive me solely. It is I think mostly about convenience. I think monetary I mentioned is because I thought it was kind of nice as a byproduct, that, OK, you're doing something good like that'll make you feel good but then you also like **rewarding you for being nice**…"*

> *"It's not the amount of money but you know **having something in return**."*

Hygiene Concern

When asked about possible drawbacks from electric toothbrushes take-back service, or what might stop them from participating, some participants mentioned that clarity regarding what happens after collection must be addressed:

> *"I'm not sure how are they gonna deal with the like the brush heads, like, are they going to recycle them or are they gonna put them in other use… that's something I would worry about"*

> *"Harshly speaking, used brush head is from people's mouth…"*

This insight, while focused on brush heads, reinforces the hygiene concern associated with electric toothbrushes, as previously discussed in section 3.3.1.

Integration of Divestment in Purchase Phase

Prior experiences with any product take-back programs were also asked. One participant highlighted their involvement in a skincare bottle collection initiative from a beauty brand, noting that their awareness of such program was built early in their purchase journey. The participant vividly recalled seeing a take-back poster at the store cashier:

> *"I remember that when I was purchasing … there was a **sign right next to my cashier** saying that … OK, empty bottles, so it was like very correct and like the context was perfect"*

Divestment Preparation

This section begins by examining how the nature of e-waste leads to the integration of disposal with other daily tasks. Then, the less deliberate nature of preparing for divesting from electric toothbrushes is highlighted, along with a different approach taken for brush head disposal preparation.

Small E-waste Disposal as a Contextual Activity

Participants frequently noted that their approach to small e-waste disposal differs significantly from general waste. General waste is typically disposed of regularly due to issues like odour and volume, which increases the urgency of its disposal. This discomfort leads to the disposal happening any time, without necessarily being incorporated into other activities.

In contrast, small e-waste causes less discomfort due to its lack of odour and minimal space occupation. Notably, the need to visit a dedicated collection point makes small e-waste disposal a more deliberate activity, often planned alongside other tasks such as shopping for groceries or going to a campus.

Less Deliberate Preparation for Divesting from Electric Toothbrush

As this project focuses on the case where consumers deciding to end the use of their electric toothbrushes, the divestment preparation observed in the interviews was minimal. Unlike ending the usage of electronics devices, such as laptops, which require deliberate preparations (e.g., removing important data or factory resets), ending the life of an electric toothbrush typically does not involve such steps.

Uncertainty of Proper Disposal Leads to Temporary Storage

One form of divestment preparation observed in the interviews related to brush heads. As mentioned in *Search & Evaluate Divestment Options*, some participants kept their used brush heads due to confusion about how to dispose of them. One participant created informal storage by using a plastic zip-lock bag to temporarily store the used brush heads, indicating a need for clearer disposal guidance or alternative collection options.

Final Act & Divestment Outcome

This section starts with insights on the final disposal method chosen by participants to divest from electric toothbrush, prompt needed for final action, and the outcome of divestment.

Final Act on Electric Toothbrush Disposal

The methods of disposing of electric toothbrush components vary. Among those who have divested from the power handle, two participants still stored their devices, one forgot about it, and another disposed of it in the bin due to a lack of regulations in their previous country of residence. Those who have not divested were aware of sustainability, thus, when prompted about divestment scenario, their approach of disposal would follow their usual practice of disposing batteries through a collection box.

All participants have divested from brush heads. Except for those who kept their used brush heads at home (discussed in *Search & Evaluate Divestment Options*), all participants, including Sonicare users, disposed of their used brush heads with household waste. One Sonicare user mentioned consistently disposing of the brush heads with household waste, considering alternative instruction is not provided by Philips:

> *"But it is always the same (disposing used brush head in the bin). There is no further instruction anyway, it is just to take it off and replace it with a new one."*

Prompt for Final Act

Interviews revealed that even when decision for ending product use is taken, with responsible disposal being decided, typical practice is to accumulate small e-waste until they reach a certain threshold. The trigger for disposing these items usually comes from situations like the storage box being full, decluttering, or moving to a new place. This approach made small e-waste disposal become significantly infrequent, with one participant noted collecting batteries only once or twice per year:

> *"And I collect my batteries, I hand them once like I think it's half year … or each every year, when like the battery thing is full then I go… take it to the grocery store"*

Outcome of Divestment

Ideally, the divestment outcome should result in positive feelings such as satisfaction, pride, resolution, or closure. For environmentally conscious participants, responsibly divesting from e-waste fulfils a sense complying with regulations–doing things right, with one participant noted being guilty when disposal is done improperly.

The sense of relief and the liberation of physical space in home seem to be felt by all participants. However, this feeling is more pronounced among participants who are less focused on environmental concerns, as they often associate waste more with burden than value.

Key Takeaways: Consumer Research

RQ5: How do consumers currently experience the divestment from electric toothbrushes?

In hindsight, divesting from an electric toothbrush is not a deliberate choice, meaning that reaching the decision to replace one is relatively simple. When its performance disrupts daily hygiene routine, end-of-use is decided. Looking at its predicted lifespan of 3-5 years, disposing of electric toothbrush become a less frequent activity.

Without prior habit of disposing e-waste in an environtally friendly manner, properly divesting from electric toothbrush become an unattractive and unintuitive choice. This is exacerbated by the barriers one must go through in performing the sustainable practice. As properly disposing of small e-waste is not an isolated activity; it is often combined with other daily errands, adding complexity to the process. Moreover, the lack of reward or something “fulfilling“ also contributes to consumers’ decision in storing electric toothbrush for prolonged time or throwing it in the bin.

4.5 Target Practice Mapping

Elements constituting the current practice of divesting from electric toothbrushes is illustrated in Figure 39. In the next section, the strong and weak elements, as well as tension within the practice is explained.

Strong Elements in Practice Configuration

Strong element is interpreted as hard to change components which significantly influence the practice.

- It is revealed that the disposal of e-waste requires various skills intertwined with the daily practice of managing waste, such as identifying waste types to separating waste. In terms of divesting from electric toothbrushes, more skills like identifying collection program, managing trip with daily errands, and navigating to collection points are required.
- With various skills required, divesting from electric toothbrush is seen as an effortful activity. Convenience thus becoming the overarching expectations.
- There seem to be a consistent hygiene concern attached to electric toothbrush since these devices are used directly in mouth. This image is stronger with the idea of returning devices to brand, as consumers wonder what will happen to the waste.

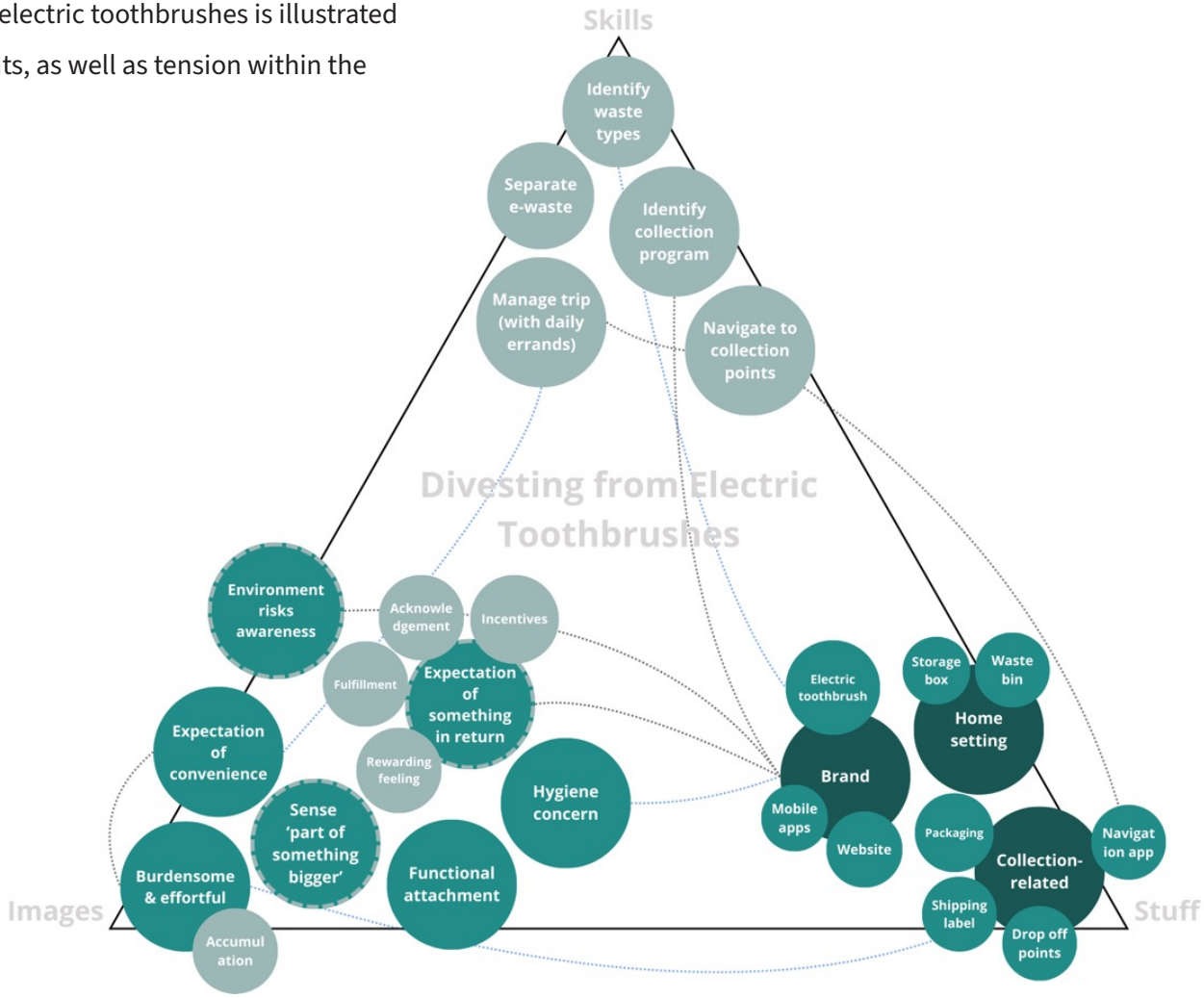


Figure 39: Practice map of divesting from electric toothbrushes

Weak Elements in Practice Configuration

Weak element is interpreted as less prominent or unstable element, which is possible to change within a practice.

- Although there is a general desire to keep e-waste out of landfills, the image of actual consequences remains vague for many. Interview participants who expressed environmental concern had a basic understanding that careless disposal of e-waste is harmful, but a concrete sense of the specific risks involved is lacking. This element is consequently weaker for those who are not environmentally conscious.
- Sense of community or belonging to a 'part of something bigger' is rather weak in the context of electric toothbrush collection.
- Due to the less urgency (no odour and less space occupation), disposing of electric toothbrush is rarely a prompt action taken. However, when the right trigger is activated, disposal is performed.

Tensions in Practice Configuration

There is a differing perceptions between household waste disposal, WeCycle collection, and product take-back (return to OEM). Typical waste disposal, which requires expenses (e.g., city taxes), is seen as a routine with no expectation of a reward other than cleanliness at home. As for WeCycle, other than freeing up some space, no other benefits is expected. However, when consumers send their used products back to the brand, the dynamic shifts, with some form of acknowledgment or reward for their responsible action expected.

Opportunities for Change

The analysis of strong and weak elements, as well as tensions in the practice configuration of divesting from electric toothbrushes, highlights some leverage points for improvement.

The complexity of the skills needed, the expectation of convenience, and the weak sense of community all underscore a need for interventions. Additionally, the tension between typical waste disposal, WeCycle collection, and product take-back points to an opportunity to reframe divestment as a meaningful and rewarding activity.

Building on these, the following opportunities for change are proposed and brought to the next stage:

Opportunity 1 *To foster an association between collection and a sense or image of contributing to a larger cause.*

Opportunity 2 *To make the divestment process convenient and rewarding for consumers.*

Opportunity 3 *To leverage Philips existing touch points such as website, mobile apps, and products to assist consumers during the divestment phase.*

Chapter 5:

Designing Reconfiguration

This chapter focus on design concept exploration, ideation, iteration, and finalisation. It first starts with discussing co-creation, which leads to the initial concept exploration. Through iteration, final proposed design concept is delivered.

5.1 Design Concept Exploration

After concluding the practice configuration of divesting from electric toothbrush, exploration of design concept was started. It begin with author's self-exploration and followed by the involvement of electric toothbrush consumers–the performers of the target practice, through a co-creation session.

5.1.1 Problem Framing–How Might We Questions

Before delving further into the exploration, the How Might We (HMW) questions were constructed from the reconfiguration opportunities, serving as a tool to allow "efficient, targeted and innovative ideation sessions" (Interaction Design Foundation, n.d.).

Opportunity 1 *HMW inspire the image of electric toothbrush collection as contributing to a larger cause?*

Opportunity 2 *HMW make the electric toothbrush divestment process convenient so that consumers can easily engage and seamlessly integrate return into their daily routine?*

HMW make the return of electric toothbrush rewarding so that consumers feel recognized and incentivized for their sustainable actions?

Opportunity 3 *HMW we leverage the Philips Sonicare touch points in guiding consumers during the divestment phase?*

5.1.2 Co-Creation

The co-creation session was conducted for 120 minutes and involved a total of five co-creators, whom all are electric toothbrush users. Prior to the session, a sensitizing workbook is given to prepare participants. It includes three short tasks: reflection on electric toothbrush, stored devices at home, and experience on disposing electronic devices (see Appendix D).

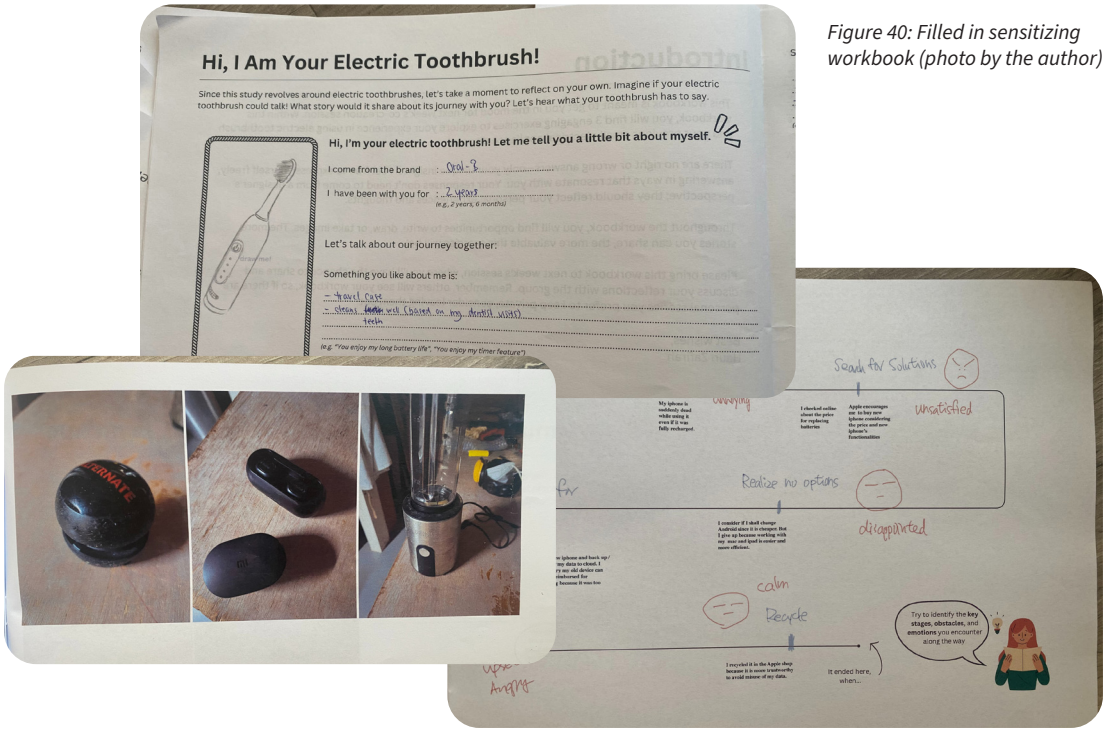


Figure 40: Filled in sensitizing workbook (photo by the author)

The first hour of the session began with an introduction to the project, covering the scope of study, key findings, and the context of Philips Sonicare. This was followed by workbook sharing among participants, which allowed them to learn from each other and helped build the dynamic of group.

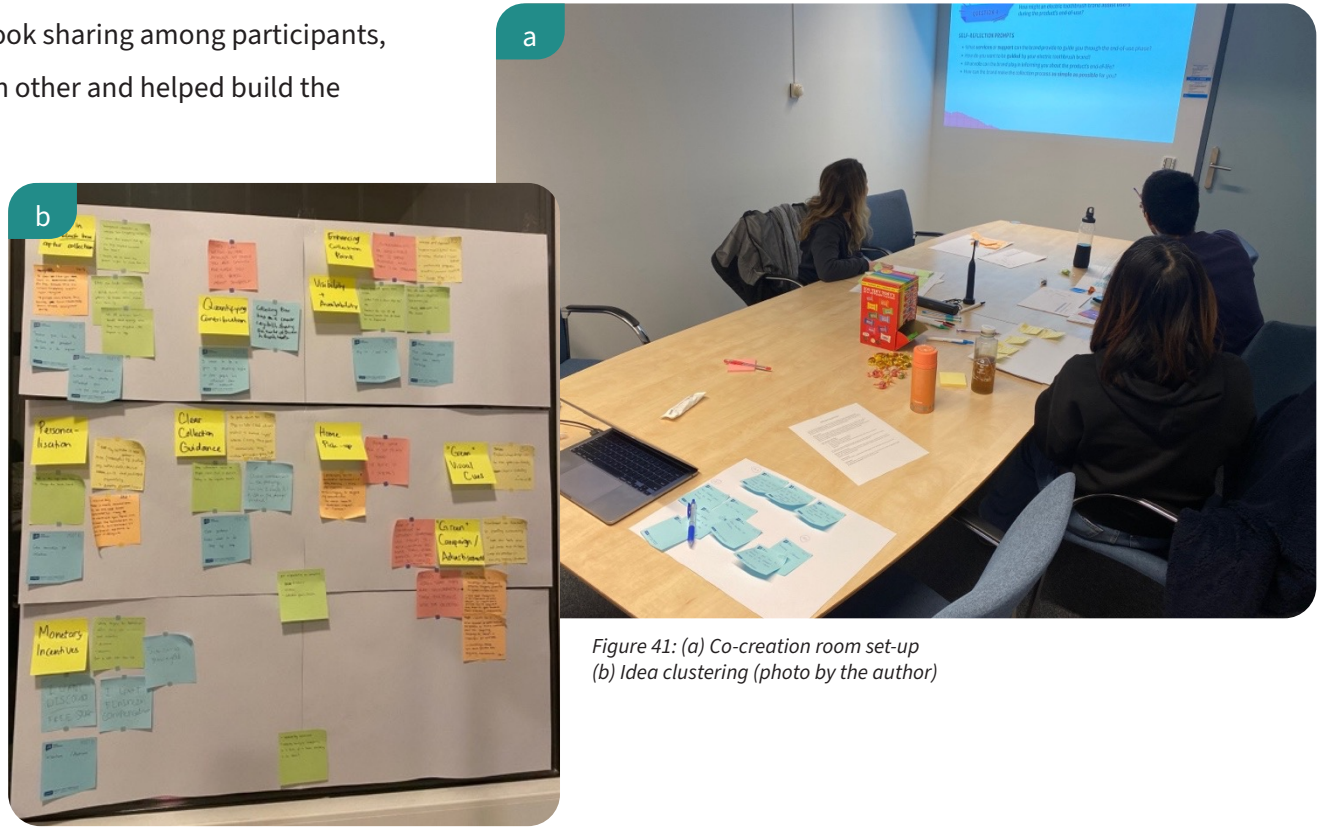


Figure 41: (a) Co-creation room set-up
(b) Idea clustering (photo by the author)

In the second hour, the session focused on the co-creation and idea brainstorming, where participants answered the previous HMW questions. The HMW questions were answered one-by-one, with self-ideation time for each participant, followed by group sharing. This process enabled participants to react to each other's ideas, add more details to them, or even contradict them, fostering a collaborative environment.

Due to the limitation of time, the ideas generated by the co-creation participants were clustered by the author independently, which resulted in several themes of ideas (full at Appendix E).

Key Insights: Co-Creation

Some insights discovered during the co-creation echoes the previous interview findings. Several new insights also emerged during the group discussion, and are briefly explained as follows.

The "black box" of divestment: the need of clarity and transparency

A term of "black box" was used by one of the co-creators to describe the lack of clarity and transparency throughout the process of divesting responsibly from electric toothbrush. For instance, how and where do one should dispose the used device, and what would happen to the returned products. Due to this "black box", divestment become a detached step in the consumer life cycle from the previous two (purchase and use).

Brand-led collection as an approach that make sense

Some participants mentioned that collection led by brands, with clear intention of reprocessing and reusing materials for good cause, is seen as the approach that make sense, with two co-creators noting the importance of "giving the responsibility back to the company".

The lack of acknowledgement and meaning in the typical e-waste disposal

The usual process of disposing e-waste into a collection box reinforces the perception of e-waste as mere waste. During the co-creation, one co-creator shared their experience with e-waste collection in their home country. The program was facilitated through nearby convenience stores. The e-waste was weighed, placed in a box, and labelled with name, date, and weight of the collected e-waste. The staff who helped the process then verbally ensured that collected items will be processed responsibly. Though economic incentive is given per kilograms of e-waste collected, which might influence participation, the box and labelling approach instilled a sense of acknowledgment and feeling good, which other co-creators resonated with. One remarked, along the lines of *"it is nice to see that the device you have cared for during its use phase is treated with the same care at the end of its life"*.

5.2 Design Brief

The co-creation session marks the final insights gathering for design concept ideation. Before conceptualising the practice reconfiguration design, a design brief is defined to set a clear starting point moving forward. It consists of the chosen target group, design vision, and design requirements.

Target Group

The target group consists of young consumers, aged 18-34. This segment is chosen to align with Philips' consumer focus and is consistent with the limited participant pool from the questionnaire, interviews, and co-creation sessions.

Design Vision

A design vision was crafted to define the desired reconfiguration that the design concept seeks to achieve. To envision the future of Philips Sonicare divestment, insights from the current practice are contrasted with the visions for the future:

Design Requirements

These requirements serve as a criterion to guide the ideation and design concept evaluation. In building the requirements, the author also took inspiration from Poppelaars et al. (2020) work on design principles for divestment. The requirements for Philips Sonicare divestment design concept are crafted as follows:

Integrated Divestment should be seen an integrated part of the entire Philips Sonicare consumption cycle, connecting the purchase, use, and divestment phases.

Supportive Consumers must feel supported and confident throughout the divestment process. The design concept should incorporate the necessary skills and knowledge to support consumers in the divestment process.

Rewarding The design concept should have a rewarding feeling as the outcome without solely relying on monetary gain.

5.3 Design Concept Ideation

5.3.1 Initial Concept

The initial ideation focused on generating ideas surrounding Philips Sonicare divestment, shaped by prior findings as well as the design brief. It is important to note that the first concept exploration intentionally suspending considerations of feasibility, resources, or constraints. This is chosen to encourage the author's creativity by allowing concepts to emerge rather freely. The initial ideation was mapped into a consumer journey, shown by Figure 42.

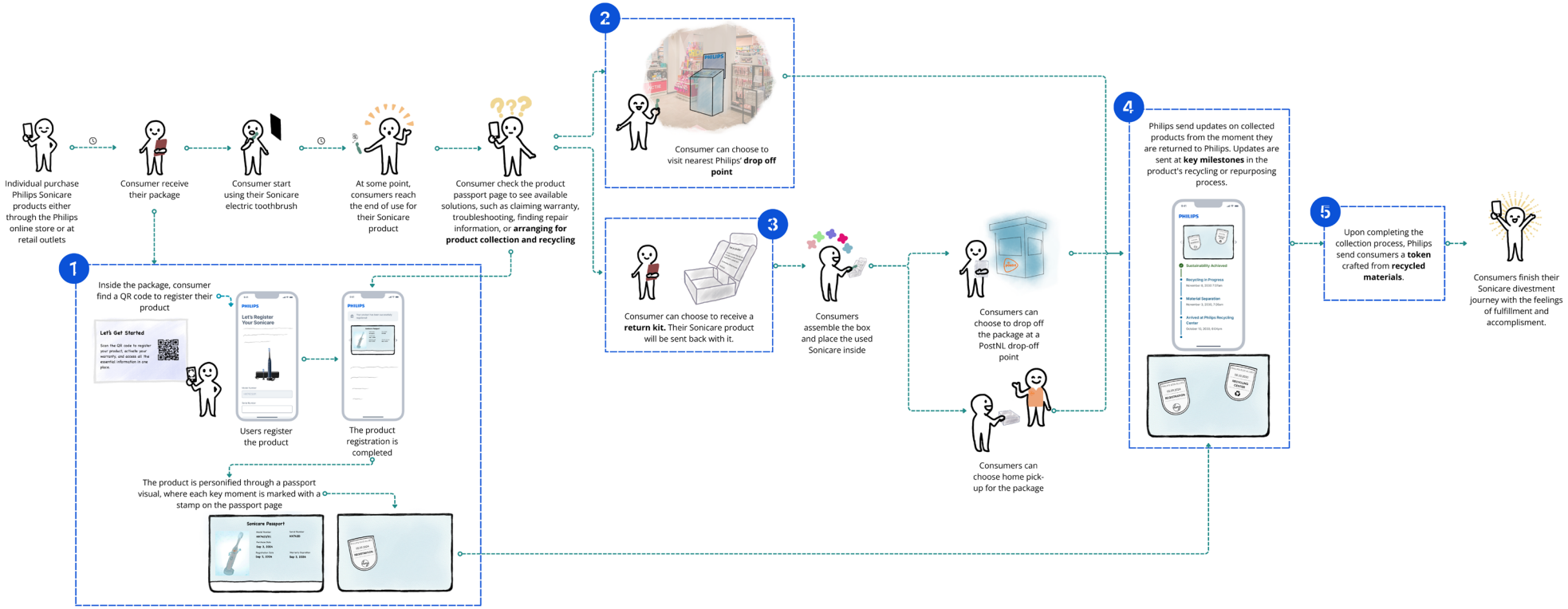


Figure 42: Initial design concept flow

Overview

#1 Product Registration and Personification Through Passport

The first intervention occurs during the unboxing stage. The product packaging includes a QR code that directs consumers to register their product. Consumers are expected to log into their Philips account, then enter the product's serial number, purchase date, and proof of purchase.

Aside from activating the product warranty, the registration also activates the product passport, shown by Figure 44, which personified the product with a passport-like design. Key moments, such as registration, are marked with stamps on the passport pages. This is later connected to idea #4.

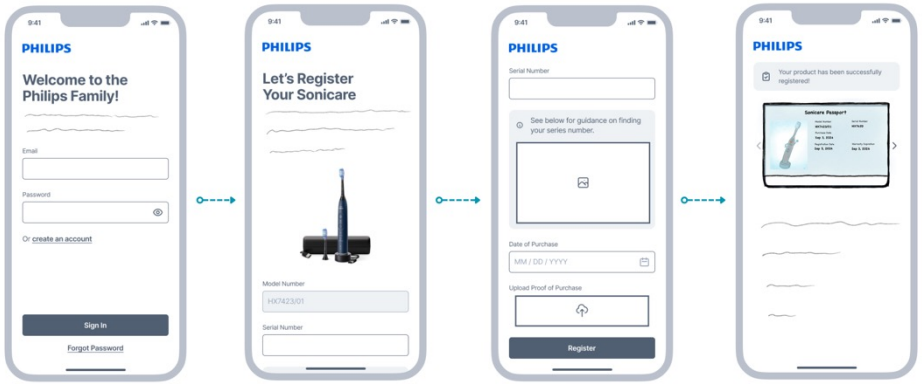


Figure 43: Product registration flow.

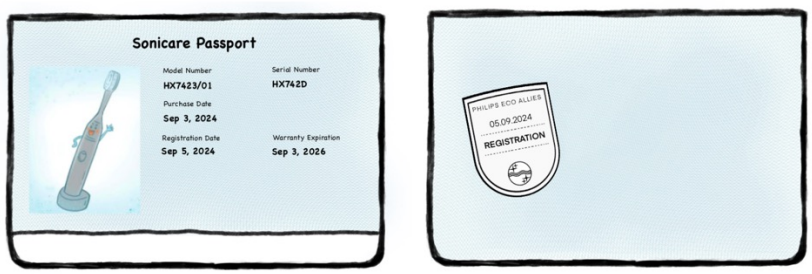


Figure 44: Passport-inspired design for product personification.

Encouraging early product registration and using personification through the passport-inspired designs seeks to create a sense of care and personal connection between consumers and their Sonicare devices. This approach aims to encourage consumers to view the product as more than just a disposable object. Moreover, the passport page visioned to be an all-in-one hub, providing quick access to product guides, care tips, including directions on how to divest from the product.

After some years of usage, consumers might want to replace their Sonicare. It is expected that they go back to their product passport page during this time, in which they can find information about product disposal.

#2 Philips' Dedicated Smart Collection Box

During the divestment phase, consumers have the option to drop-off used products at a dedicated Philips smart collection box located at nearby stores that sell Sonicare products (e.g., Mediamarkt).

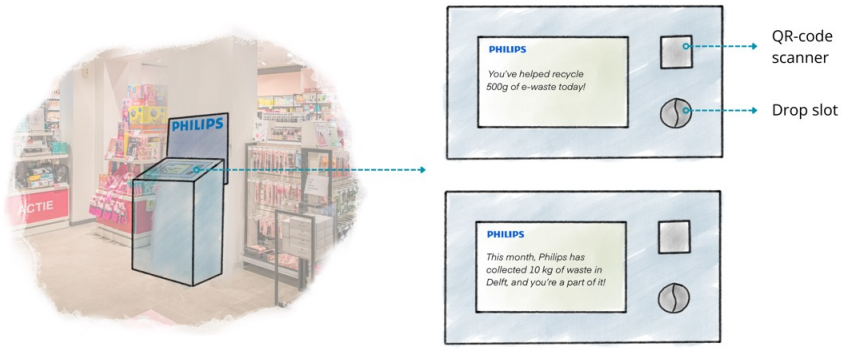


Figure 45: Philips smart collection box

Consumers visit the machine and scans their product passport (in this exploration QR code is used as example for identification). The machine then detects the item, opens the drop slot, and the consumer places the item inside. Once the item is dropped, an acknowledgment message appears on the screen, confirming the completion of the process.

Through this smart collection box, the collection process can be more engaging and rewarding. Real-time feedback helps consumers visualize the positive impact of their action, framing it as part of a collective effort.

#3 Return Kit

Alternatively, consumers can return their used Sonicare by mail. To facilitate the collection, a free return kit, shown by Figure 46a, can be ordered by consumers. A message of encouragement is printed inside the box, personalized with the consumer's name. Simple term like "eco-allies" is used, emphasizing collective effort of the initiatives. The kit also includes printed instructions and a QR code providing guidance on how to assemble the box.

Inside the box, consumers also find a small card featuring an image of new product made from returned Sonicare, as illustrated by Figure 46b. This is to visualize that used products, normally seen as waste, is not the end but rather valuable materials for creating new products.

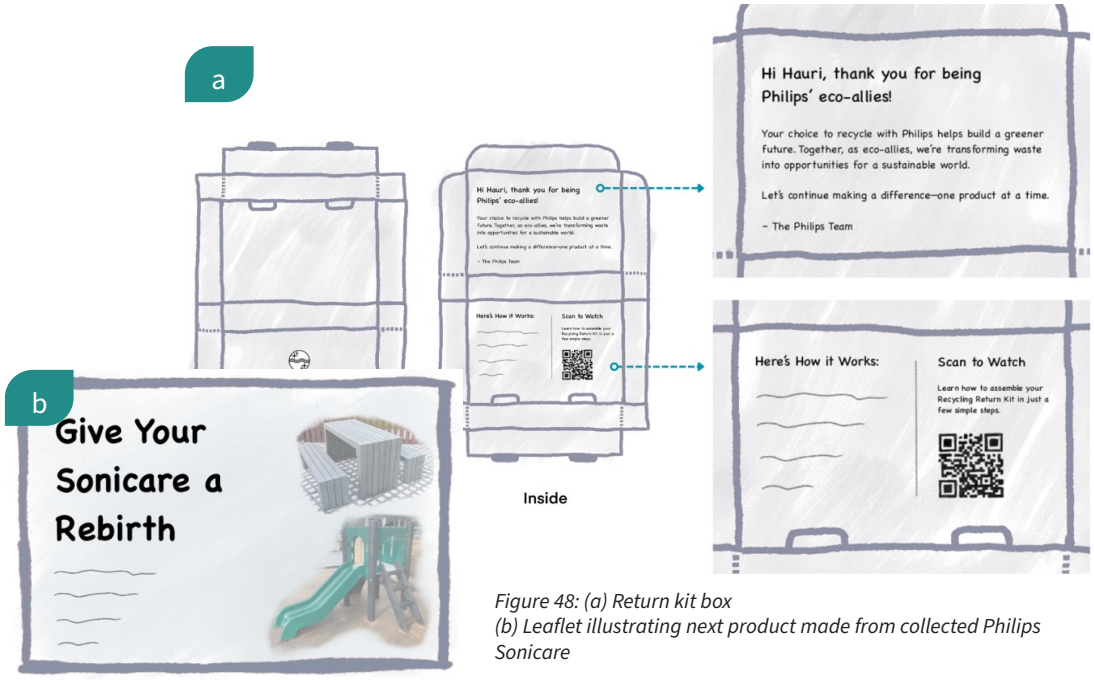


Figure 48: (a) Return kit box
(b) Leaflet illustrating next product made from collected Philips Sonicare

#4 Post-collection Tracking

In the current e-waste collection, dropping the items in the WeCycle box is the end of journey. It is not possible for consumers to track their contribution. In the first concept exploration, a post-collection tracking is proposed as one of the ideas, connected to the previous product passport idea from #1.

After used Sonicare is collected through smart collection box or mail delivery, Philips send updates on key milestones in products' recycling process from the moment they are returned. Furthermore, a new stamp is given to the product passport page in accordance with the steps the used products go through, as illustrated by Figure 47.

This idea mimics the common practice of tracking a purchase journey. The post-collection tracking enhances transparency and reassuring consumers that collected products are recycled. It makes the impact more tangible by framing the end-of-life stage as an integral part of the consumer lifecycle.

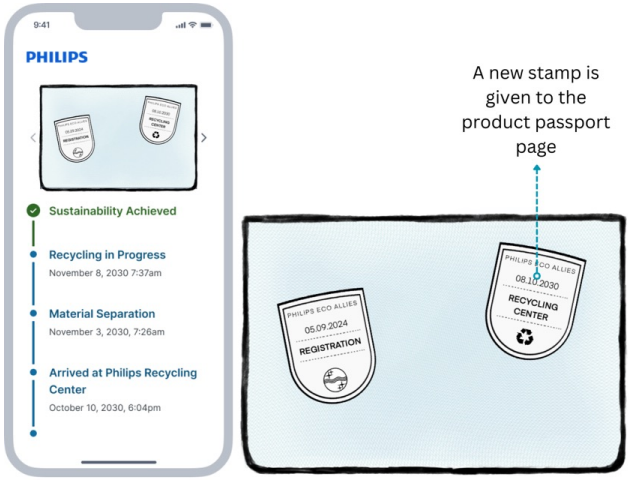


Figure 47: Post-collection tracking and passport stamps update

#5 Closing the Loop: Physical Token

At the end of collection, a physical token made from recycled materials is given. Taking an inspiration from Nespresso coffee coaster, shown by Figure 48, a physical token given to Sonicare consumers could be a usable item related to toothbrushing, such as a brush head cover or drip tray. Additionally, Philips is internally exploring the potential use of bio-based materials or recycled plastics for future products. If Sonicare brush heads were to be made from recycled materials, they could be used as a tangible and usable token for consumers.

This physical token idea checks two design visions. First, it acknowledges consumers' effort in returning used products by offering a small reward. Second, the physical token serves as tangible evidence, demonstrating how old materials can be transformed into new products.

Figure 48: Nespresso coffee coaster from recycled pods (Nespresso , n.d.)

Key Feedback: Initial Concept

Feedback for this exploration was gathered from the project supervisor, stakeholders (Partners for Innovation and Philips), informal discussion with fellow design students, and personal reflections by the author. At this point of exploration, the real consumers were not involved yet.

The initial concept missed integrating the purchase moment

Given that the target age group is 18-34, repurchase is more likely than purchasing an electric toothbrush for the first time. The initial concept missed integrating this key moment of purchase.

The proposed concept needs to think about how the new practice of returning can be shared

The overall initial concept primarily focus on individual experience, and still lacks mechanism for sharing the practice on a social level.

The products eligible for return needs clarification

Within the initial concept, it was unclear if brush heads are eligible for return, and if so, which collection methods are applicable (smart collection or mail-in).

The uncommon practice of early product registration presents a challenge

Currently, registering Philips Sonicare products is not part of the unboxing or initial use phase. Consumers typically register their products only when checking or claiming a warranty. Unlike devices like phones, where registration (e.g., creating an Apple iCloud account) is essential for use, registering an electric toothbrush has no immediate benefit, making early registration harder to promote.

The proposed concept should emphasize closed-loop recycling

In Figure 49, playground slide and park bench are used as an example of how returned Sonicare could be recycled into. The proposed design concept should ideally introduce a closed-loop, where recycled materials stay within the same product or brand stream (e.g., from Sonicare to Lumea product), as opposed to repurposed for a completely different product stream.

The challenges of Philips dedicated smart collection box: retail interest and network establishment

The Philips dedicated smart collection box faces some challenges. Retailers might find it undesirable, as it requires space and offers little benefit to the business. Additionally, this idea would require establishment of a network of collection points, which could be both logistically complex and resource intensive.

The proposed concept should be tactical in terms of sustainability

The smart collection box requires a production, involving resource use and generate emissions. Similarly, the idea of physical token, such as brush head cover or drip tray, may serve a purpose initially but could eventually contribute to more waste. To align with sustainability goals, the design concept must be carefully designed to minimize environmental impact and avoid creating additional waste.

The return process could be simplified by using personal boxes

While return kit is intended to support consumers with stuff (box) needed to perform product return, this might add extra steps to the practice, such as ordering the box, picking it up, assembling it, and sending it back.

The post-collection communication needs to be more strategic and rewarding

In the concept exploration, the step of "material separation" was included. This raises question of how much information consumers actually care, as "material separation" information might be too technical. Moreover, the product passport stamps visual, which intended to build a rewarding feeling, is also questionable.

Defining Improvement

Feedback of the initial concept was taken into consideration for the refinement phase. Some ideas were identified to be less aligned with the intended outcomes of the design concept, hence deprioritized:

- Personification Through Passport: The lack of evidence of how such design would significantly shift consumers' practice led to the idea being set aside.
- Philips' Dedicated Smart Collection Box: The smart collection box has been deprioritized due to logistical challenges and retailer buy-in challenge.
- Return Kit: As return kit would add more elements (stuff and skills needed) into the practice configuration, possibly hindering the performance, it has been deprioritized as well.

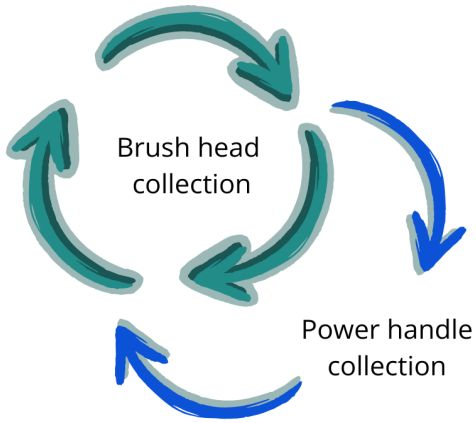
Summing up, the next concept refinement aims to:

- Integrating the purchase moment
- Clarifying eligible products for return
- Considering digital token as reward
- Focusing on closed-loop product life cycle
- Improving post-collection tracking and messaging
- Developing how practice can be shared on a social level

5.3.2 Refined Concept

Overview

The refined design concept includes interventions spread across the purchase, use, and divestment phase. In the refined concept, collection is designed for both the brush head as well as the power handle. It is understood that the practice of returning old electric toothbrushes would be infrequent, considering their lifespan of 3-5 years. In order to build the practice, brush head return is proposed as the strategy to help consumers establish and engage with the practice.



Brush Head Collection

To set up for Sonicare brush head collection, a small bag is provided, which included within the first purchase of the electric toothbrush set or as an add-on during brush heads replacement purchase. Once fully filled, the bag can be directly returned via a PostNL mailbox or handed to a delivery driver, as it already provided with free shipping label.

Power Handle Collection

Sonicare power handle collection allows consumers to return their well-loved Sonicare back to Philips. Based on previous interview insights, issue with accessories were not mentioned by participants. The design concept assumed that the accessories are disposed of alongside the power handle. As such, collection occurs simultaneously.

Consumers can return their power handle as a part of their purchase journey, where a free shipping label is included with their new purchase. Alternatively, they can return the power handle separately using their own packaging, and generate a shipping label online. Once safely packed, the package can be returned via PostNL drop-off point, lockers, or handed to a delivery driver.

Purchase Phase Integration

Divestment Banner and Page

Integration of divestment on the purchase phase is designed primarily within the Philips existing website. Two intervention points are the product and the check-out page. As seen in Figure 49, a small banner is added into these pages with the aim of reminding consumers of their old Sonicare products they might still have at home. The arrow buttons will take consumers to the dedicated page illustrated by Figure 50.

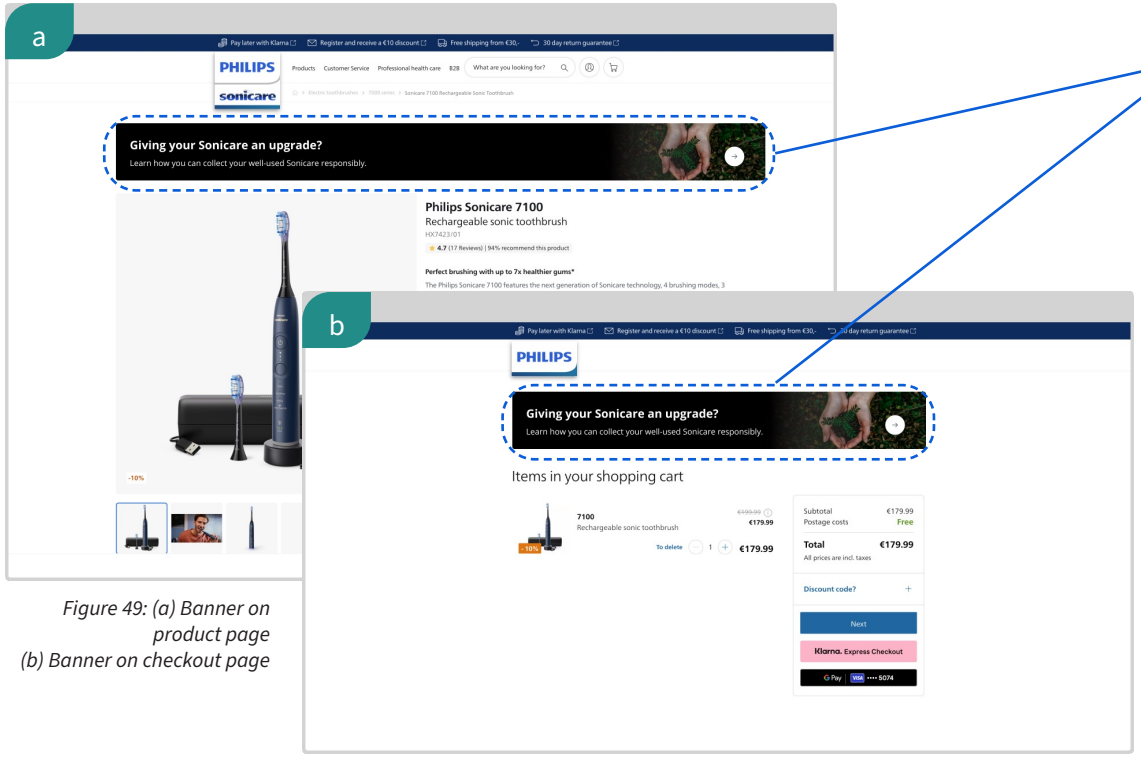


Figure 49: (a) Banner on product page
(b) Banner on checkout page

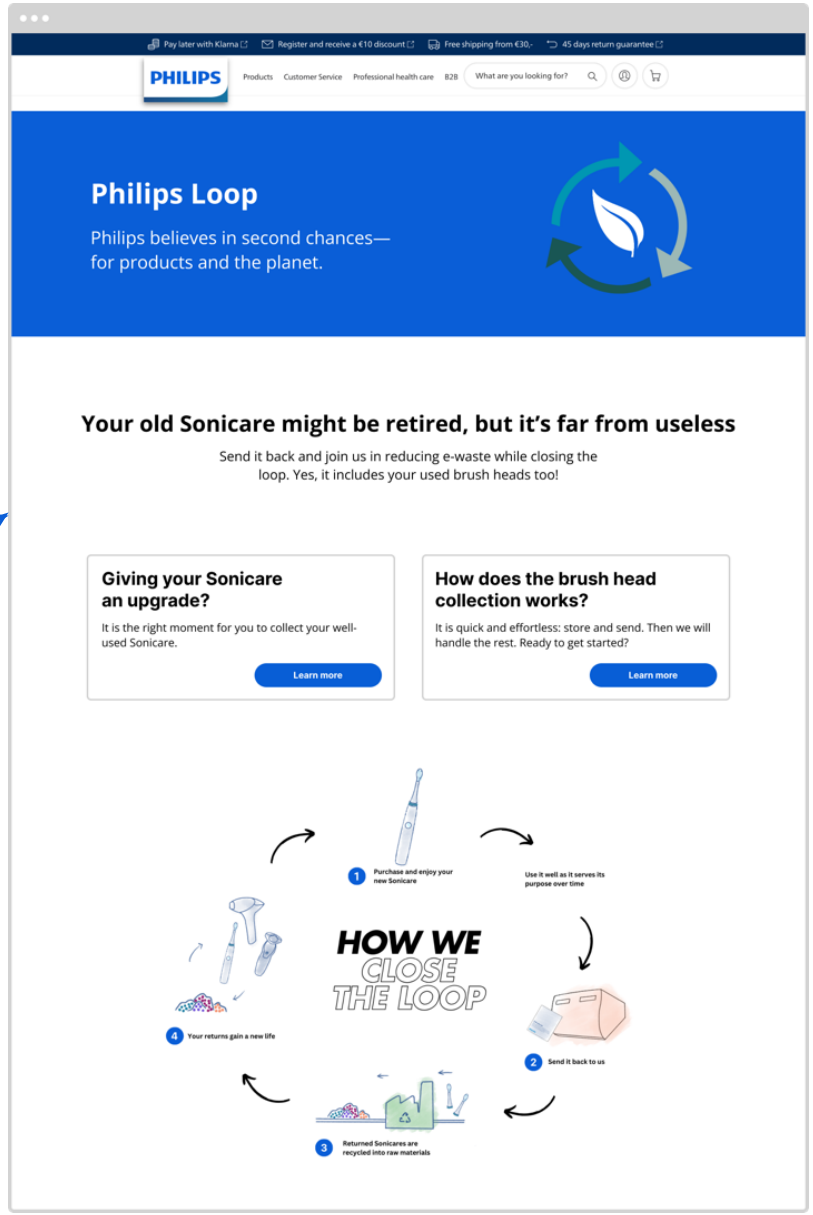


Figure 50: A webpage containing divestment-related information (collection service and how Philips close the loop)

Use Phase Integration

Product Packaging

During the use phase, the unboxing moment became the main intervention point, where information relevant to divestment is provided.

With the goal of having divestment-related information visible and not overlooked by consumers, slight change to the packaging is proposed, illustrated by Figure 51. Unboxing flap mechanism adds five additional surface areas (indicated by yellow colour) that can be used to incorporate important information about product divestment.

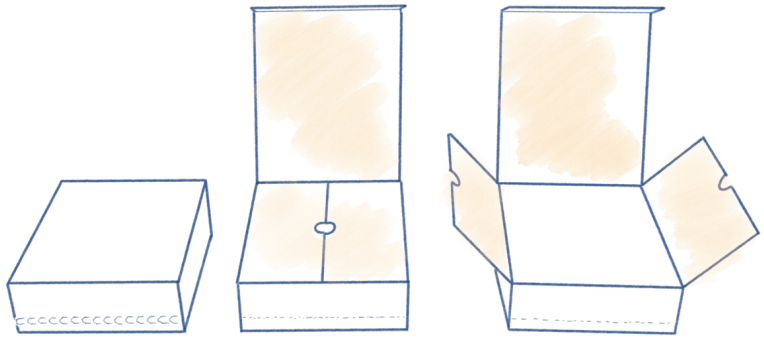


Figure 51: Sonicare packaging change

Figure 52 illustrates a proposition of how these surfaces are utilized, with the left flap providing information about product disposal and the right flap explaining how Philips closes the loop. This design aims as a “disruption“ to the usual unboxing experience to trigger returning consumers to engage in product return, while also informing new consumers about divestment.

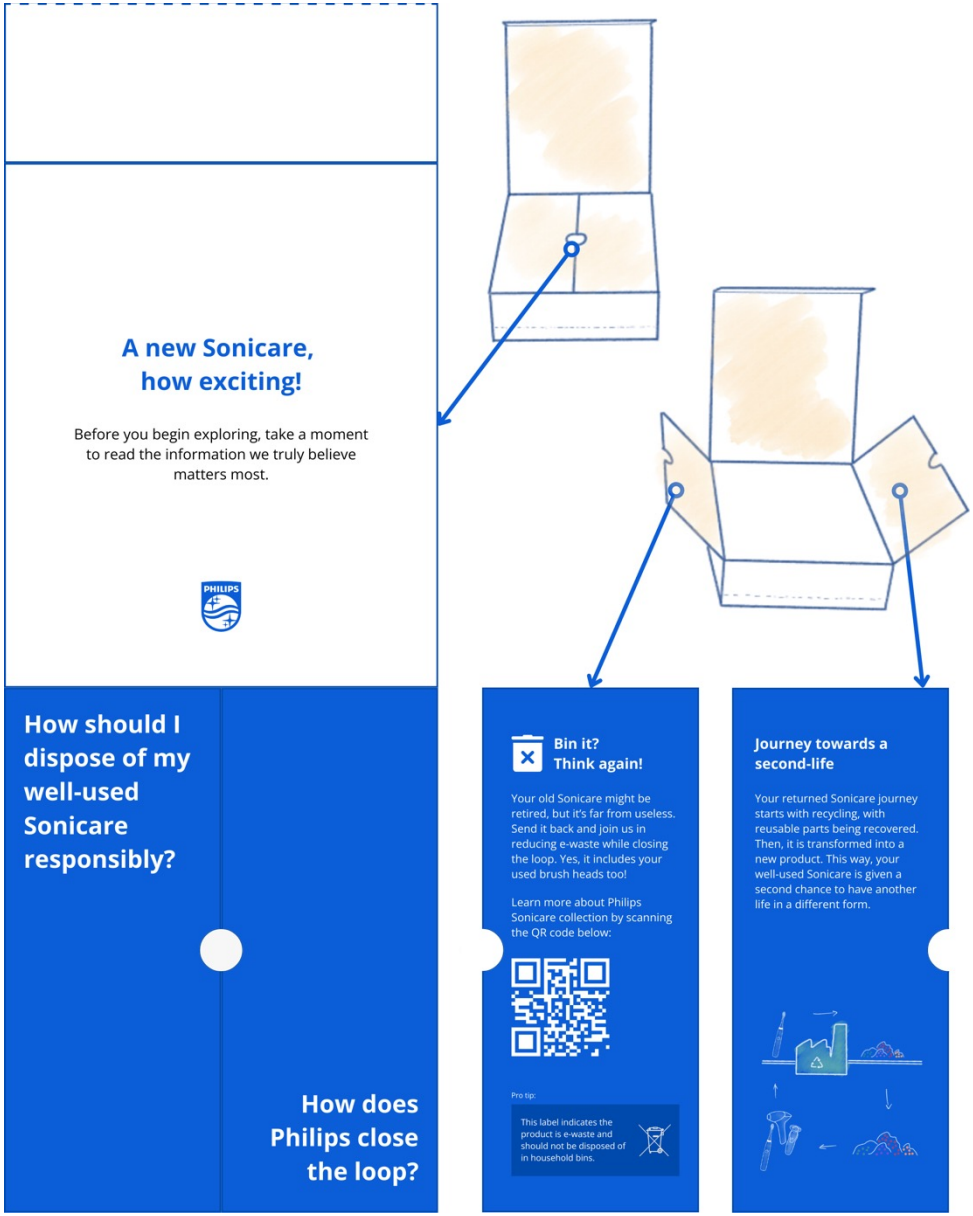


Figure 52: Sonicare packaging integration with divestment.

Brush Head Storage Bag

Illustrated by Figure 53, a small storage bag is introduced, serving as a new element within the practice configuration. This storage bag serves as a designated space for consumers to store their used brush heads, keeping them organized until ready for collection. The storage bag includes a supportive message on how to do collection and an illustration showing how Philips close the loop, highlighting brush head collection as one of the significant steps in the process.

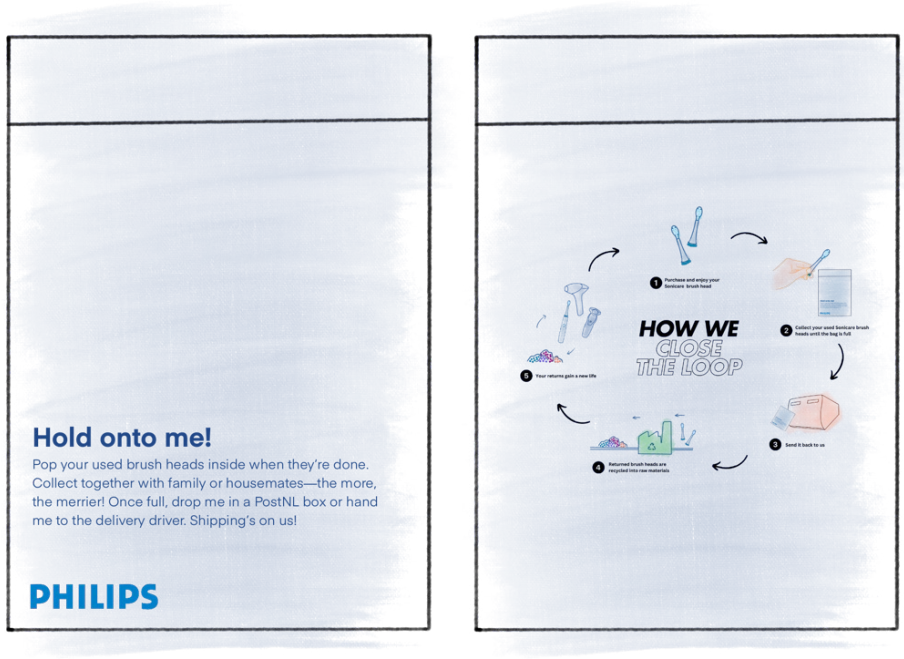


Figure 53: Brush head storage bag.

Divestment Phase

Post-return Update

After return is completed, an update is sent via consumers' email to give them a sense of reward by acknowledging their contribution. Three different messages were explored:

1. Highlighting emissions saved, for example:

   *"Your returned Sonicare **contributed to avoiding 0.4 kg of CO_2 emissions**, equal to driving 2 km by car."*

2. Focusing on weight of materials recycled, for example:

   *"Your returned Sonicare **contributed to recycling 0.25 kg of plastic and metal**, reducing the need for new materials."*

3. Showcasing new product creation, for example:

   *"Your returned Sonicare **contributed to creating the Philips Lumea** using recycled materials, helping to reduce waste and promote a sustainable future."*

The last message option echoes with previous study by Kamleitner et al. (2019), which showed that salient narrative about product past self or identity (e.g., backpack from old airbag) allows consumer to "feel special" about the product. In this case, similar idea is applied but with reversed order– emphasizing how consumer's return contributed to the creation of new product.

Referral Campaign

Particularly for the power handle collection, a referral campaign called “Return Forward” is proposed, encouraging consumers to share the practice to others in exchange for a reward. This campaign builds on the common concept of referral program, where incentives are offered for successful registrations or purchases.

As shown by Figure 55, consumers receive a €5 voucher upon verified collection of their power handle, which they can later use to purchase product from Philips website. A referral link is also sent, allowing them to share it with others. Additional €5 voucher is then rewarded for each successful referral (up to three).

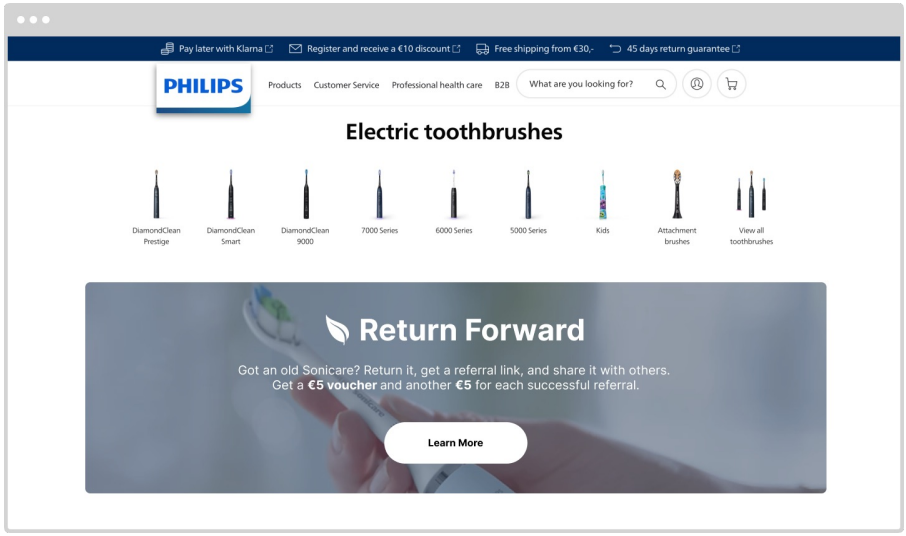


Figure 54: Return Forward banner on Philips Sonicare landing page

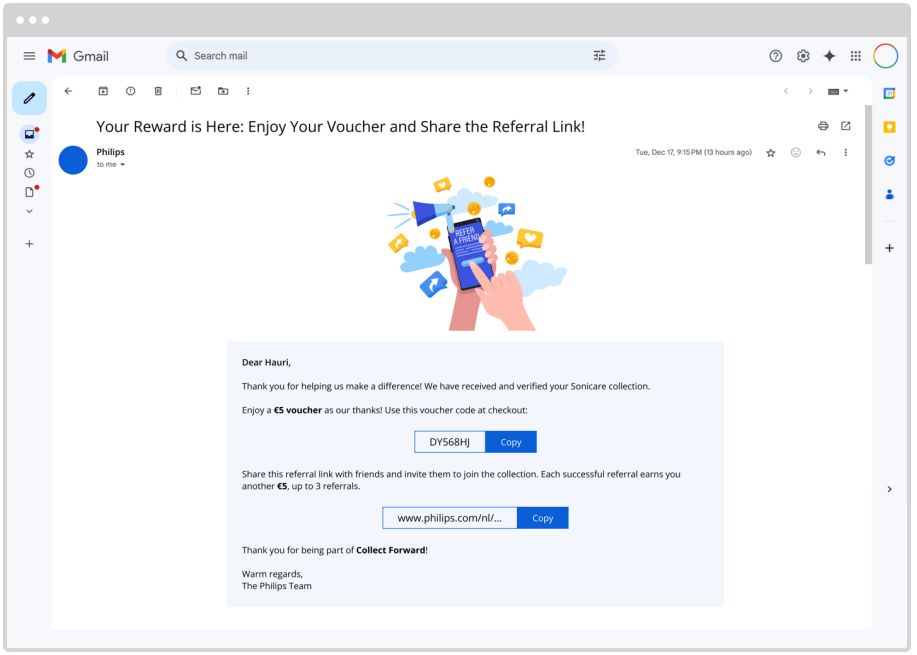


Figure 55: Reward and referral link sent to email

5.3.2 Iteration: Feedback Gathering

The evaluation for the refined concept was mainly gathered through feedback sessions with consumers and a discussion with Philips representative. This section first disuss the set-up used for the feedback gathering sessions with consumers. Then, key feedback from both consumers and Philips representative is explained.

Consumers Feedback Session

In the second part of practice-oriented design, reconfiguration of practice is designed through enacting practice through medium of prototypes and scenarios. The result of different performances is then evaluated and combined into a reconfiguration that works.

The in-person feedback session for the refined concept lasts up to 45 minutes. The proposed design concept involves visiting a delivery point, however, due to the limitation of time, this action could not be enacted. To supplement this, the session is strengthen with scenario-building. It then followed by consumers hands on the prototypes and open-ended questions (full details in Appendix F).

Additionally, to enhance contextual immersion, participants were asked to bring their electric toothbrush to the session.

Figure 56: Prototype for consumer feedback session

Key Feedback: Concept Refinement

The result from four consumer feedback sessions and a discussion with Philips representative is summarised as key feedbacks per cluster of ideas as follows.

Divestment Banner and Page

Participants generally understood the purpose of the divestment banner based on the text provided. However, the two placement within the product and checkout page resulted in a different feedback. When placed on the product page, the banner was overlooked due to the abundance of other content. Meanwhile, the banner on the checkout page stood out more, as the page contained minimal information, making it easier for participants to notice it. As a result, all participants opened the divestment page through the checkout page touchpoint.

Product Packaging

Feedback on the product packaging highlighted both strengths and areas for improvement. First, participants found the packaging design interesting. With the book-like flap, they mentioned the unboxing moment to be more engaging wiht a “story to tell”-like feelings. Participants found the information provided on the inside of the packaging to be clear enough, with some mentioning that they learned for the first time that Philips brush heads should not be disposed of in the general waste bin.

However, two participants noted that the outer packaging was a bit overwhelming due to the amount of text, making the additional text inside the box feel excessive. Additionally, some commented on the illustration provided, noting that the sketch-like style felt inconsistent with Philips’ design on the outer box, which features real product images.

Moreover, a participant expressed unwillingness to scan the QR code provided, stating that primary focus was on trying the product rather than engaging with irrelevant instructions. A discussion with Philips also uncovered concern about the addition of QR code inside the packaging, as one was already included in one of the existing leaflet. The concern was related to the potential for redundancy, which could disrupt the overall experience.

Some participant noted that the provided box could serve as a temporary storage for the old device. However, there was uncertainty if the same box could be used for return and if so, how to do it, as the packaging did not clearly prompt reuse for returns. A participant referencing Zalando’s intuitive packaging, which includes a sticker strip to indicate reusability.

Brush Head Storage Bag

The adoption of the brush head storage bag into daily life may vary depending on living situations. Participants living alone were more likely to store the bag inside their bathroom, keeping the used brush heads in an isolated, somewhat unhygienic space. In contrast, a participant living with housemates preferred to store the bag in their bedroom alongside other personal waste. However, it was noted that if the roommate is closer, the storage bag could potentially be shared and used together.

One participant noted that the brush head storage bag could serve as a reminder to think about disposal, similar to how multiple trash bins in a home encourage for waste separation. However, a clear direction is needed regarding how many brush heads should be collected before returning the bag. This feedback may also have been influenced by the size of the plastic bag used during the session, which was 20x20cm, potentially influencing participants' expectations about capacity and return timing.

Returning Action

As previously mentioned, the act of returning was introduced to participants through scenario building, highlighting the steps required to return an electric toothbrush to Philips. The different options for delivering the package (drop-off or handing it to delivery driver) offer convenience for participants. There was an inclination toward handing the package to a delivery driver, as no additional effort has to be made in locating and visiting the drop-off point.

Post-return Update

Generally, participants felt that post-return update gives a sense of closure and acknowledgment for their actions, which aligned with one of the design vision point. Among the options presented, Option 3 emerged as the preferred choice, as it clearly illustrates the impact from their return. One participant noted Option 3 to *"creates a feeling that I took part in making a new product".* Option 2, which quantifies waste in kilograms, was perceived as less desirable. With the likelihood that single electric toothbrush contributes only a small amount of recycled materials, the perceived impact is diminished. Additionally, the Option 1 which provides message in terms of CO_2 emissions saved felt somewhat "gimmicky" and tricky for consumers to interpret.

However, identifying an effective touchpoint for delivering this message remains a challenge, as digital communication channels, such as email, may not always engage consumers effectively.

Referral Campaign

The return referral campaign received mixed reactions. While a voucher as a reward for returning a product was seen as desirable, the idea of referring others to return used items was perceived as unfamiliar. This was especially the case for hygiene-related products, as asking friends to return their used electric toothbrushes felt not only impractical but also somewhat unpleasant or even disgusting. This insight echoes previous master thesis by Fan (2022) related to Philips' grooming take-back, which found that the idea of group returns was less desirable due to the personal nature of the product Additionally, one participant mentioned they would be willing to return their own product in exchange for a voucher but would not engage in the referral system.

Defining Improvement

Based on key to the key feedback for the refined concept, points for improvements are identified as follows:

Divestment Banner and Page:

- The banner will be slightly enhanced to stand out more.
- In addition to the banner, the product page will include a section on how to collect and return an electric toothbrush.
- The divestment page will be redesigned with a more realistic illustration.

Product Packaging:

- The box will clearly indicate that it can be reused for product returns.
- A strip will be added to highlight its reusability.

Brush Head Storage Bag:

- The recommended number of brush heads for return will be explicitly stated.

Post-return Update:

- Option 3 has been selected for the proposed design.

Given the limited interest expressed by participants, along with supporting evidence from other studies, the Referral Campaign has been deprioritized for the final concept.

5.3 Final Design Concept

The previous ideation and iteration led to the final design concept, proposing three stages of interventions, spanning through the purchase, use, and the divestment phase itself. Each stages introduce new stuff to the practice configuration. This is illustrated by Figure 57.

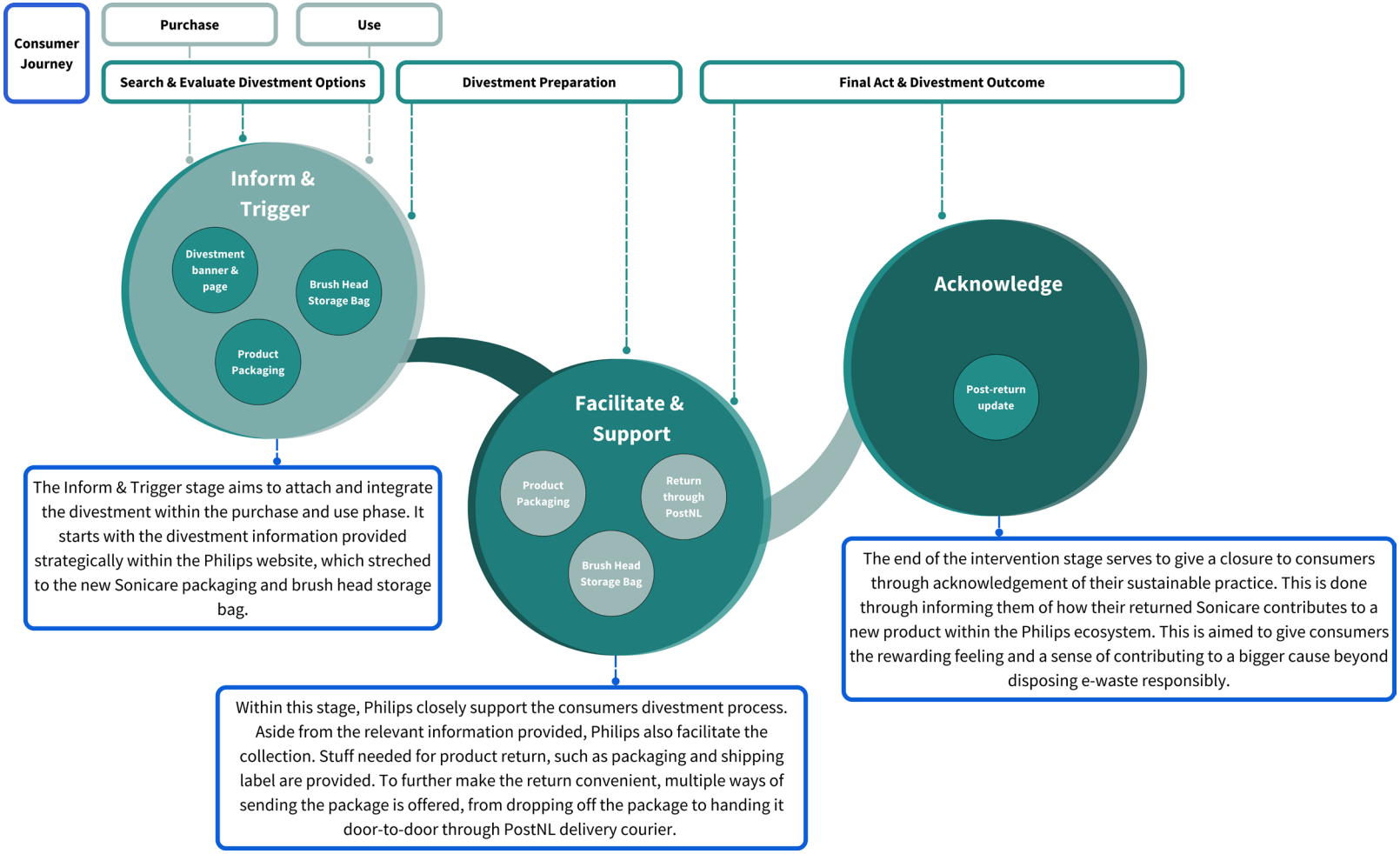
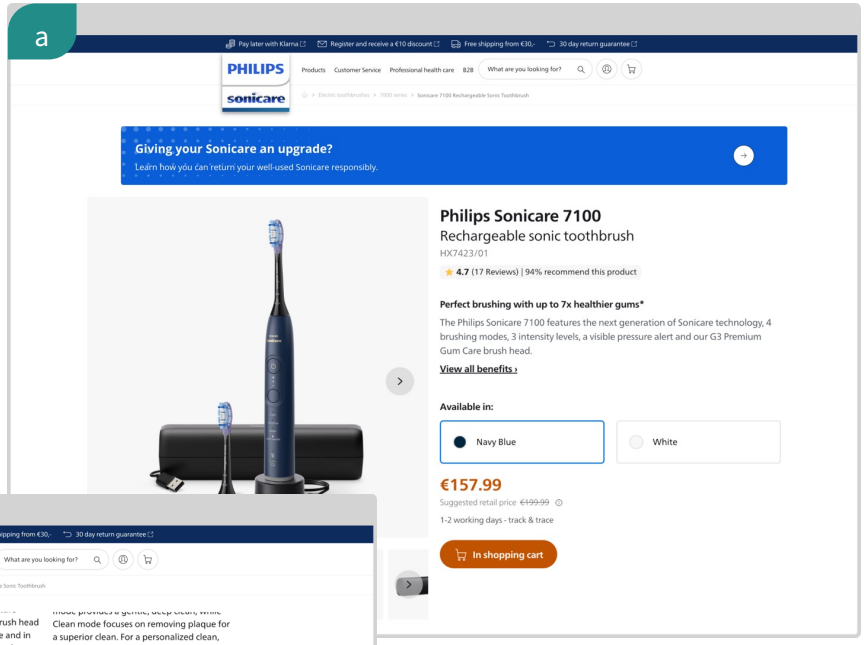


Figure 57: Three stages of interventions within the design concept and their alignment to consumer journey

5.3.1 Touchpoints Elaboration

Divestment Banner and Page

During the purchase phase, product divestment information is provided on the product page, as illustrated by Figure 58a and Figure 58b.



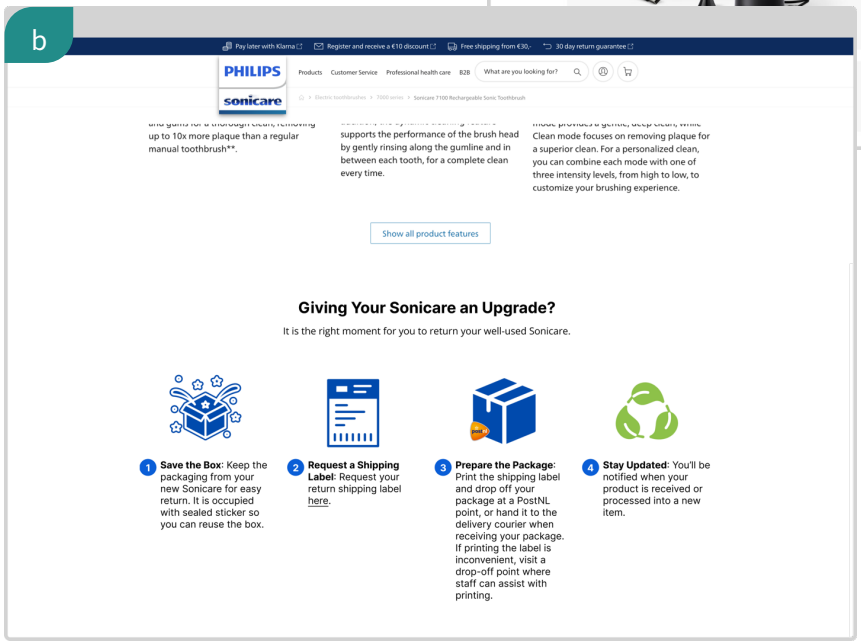


Figure 58: (a) Philips Sonicare product page top
(b) Philips Sonicare product page bottom (scrolled down)

Banner as entry point to the divestment page is provided on top of product page.

Snippets of information on how to return Sonicare is provided on the bottom of the page.

When consumers click the banner, they are directed to a dedicated divestment page consisting information on how to return their Sonicare and what happens afterward. To reinforce the idea of return as a new beginning, the page showcases sold products made from recycled materials at the bottom.

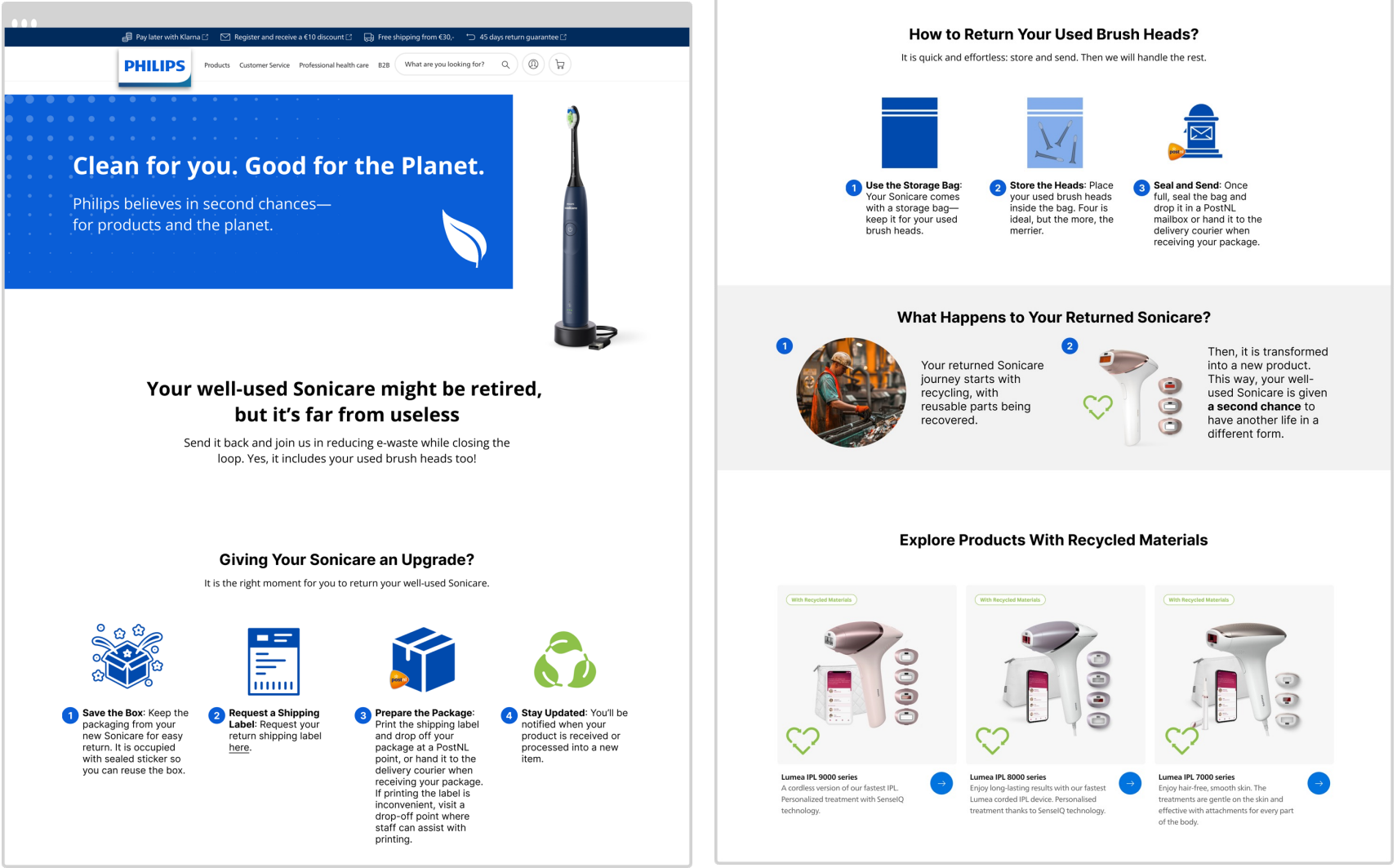
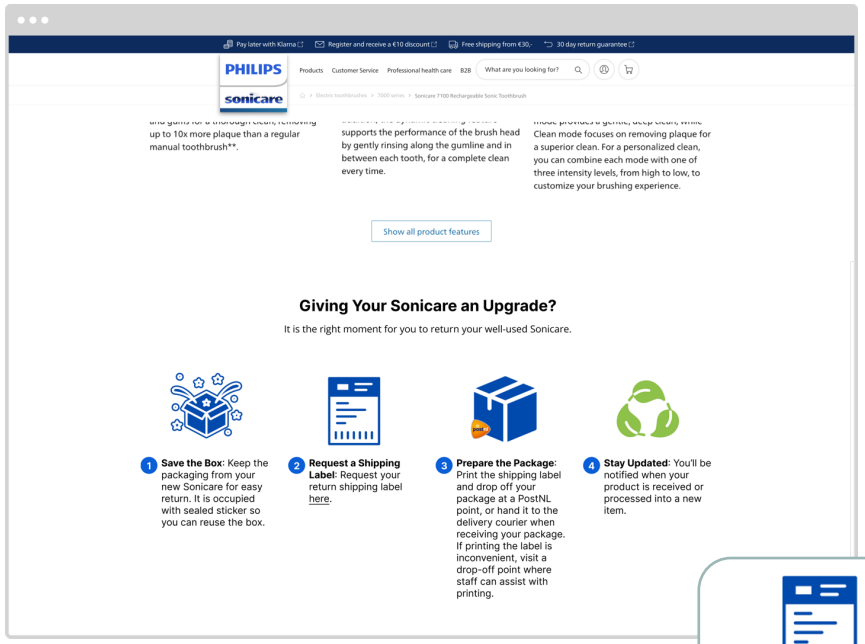


Figure 59: Philips divestment page

Shipping Label Creation



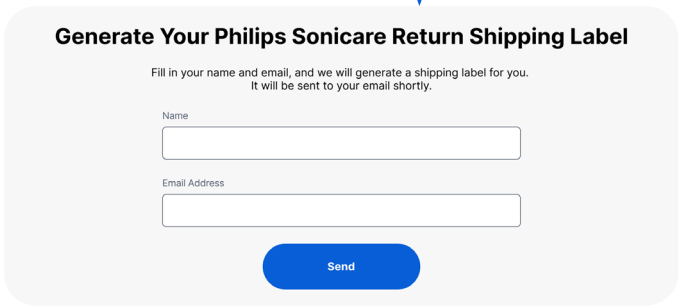
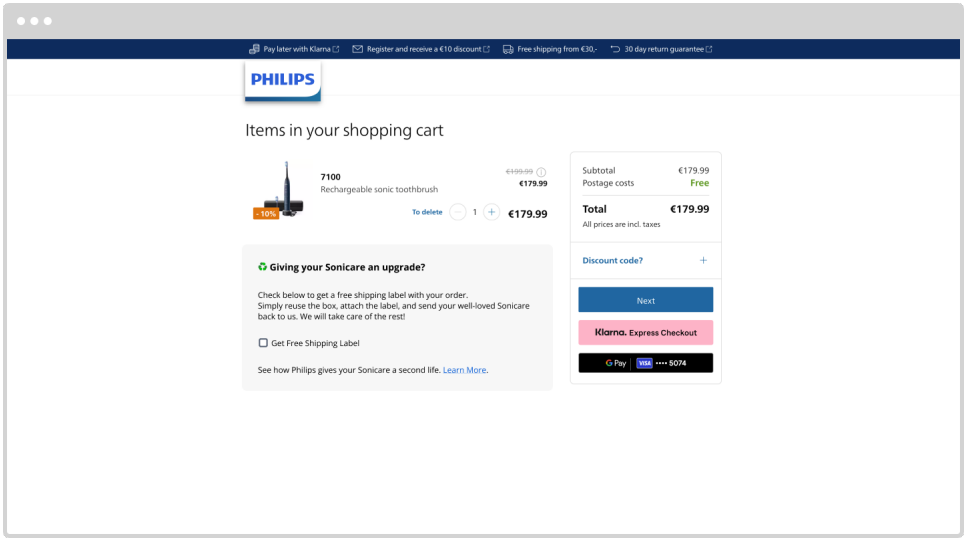


Figure 64: Form for shipping label creation

If consumers upgrading their Sonicare wish to return their old device, they can generate a shipping label, which will be sent to their email address.



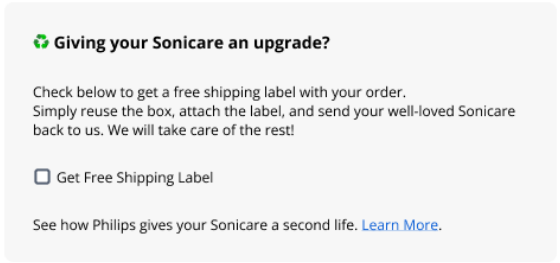


Figure 65: Philips checkout page

In cases where consumers miss the divestment information, a small section under the purchased product on the checkout page will provide a nudge, prompting the creation of a free shipping label for product return.

Product Packaging

When the purchased Sonicare arrives, consumers receive another reminder about product divestment. This repeated exposure during the early purchase and use phases is intended to disrupt their usual habits.

The information inside the box is made clearer, emphasizing that the box can be reused for returns. A seal strip has also been added to make reusing the box more intuitive.

Additionally, the journey of returned products is illustrated with real images to enhance the sense of realism in the process.

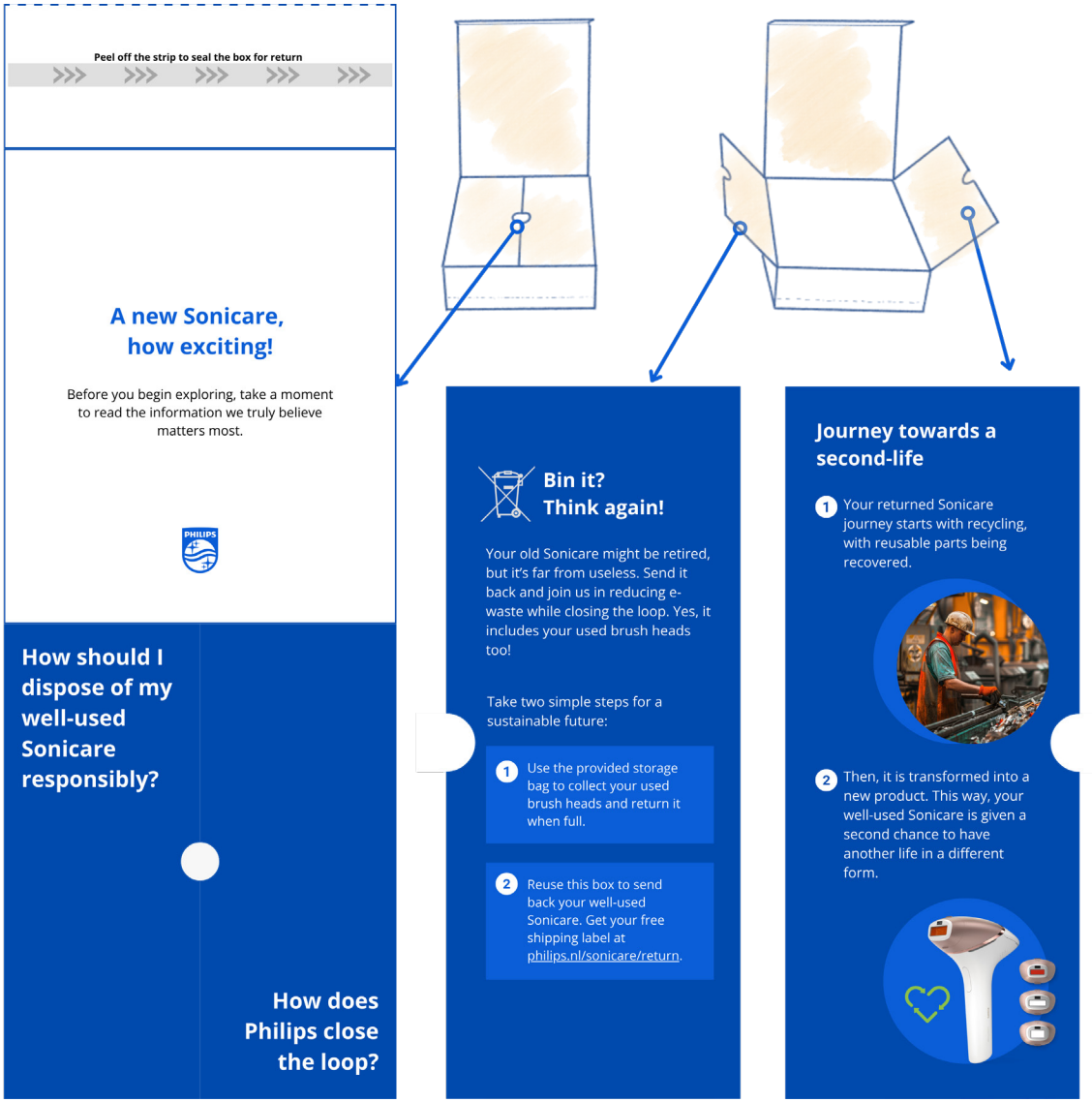


Figure 61: Philips Sonicare product packaging

Brush Head Storage Bag

The brush head storage bag is included in the product package. Instructions are made clearer with numbered steps, and a recommended number of collected brush heads is provided (the proposed 12x10 bag size aligns with this recommendation).

The suggestion of two to three brush heads for return is based on a comparison with SURI (three to four) and Boombrush (eight), as well as the goal of establishing the return practice. If too many brush heads are suggested, it may take longer for consumers to return them, making the practice more difficult to establish.

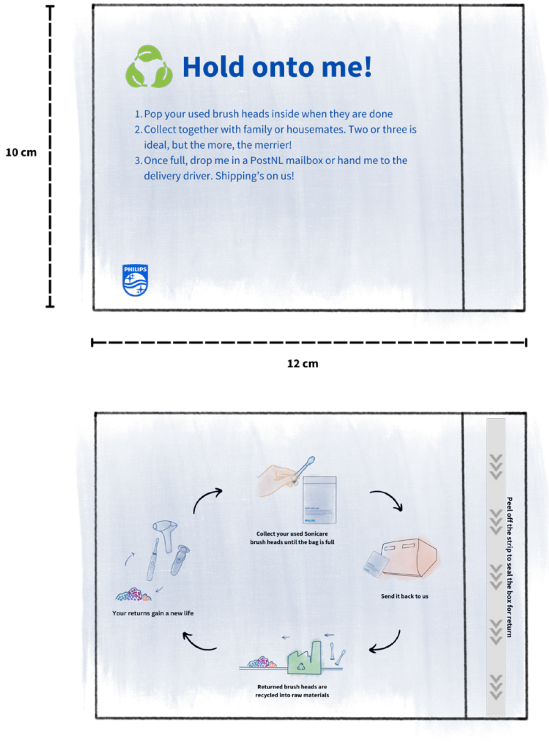


Figure 62: Philips Sonicare brush head storage bag

Post-return Update

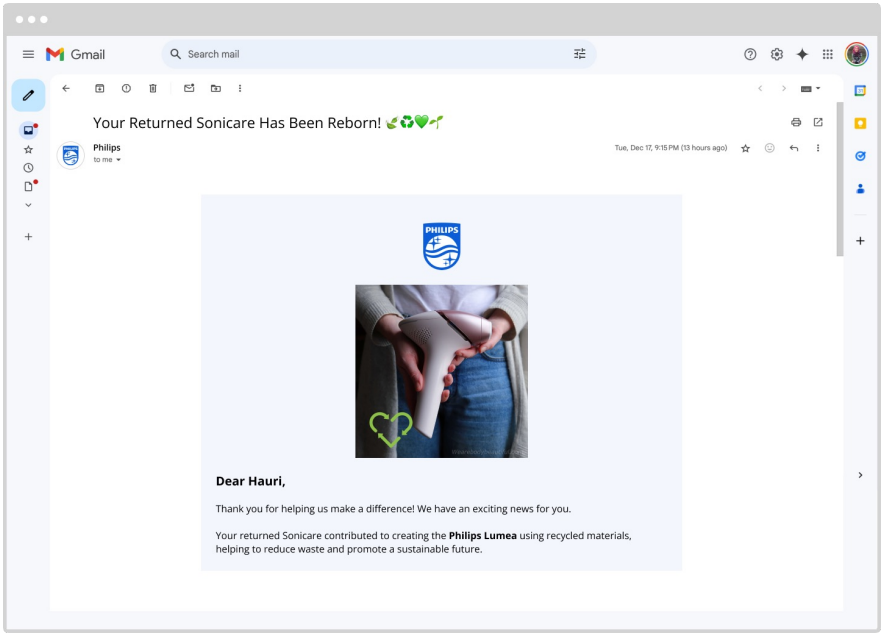


Figure 63: Post-return update sent via email

After the return is completed and the product is recycled into a new one, consumers receive an email (using the address from the shipping label) to provide closure on the process and acknowledge their contribution.

5.3.1 Cost Analysis

This subchapter briefly analyze the cost needed to establish the design concept. The proposed design concept involves four additional costs for Philips: the creation of new packaging, a brush head storage bag, package delivery, and recycling.

Product Packaging

For the new Sonicare packaging, the overall size does not need to change, however, the addition of a book-like flap increases the use of resources (paper and printing). At this stage, it is difficult to assess the exact cost of implementing this improvement. However, the added flap increases the surface are by approximately 25%, which leads to higher production costs due to additional materials and printing required.

Brush Head Storage Bag

According to Daklapack.nl, 100 orders of recycleable flat bag with (8x13 cm) €59.52, or approximately €0.6 euro per bag. For larger orders of 2,500 bags, the price drops to €47.02 per 100 bags, or €0.47 per bag. However, this price applies only to blank bags and custom designs are expected to result in additional costs.

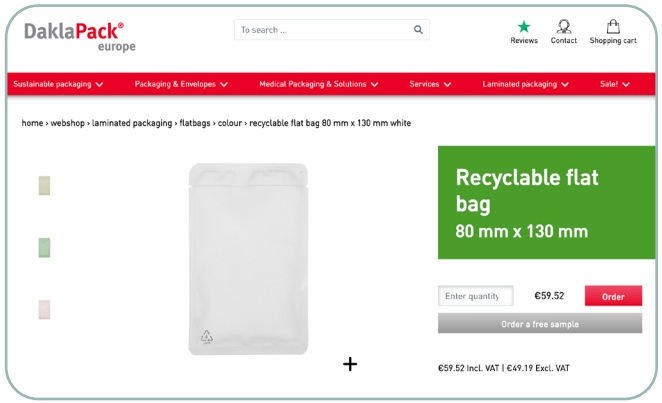


Figure 64: Recycleable flat bag price reference

Package Delivery

Figure 65 shows the calculation for PostNL Business Account package delivery. The main Sonicare product return would require “Packages” for delivery, as it cannot fit in a letter box. For 500-1000 packages per year, a cost of €6.55 per package is required.

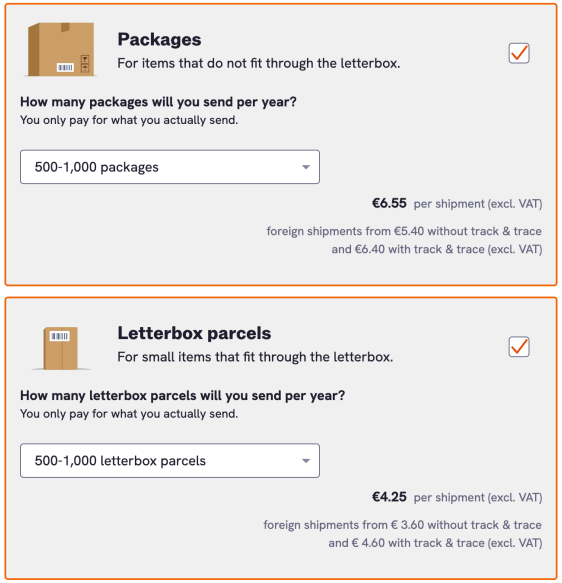


Figure 64: Package delivery price reference

Meanwhile, the brush head return bag would fit inside a letterbox. Therefore, for 500-1000 “Letterbox Parcels”, a cost of €4.25 euros per parcel is required.

Recycling

The proposed design concept requires a new partnership with a private recycling company. Taking reference from Fan (2022) analysis, the cost needed for recycling Philips grooming device is €3.9 per device. However, the size and weight of the Philips grooming device and the Sonicare electric toothbrush differ, making this number only an estimation. Furthermore, as Sonicare brush head's weight is 19% of the power handle, which suggest that recycling cost per item should be lower.

Assumed Collection Target & Estimated Cost

For assumed collection target of 2000 brush heads and 1000 power handle (and accessories) per year, estimated cost needed are:

Item	Target	Cost per Delivery	Total Cost	Cost per Packaging	Total Cost	Recycling Rate	Recycling Cost	Total
Brush Head	2,000	€4,25 / parcel	**€2,833.33**	0.47 / bag	**€314.67**	€0.78	**€1,560**	**€4,708**
Power Handle	1,000	€6,55 / parcel	**€6,550**			€3.9	**€3,900**	**€10,450**
								€15,158

5.3.2 Benefit for Philips

The proposed design concept offers several strategic benefits for Philips:

Keeping Up with Market Trends and Strengthening Consumer Relationship

As electric toothbrush competitors increasingly provide take-back and return service, Philips must stay competitive by offering a similar initiative, reinforcing its leadership in sustainability.

Additionally, insights from co-design sessions suggest that consumers see divestment as a shared responsibility with the brand. By facilitating returns, Philips could foster a stronger relationship with its consumers beyond purchase and use phase.

Bridging High-Level Sustainability Goals and Actionable Solutions and Laying the Foundation for Future Circularity

The proposed design concept translates Philips' overarching sustainability ambitions into a tangible, testable initiative. Looking ahead, the concept lays some groundwork for Philips' circularity. With the potential for Philips to incorporate recycled materials from its own product stream into the creation of new product, designing consumers practice to return used products is a crucial step in establishing a reliable return flow.

5.3.3 Feasibility Assessment

Recycling Partner and Tracking

Philips currently does not have the capability to recycle their product in-house. Hence, a private recycling partner is necessary to receive product returns and process them. As post-return update is also proposed, a tracking capability within the recycling partner is crucial. For instance, once returned Sonicare are recyled into materials, they can be given a unique batch ID, allowing the system to track the materials from their origin (e.g., Sonicare A) to their future use in new products (e.g., Lumea B). This ensures that consumers can be notified when their returned product has been repurposed.

Packaging Improvement

The Sonicare packaging contains various information, including product features, technologies, and trademark details in multiple languages, making any modifications a likely thorough process. However, the design concept does not alter the text or materials of the outer box but only focuses on redesigning the structure to add more surface area. Hence, while challenging, there is room for possibility in adapting the packaging design within Philips' possible constraints.

Chapter 6:

Limitation, Reflection, and Recommendation

This chapter concludes the report by addressing the limitations encountered along the research, reflect on the overall process, and offer recommendations for future work.

6.1 Limitation

6.1.1 Research Participants

This project's participant pool was primarily drawn from the author's closest network, including IDE students and fellow friends. This selection may introduce bias, as participants likely share similar backgrounds, perspectives, or prior knowledge of sustainability and circular practices. Additionally, the sample size was limited, which may affect the generalizability of the findings. While the insights generate valuable perspectives, they may not fully capture the diversity of consumer experiences.

6.1.2 Designing Configuration

The nature of the proposed concept, which involves the return of a product, presents challenges in fully implementing the second part of the practice-oriented design process. Ideally, this phase involves the repetition of performance, allowing for an assessment of variability and exploration of how individual practices can be modified by participants over time. However, due to the nature of the concept and the constraints on engagement, it is difficult to replicate the iterative performance of practices needed for this stage. This limitation reduces the opportunity to observe and fine-tune variations in participant behavior, which is essential for refining the design based on real-world usage patterns.

6.2 Reflection and Recommendation

6.2.1 Practice Theory and Practice-Oriented Design

The use of practice theory in this project had its strengths and challenges. One of the biggest advantages was how it pushed the author to move beyond the usual way of thinking about behavior change. Instead of looking for cause-effect explanations, the author had to consider the broader system shaping how people handle their e-waste. The elements of practice—skills, stuff, and images—helped the author see the fuller context, leading to explore related practices like daily waste management and household routines that influence e-waste disposal behavior.

That said, working with practice theory also had its difficulties. Unlike behavior change models from psychology, which are more commonly applied in design, practice theory felt less intuitive. As the author was more familiar with psychological approaches that focus on motivation, intention, and decision-making, shifting to a sociological perspective (where behavior is seen as part of broader social structures) required a different way of thinking.

Another challenge was the lack of studies applying practice theory at a brand level, making it difficult to find relevant examples. Additionally, the author often found herself wondering how to balance viewing individuals as carriers of practice without falling into the 'trap' of oversimplifying behavior change as something linear.

In terms of practice-oriented design method, while the author understood the importance of analysing the historical perspective of a practice, exploring the historical development of e-waste was challenging due to limited resources.

6.2.2 Design for Divestment

The cognitive model (phases) provided a useful framework for the author to understand the steps people go through before deciding to dispose of a product. It helped the author to focus on the details and situations that could influence someone to dispose of something irresponsibly.

The 10 principles of design for divestment were also helpful in shaping requirements for the design concept, since they are generally applicable various product types. One principle that the author felt was irrelevant was the “7. Consider the body and soul of devices” which mainly explores how personal data could influence consumers psychologically (e.g., anxiety) during the divestment process. Additionally, reflecting on the project, since electric toothbrushes have two main components that are disposed of at different times, it might be worth adding a principle that considers divestment at the component level.

An obstacle along the way was the initial unfamiliarity with the term “divestment”, which was also encountered during research with participants. Additionally, the tone of “divestment” might be negative, due to the association between “divestment” and the boycotting act towards certain brands. A suggestion from the author to replace the term without losing its meaning: “product reintegration”.

6.2.3 In-depth Interviews

Initially, as illustrated by Figure 66, the in-depth interview was designed to include a generative exercise, where participants would receive a piece of paper with pre-made divestment steps and emotion cards. They are then asked to reflect on their experiences by writing down their thoughts and selecting cards to help recall those moments. However, after two participants struggled with this setup, it was eliminated, and only interviews were conducted. Looking back, this pre-made divestment steps seemed to constrained participants in explaining their process. The elimination of this generative exercise proved beneficial, as it allowed participants to share their experiences in their own language.

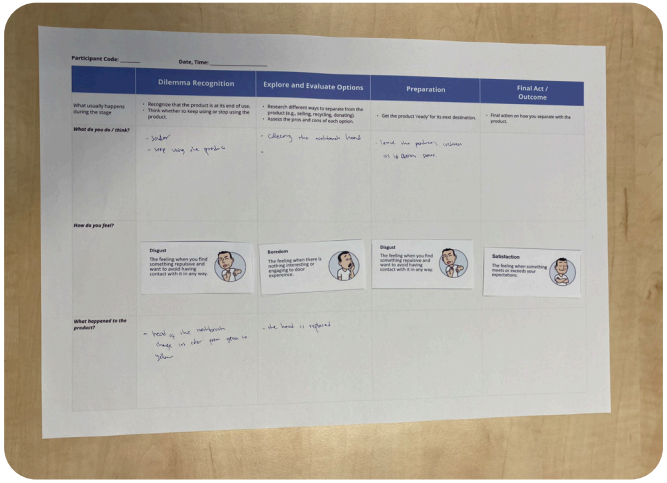


Figure 66: Planned generative exercise during the in-depth interview (photo by author)

6.2.4 Co-creation

The sensitizing toolkit created by the author proved valuable as a trigger for discussion, as it helps participants reflect on their experiences and ignite conversations. However, relying solely on the toolkit for deeper insights proved challenging, as some participants did not complete it to the expected standard.

Additionally, the combination of three exercises, five participants, and a one-hour session was not sufficient according to the author's experience. Therefore, to improve the effectiveness, the author would suggest to either extending the time duration or reducing the number of exercises and participants.

6.2.5 Influence of Electric Toothbrush in Research

The nature of electric toothbrush as a personal and hygiene-related product influenced this research, specifically during interviews and feedback sessions. At the beginning of the study, participants were asked to either bring their electric toothbrush or take a picture of it. While some complied and brought theirs, others chose not to, possibly due to concerns about hygiene or discomfort in sharing a personal item. This reluctance influence the engagement during discussions, potentially affecting the depth of insights.

Given these challenges, a change in research setup could perhaps be beneficial. For instance, conducting sessions in participants' houses may provide a more natural setting for observation and offer richer, more contextual insights while also tackling participants reluctance in bringing their electric toothbrush, as they would not need to transport their toothbrush to an external setting.

6.2.6 Recommendation for Philips

The scope of proposed design concept for this project excludes the product itself. However, as observed, current Sonicare brush head is missing the e-waste label on the exterior body (label only provided on the outer packaging). The proposed new packaging aims to discouraged consumers from discarding Sonicare in the bin, using the e-waste label as an illustration. To reinforce this message, ensuring consistent use of the e-waste label across all electronic components of Sonicare is crucial.

6.2.6 Future Study

This project primarily relied on qualitative methods, partly influenced by examples of practice theory applications in the design field. While qualitative methods provided deep insights into consumer behaviour and divestment practices, it was limited by a smaller sample size.

Upon reaching the halfway point of the project, the author found a nice example of mix methods combining quantitative and qualitative approaches within a practice theory lens. It is a study on cycling practice by Spotswood et al.(2015) which used quantitative data and analysis to grasp a wider understanding of the image of cycling across the UK, which then further studied and confirmed through interviews and focus groups sessions. This approach allowed for a more comprehensive understanding of the practice by integrating large-scale patterns with in-depth qualitative insights, which future study could benefit from.

Furthermore, the final design concept proposed in this project may lack in realizing the collective vision. The mechanism of sharing the return practice remains a challenge, as previous idea of referral campaign faced challenge of reluctance from the participants. Hence, future study could deep dive into how return practice can be designed to be socially shareable

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Appendices

Appendix A. Project Brief

TU Delft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME
Complete all fields and indicate which master(s) you are in

Family name	Zafirah
Initials	H.S
Given name	Hauri Silmi
Student number	569183

IDE master(s)	IPD ☐ Dfl ☐ SPD ✔
2nd non-IDE master	
Individual programme *(date of approval)*	
Medisign	☐
HPM	☐

SUPERVISORY TEAM
Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Prof.dr.ir. R. (Ruth) Mugge	dept./section	DOS - RMCB
mentor	Dr. S.S. (Sonja) van Dam	dept./section	DfS - CPD
2nd mentor	Flora Poppelaars		
client:	Partners for Innovation		
city:	Amsterdam	country:	Netherlands
optional comments			

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in **by the Chair** of the supervisory team

Sign for approval (Chair)

Ruth Mugge — Digitally signed by Ruth Mugge Date: 2024.09.11 16:13:28 +02'00'

Name Ruth Mugge Date 11 Sept 2024 Signature

CHECK ON STUDY PROGRESS

To be filled in **by SSC E&SA** (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total _____ EC

Of which, taking conditional requirements into account, can be part of the exam programme _____ EC

	YES	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

Name _____ Date _____ Signature _____

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES		Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is ...

	ALLOWED to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Name _____ Date _____ Signature _____

Personal Project Brief – IDE Master Graduation Project

Name student Hauri Silmi Zafirah **Student number** 5691834

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Design of Philips' Sonicare Divestment Towards Circular Collection Practice

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

Between 2012 to 2021, the presence of electronic and electrical equipment (EEE) products on the EU market surged by 77.1% [1], making e-waste one of the fastest growing wastes streams in the EU. In response to this urgent issue, the EU has embraced the circular economy (CE)—a closed-loop system aimed at extending the lifecycle of products and materials [2]—as one of the key elements to achieve the EU's agenda of sustainable growth [3].

In the context of e-waste, improving the collection of EEE products at the end of their lifecycle is crucial. By returning products to manufacturers, who have the expertise to efficiently recover and reuse valuable resources, the need for new materials can be reduced, advancing the CE. However, returning obsolete products to manufacturers is not yet the common practice. A fundamental shift in practice is required: from discarding products as garbage or leaving them unused toward voluntarily returning them to manufacturers for proper recycling and reuse. Interventions to influence consumer behavior during the final phase of the consumption cycle —divestment—can be implemented through design principles [4]. Strategies can be crafted to guide consumers through the process of separating from a product, ultimately encouraging them to choose environmentally responsible divestment options.

This graduation project is part of the Horizon Europe INCREACE initiative, conducted by Partners for Innovation in collaboration with Philips. As a manufacturer of various electronics, Philips is committed to CE practices [5]. For this project, Philips is keen in designing the divestment experience for Sonicare electric toothbrushes to help consumers and society transition to a CE practice by returning products back to Philips at the end of their lifecycle. This project provides an opportunity to explore current divestment practices for Sonicare products and identify barriers to effective circular collection. The findings will then guide the creation of strategies to shift current practices toward participation in product return programs.

→ *space available for images / figures on next page*

Note: Supporting images, gantt chart, and references are attached to the end of this document.

Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

A study [6] has shown that electric toothbrushes have a greater environmental impact compared to manual toothbrushes, particularly concerning land use and biodiversity. Additionally, research [7] indicates that consumers do not prefer refurbished toothbrushes due to the perception of contamination and reduced hygiene. This same perception may influence consumer behavior during the divestment phases (shown by Image 2), leading them to discard used toothbrushes as mere waste rather than considering their potential for extended value through CE. As a result, this attitude can complicate Philips' efforts to implement effective circular collection practices.

Based on the problems, this project aims to address the following key question:
"How can Philips design and implement an effective divestment experience for Sonicare electric toothbrushes to facilitate and enhance practices in circular collection programs?"

This project will investigate current consumer divestment experience and practices for electric toothbrushes and identify barriers to effective circular collection. By understanding consumer experiences and current practices, the project aims to develop strategies that enhance the divestment experience for Sonicare products, leading to a new practice of circular collection. Improved collection rates will enable Philips to apply appropriate treatments

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Investigate consumer divestment experiences and collection practices for Sonicare products, and then design solutions that drive social-level changes, addressing barriers and enhancing participation in circular collection programs to support Philips' circular economy goals.

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

This project uses the lens of practice theory, which shifts focus from individual behaviors to the interconnected elements of social practices—skills, stuff, and images. Practice theory supports this research by examining these elements to uncover barriers and opportunities in consumer divestment experiences and collection behaviors, addressing both individual and collective social practice levels.
Shown by Image 1, this project is keen to combine the practice-oriented design [8] with double diamond framework:
[Discover (4w)] This phase will comprise of: literature study on CE, divestment, practice theory, consumer behavior during divestment, to historical trace of waste handling practice; research on Philips; consumer research to uncover current journey of divestment and collection practice; benchmark study.
[Define (3w)] Insights from Discover will be used to: (re)define problems; (re)frame design vision and goals; map the target practice; define scope of opportunities for the reconfiguration of practice elements; generate design criteria and requirements for the Develop phase.
[Develop (7w)] This phase will focus on: individual ideation; co-design session with consumers to generate effective reconfiguration of target practice elements; 2-weeks small-scale test.

Note: Supporting images, gantt chart, and references are attached to the end of this document.

Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting**, **mid-term evaluation meeting**, **green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	11 Sep 2024 (d8)
Mid-term evaluation	29 Oct 2024 (d40)
Green light meeting	20 Dec 2024 (d77)
Graduation ceremony	24 Jan 2025 (d100)

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	
For how many project weeks	
Number of project days per week	

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

By working on this graduation project, I am eager to learn and create meaningful strategies to close the circular economy loop of Philips Sonicare products. My personal learning ambitions are:
(1) Explore various research topics such as circular economy, design for divestment, and practice theory in depth.
(2) Apply co-design methods to create impactful solutions by involving the target group.
(3) Design solutions that align with Philips' vision and capabilities while promoting sustainable consumer practices.
(4) Improve soft skills like communication, time management, leadership, and stakeholder management throughout the project.

Note: Supporting images, gantt chart, and references are attached to the end of this document.

Supporting Images

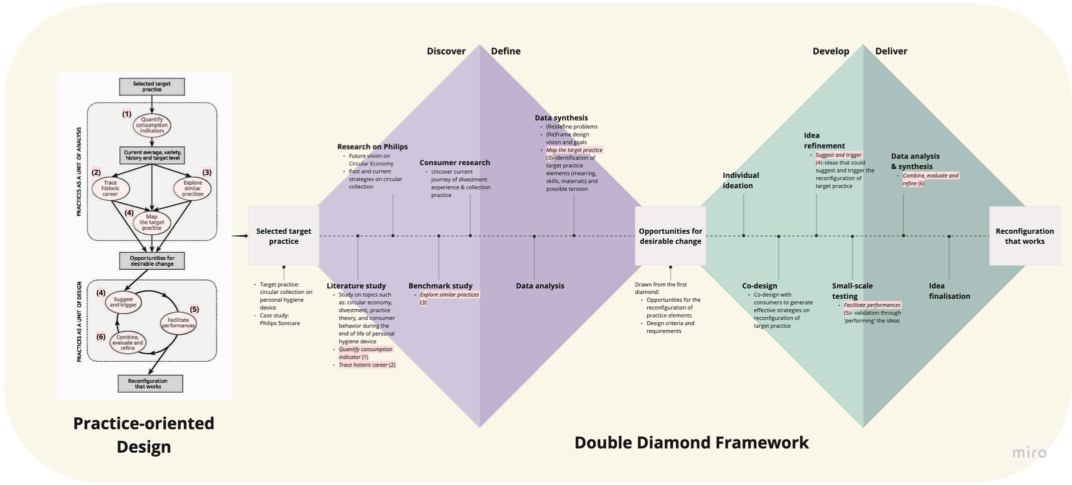


Image 1: Practice-oriented design framework (left) combined into the double diamond framework (right)

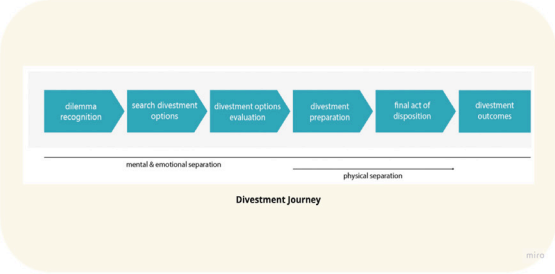


Image 2: Divestment journey phases [4]

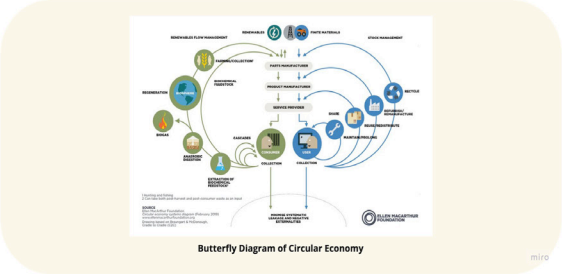


Image 3: Butterfly diagram of circular economy [9]

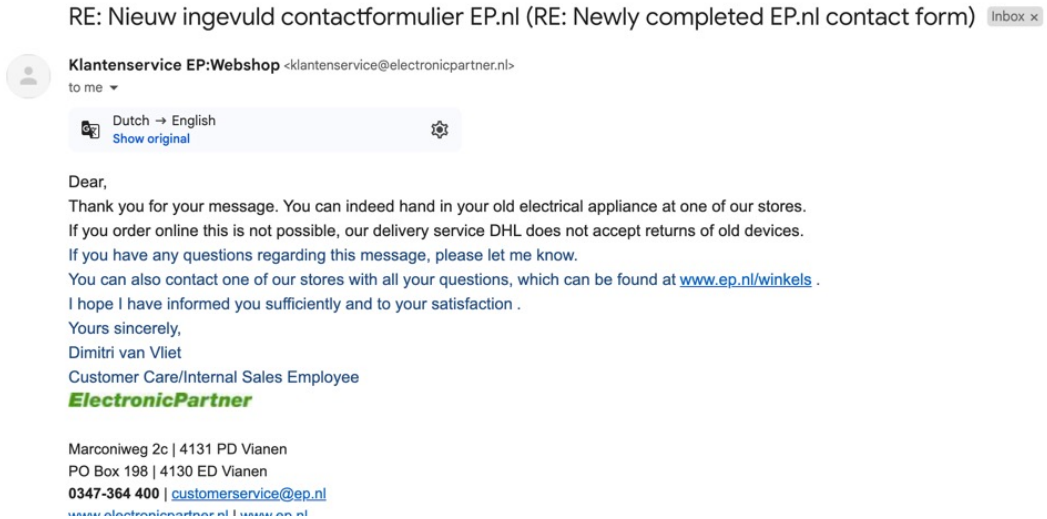
Hauri Silmi Zafirah | Strategic Product Design | Graduation Project Planning

Kickoff meeting	11 Sept (d8)	Total calendar weeks	21 weeks
Midterm meeting	29 Oct (d40)	Working days per week	5 days
Greenlight meeting	20 Dec (d78)	Self-scheduled break	10–11 Oct, 25–27 Dec
Graduation ceremony	24 Jan (d100)	TU Delft holiday	23 Dec–5 Jan

		2024																2025			
Week Count		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Day / Month		September					October				November				December				January			
Monday		2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20
Tuesday		3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21
Wednesday		4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22
Thursday		5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23
Friday		6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24
Saturday		7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25
Sunday		8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26
DISCOVER (5w)																						
Literature study																						
Research on Philips																						
Benchmark study																						
Research on consumer divestment experience & collection practice	Preparation (method, participant recruitment)																					
	Execution																					
DEFINE (2w)																						
Data analysis and synthesis																						
(Re)define problems																						
(Re)frame design vision and goals																						
Design criteria and requirements																						
DEVELOP (7w)																						
Individual ideation																						
Co-design	Preparation (method, participant recruitment)																					
	Execution																					
Idea refinement																						
Small scale testing	Preparation (method, participant recruitment)																					
	Execution																					
DELIVER (6w)																						
Data analysis and synthesis																						
Concept finalisation																						
Finalise report																						
OTHER																						
Report writing																						
Meeting																						
Revise plan																						
Submit deliverables to TU Delft Repository																						

Image 4: Gantt chart for the graduation project research plan

Appendix B. Confirmation of WeCycle ‘Old for New’ Program



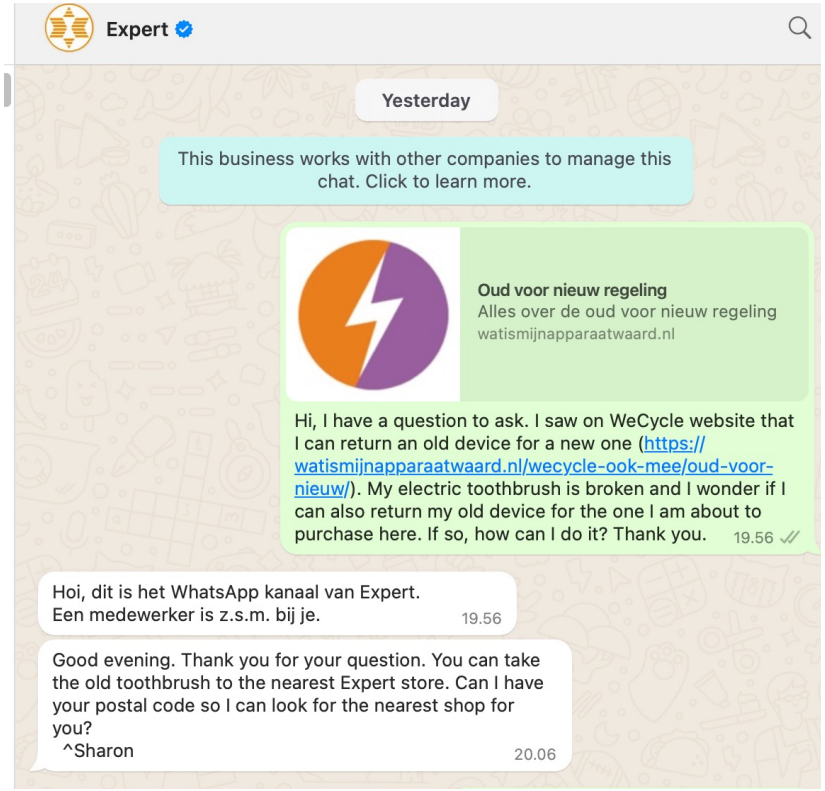
RE: Nieuw ingevuld contactformulier EP.nl (RE: Newly completed EP.nl contact form) Inbox ×

Klantenservice EP:Webshop <klantenservice@electronicpartner.nl>
to me

Dutch → English
Show original

Dear,
Thank you for your message. You can indeed hand in your old electrical appliance at one of our stores.
If you order online this is not possible, our delivery service DHL does not accept returns of old devices.
If you have any questions regarding this message, please let me know.
You can also contact one of our stores with all your questions, which can be found at www.ep.nl/winkels .
I hope I have informed you sufficiently and to your satisfaction .
Yours sincerely,
Dimitri van Vliet
Customer Care/Internal Sales Employee
ElectronicPartner

Marconiweg 2c | 4131 PD Vianen
PO Box 198 | 4130 ED Vianen
0347-364 400 | customerservice@ep.nl



Appendix C. Semi-structured In-depth Interview Guide

Introduction

Good morning/afternoon,

First of all, thank you for allocating your time to participate in this study. My name is Hauri Zafirah and I am from Strategic Product Design program. This study is being conducted as a part of my graduation project / master thesis which is expected to end by January 2025. This study is in partnership with Partners for Innovation.

Before we began the session, I will explain the context of the study and other conditions to ensure ethicality and your safety as a participant.

This study will take approximately 45 minutes to 60 minutes complete. During this session, you will be asked to share your experience in using electric toothbrush, specifically related to your journey and practice during the end of life of toothbrush. Hence, questions about handling waste practice will also be asked.

Your participation in this study is entirely voluntary. If you do not wish to continue, you have the right to withdraw from the study, without penalty, at any time. Please also let me know in case some questions are uncomfortable to answer.

During this session, I will record the audio of our conversation for study purpose. The file will be safely stored in the TU Delft OneDrive password-protected account and will be deleted after the research is finished. Any identifiable data such as name will anonymised using code, such as P1, P2, etc.

[give informed consent form to read and sign]

Question	Probes
General [5 min]	
How long have you been using electric toothbrush for?	
What brand of electric toothbrush do you use?	
Topic: 'Handling waste' Practice [10 min]	
What comes into your mind when 'handling waste' is mentioned?	
In your everyday life, how do you typically handle waste in your household? (e.g. storing / collecting, throwing, recycling)	• *Do you live alone or with family/ roommate/partner?* • *Who else is involved in the storing and throwing waste?* • *Do you have any specific schedule to throw your waste?* • *Do you separate your waste?*
How do you typically handle your electronic waste (e-waste)?	
What do you think is important when it comes to handling waste?	
Has your handling waste practice or habit change overtime?	

Question	Probes
Topic: Current Divestment Journey [15-30 min]	
Brush Head Divestment Experience	
What usually prompts / triggers you to replace your brush head?	*If time is your primary indicator, what is the interval?*
Can you take me through your usual process of replacing your brush head?	Think and feel: • *What goes through your mind during ___?* • *How do you feel during ___?*
[use materials]	Disposal behavior: • *What do you do with the used brush head?* • *Has your behavior in disposing the brush head changed over the years?* • *Have you considered other disposal options?* • *How would you do it differently in the future?*

Question	Probes
Power Handle Divestment Experience	
Have you ever replaced/disposed your power handle?	*When was the last time you replaced your power handle?*
What prompts / triggers you to replace your power handle?	
[For participant who has replaced power handle]	Think and feel: • *What goes through your mind during ___?* • *How do you feel during ___?*
Can you take me through your process of replacing your power handle?	Disposal behavior: • *What do you do with the used power handle?* • *Have you considered other disposal options?* • *How would you do it differently in the future?*
[use materials]	
[For participant who has not replaced power handle] *Would you consider changing your power handle in the future?*	
I would like you to imagine a scenario that your power handle is no longer functioning, and you need replacement.	Think and feel: • *What would likely go through your mind during ___?* • *How would you likely feel during ___?*
How would your process of replacing your power handle looks like?	Disposal behavior: • *What would you likely do with the used power handle?*
[use materials]	

Question	Probes
Circular Collection [10 min]	
Current Knowledge and Experience	
As a [brand] consumer, have you heard of any service or program related to collection? (e.g. collecting brush head, collecting used power handle)	• *How do you know the service/ program?* • *Have you participated in the service/ program?*
Have you participated in such program that return the used product back to the brand/company? (for any product)	
Opinions on Collection Program	
What are your thoughts on a collection program for electric toothbrushes?	• *How do you feel about the idea?* • *What do you see as the pros and cons of such a program?*

Appendix D. Co-creation Sensitizing Workbook

Sensitizing Workbook

For electric toothbrush co-creation

Your name: : .....

Introduction

This workbook is meant to get you in the mood for next week's co-creation session. Within this workbook, you will find 3 engaging exercises to explore your experience in using electric toothbrush and your previous small electrical appliance disposal.

There are no right or wrong answers—only your unique insights. Feel free to express yourself freely, answering in ways that resonate with you. Your responses don't need to come from a designer's perspective; they should reflect your personal experiences and thoughts.

Throughout the workbook, you will find opportunities to write, draw, or take images. The more stories you can share, the more valuable this exercise will be!

Please bring this workbook to next week's session, where you'll have the chance to share and discuss your reflections with the group. Remember, others will see your workbook, so if there are personal stories you prefer to keep private, consider leaving them out.

Best wishes,
Hauri Zafirah

Hi, I Am Your Electric Toothbrush!

Since this study revolves around electric toothbrushes, let's take a moment to reflect on your own. Imagine if your electric toothbrush could talk! What story would it share about its journey with you? Let's hear what your toothbrush has to say.

draw me!

Hi, I'm your electric toothbrush! Let me tell you a little bit about myself.

I come from the brand : .....

I have been with you for : .....
(e.g., 2 years, 6 months)

Let's talk about our journey together:

Something you like about me is:

.....
.....
.....
.....
(e.g. "You enjoy my long battery life", "You enjoy my timer feature")

Something you find challenging or wish was different:

.....
.....
.....
.....
(e.g., "You don't like how long it takes to charge", "You find me too noisy in the mornings")

A Snapshot of Your Stored Devices

In our everyday lives, we often accumulate various electrical appliances and gadgets. Some of these devices are used frequently, while others may be *tucked away*, *forgotten*, or *waiting for the right moment to be disposed of*. This section invites you to explore your home and reflect on the small electrical appliances you currently own but aren't using.

Take a look around your home and find any small electrical appliances or gadgets that are currently not in use and are awaiting disposal. Take a picture of them in their current state or location (e.g., in a drawer, on a shelf, in a storage box).

You can bring your images digitally or as prints to the session to share and discuss.

Why are these devices stored here?

.....

.....

.....

.....

.....

What made you decide to store them instead of disposing of them?

.....

.....

.....

.....

.....

How easy or difficult is it to remember and access these stored devices?

.....

.....

.....

.....

.....

Your Small Electronic Appliances Disposal Journey

In this exercise, you will reflect on your experiences with disposing of small electronic appliances (e.g., mouse, phone, hair dryer, water kettle). Try to map your journey from recognizing the need to dispose of these items to the actual disposal process. Feel free to explain the journey in your own way! If you have replaced your electric toothbrush in the past, you can also share your story about how you dispose of it.

What is the small appliance?

.....

When did you dispose of it?

.....

Why did you decide to dispose of it?

.....

.....

(e.g., broken, outdated, or no longer needed)

You can utilize the third answer as the initial step in mapping your journey on the next page.

How did you dispose of it?

.....

.....

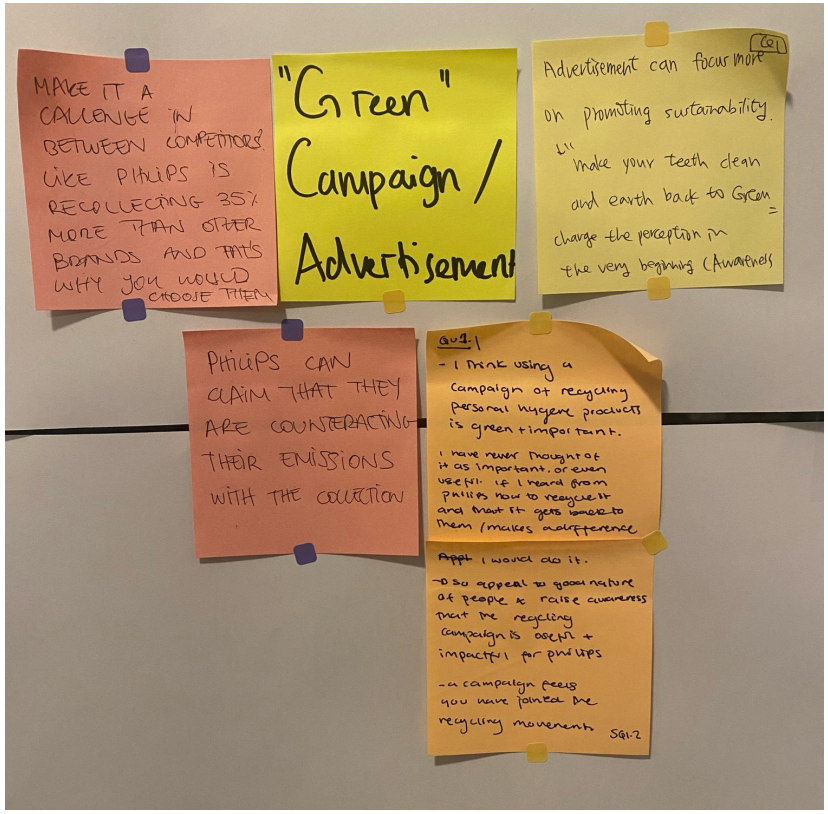
(e.g., recycle it, throw it away)

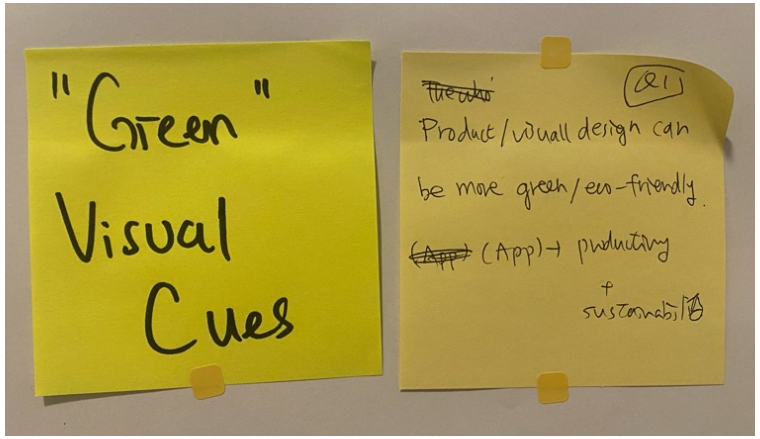
It started here, when...

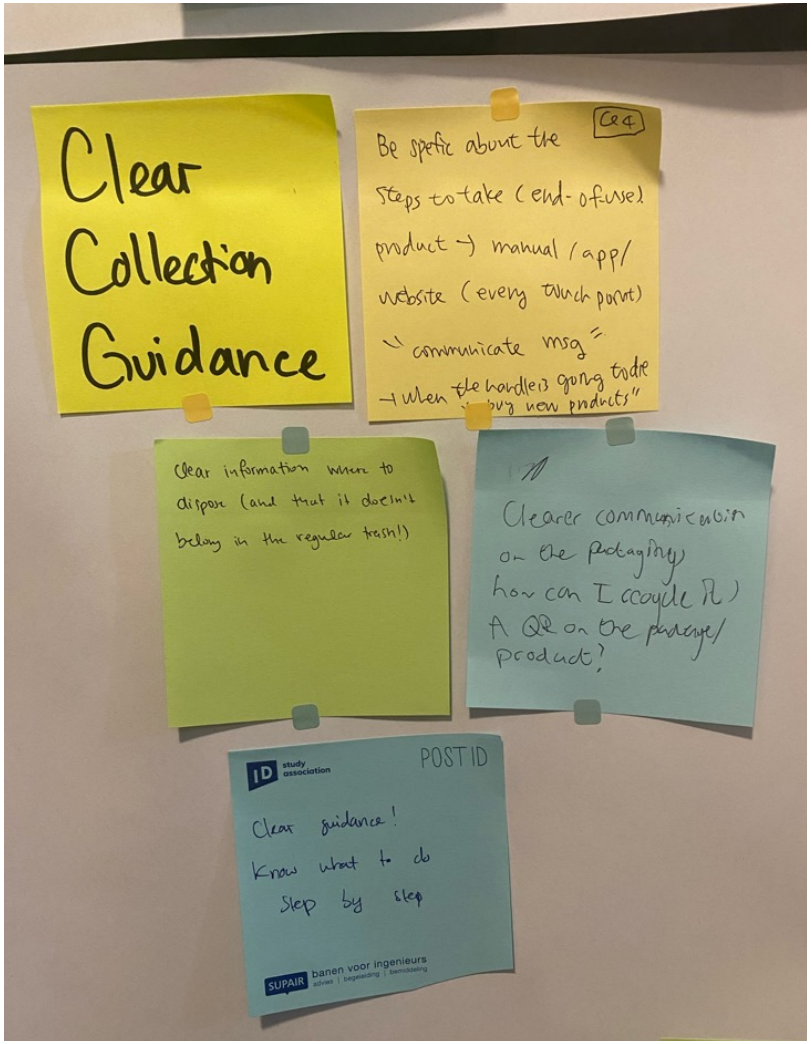
It ended here, when...

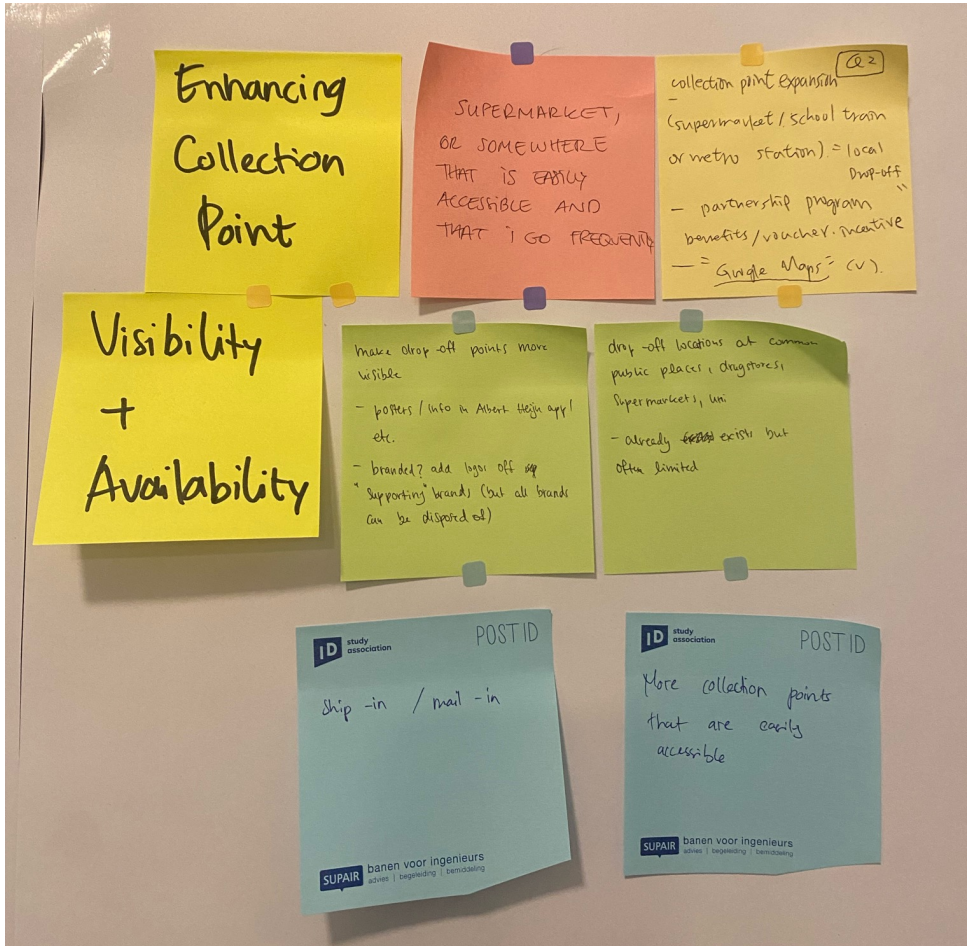
Try to identify the **key stages**, **obstacles**, and **emotions** you encounter along the way

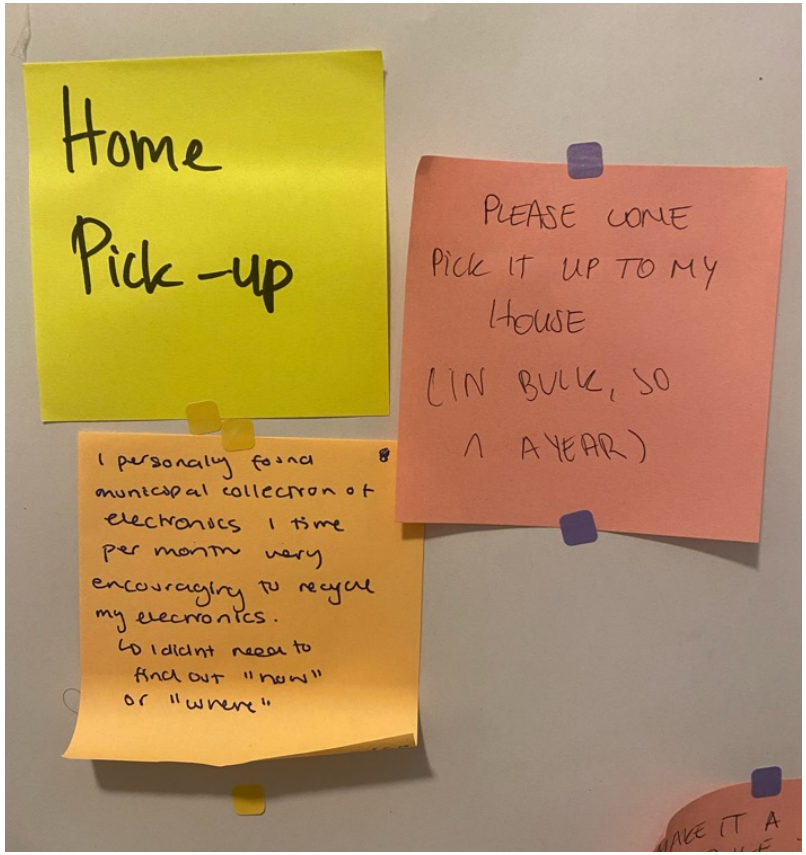
Appendix E. Co-Creation Idea Clustering

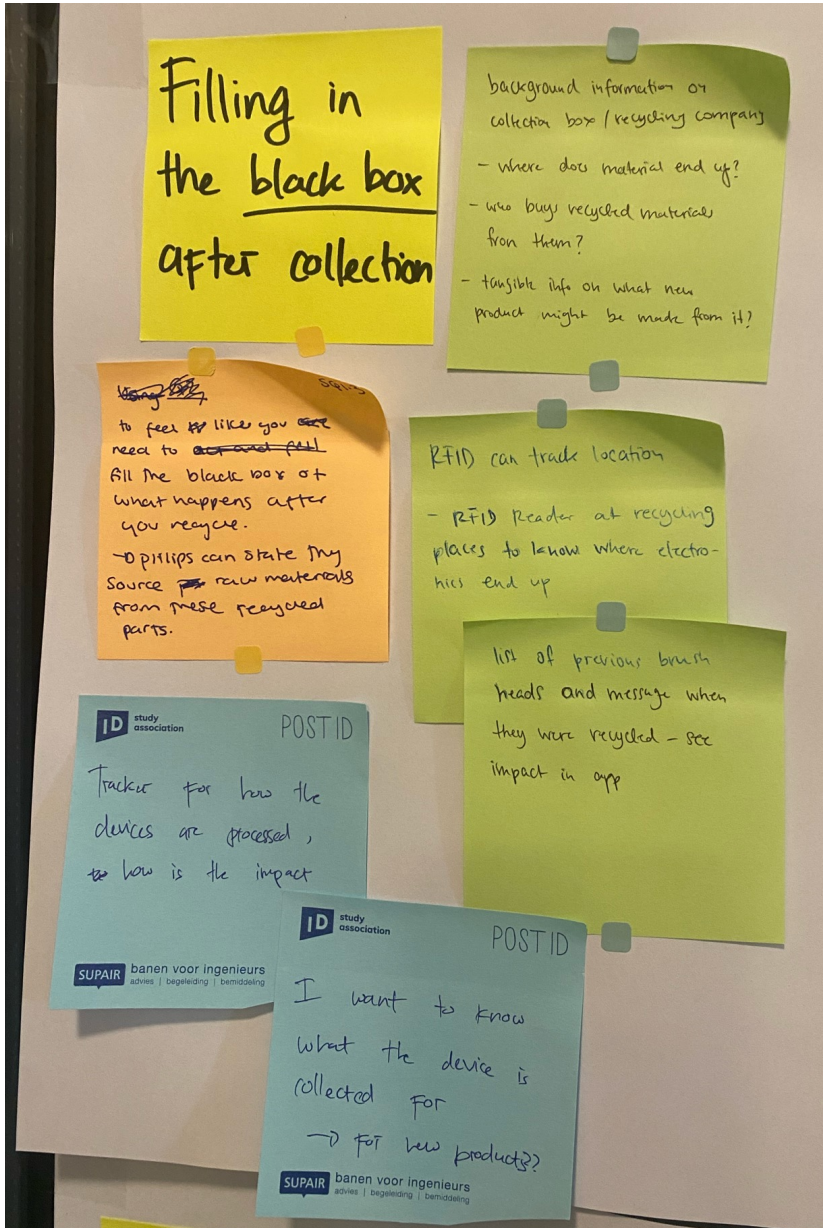


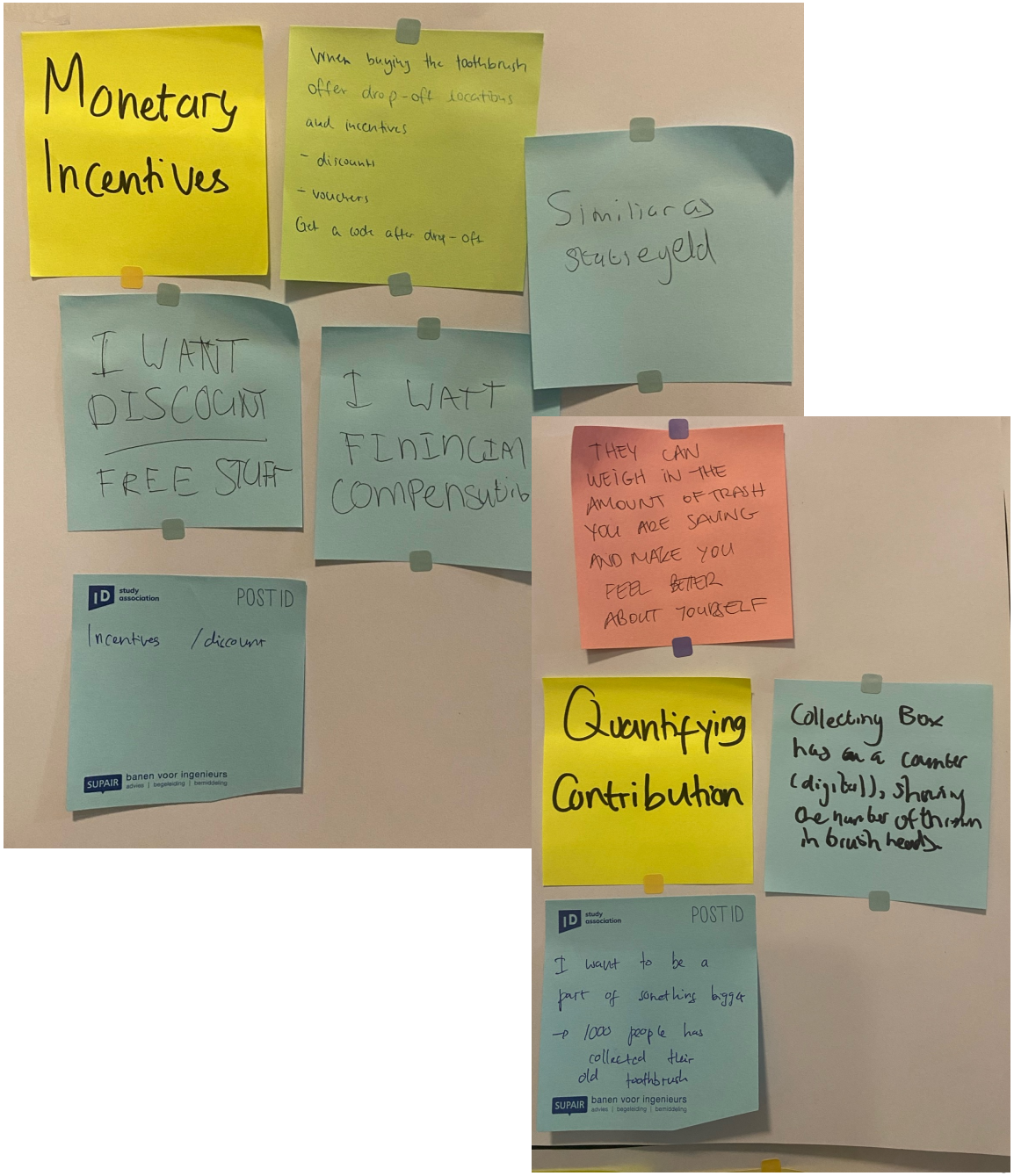





Enhancing Collection Point
SUPERMARKET, OR SOMEWHERE THAT IS EASILY ACCESSIBLE AND THAT I GO FREQUENTLY
collection point expansion
(supermarket / school train or metro station) = local Drop-off
- partnership program benefits / voucher. incentive
= Google Maps (v).
Visibility + Availability
make drop-off points more visible
- posters / info in Albert Heijn app/ etc.
- branded? add logo's off app
"supporting" brands (but all brands can be displayed)
drop-off locations at common public places, drugstores, supermarkets, uni
- already existing but often limited
POSTID
Ship-in / mail-in
POSTID
More collection points that are easily accessible


Home Pick-up
PLEASE COME PICK IT UP TO MY HOUSE (IN BULK, SO 1 A YEAR)
I personally found municipal collection of electronics 1 time per month very encouraging to recycle my electronics. So I didn't need to find out "how" or "where"


Filling in the black box after collection
background information on collection box / recycling company
- where does material end up?
- who buys recycled materials from them?
- tangible info on what new product might be made from it?
to feel like you need to fill the black box of what happens after you recycle.
→ Philips can state they source raw materials from these recycled parts.
RFID can track location
- RFID Reader at recycling places to know where electronics end up
list of previous brush heads and message when they were recycled - see impact in app
POSTID
Tracker for how the devices are processed, & how is the impact
POSTID
I want to know what the device is collected for
→ for new products?
study association
SUPAIR
banen voor ingenieurs
advies | begeleiding | bemiddeling


Monetary Incentives
When buying the toothbrush offer drop-off locations and incentives
- discounts
- vouchers
Get a code after drop-off
I WANT DISCOUNT
FREE STUFF
I WATT FINANCIAL COMPENSATIO
Similiar as stated
POSTID
Incentives / discount
THEY CAN WEIGH IN THE AMOUNT OF TRASH YOU ARE SAVING AND MAKE YOU FEEL BETTER ABOUT YOURSELF
Quantifying Contribution
Collecting Box has an a counter (digital), showing the number of thrown in brush heads
POSTID
I want to be a part of something bigga
→ 1000 people has collected their old toothbrush
study association
SUPAIR
banen voor ingenieurs
advies | begeleiding | bemiddeling

Appendix F. Design Concept Feedback

Introduction

Good morning/afternoon,

First of all, thank you for allocating your time to participate in this study. My name is Hauri Zafirah and I am from Strategic Product Design program. This session is being conducted as a part of my graduation project / master thesis which is expected to end by mid-February 2025. This project is in partnership with Partners for Innovation.

Before we began the session, I will explain the context of the session and other conditions to ensure ethicality and your safety as a participant.

This feedback session will take approximately 45 minutes complete. During this session, you will be provided with scenarios and asked to share your experience thoughts about the design concept.

Your participation in this study is entirely voluntary. If you do not wish to continue, you have the right to withdraw from the session, without penalty, at any time.

[give informed consent form to read and sign]

Intro of Scenario: *Imagine that you have been using your electric toothbrush for a while, and now it is no longer working as well as before. Perhaps the battery life becomes poor, the performance has declined, or it is simply become too worn out. Whatever the reason, you now have an old electric toothbrush that you no longer need. What do you do next?*

After setting up the context, it is expected that consumers start looking for a new electric toothbrush.

Scenario	Design Focus	Question/Probes
Purchase Phase		
Different ways of shopping is possible to be mentioned (e..g, online vs physical store). After acknowledging different ways of purchase, proceed with new scenario:	Product and checkout page with added banner	• *What draws your attention on this page?* • *What do you think this banner is about?* • *What do you think about the banner placement and messaging?* • *Would you normally notice something like this while shopping? Why or why not?*
Sure, there are different ways to shop for a new electric toothbrush. Let's say today, you are considering purchasing directly from Philips. You go to the Philips website to browse your options. Now, let's take a look and explore this mock-up design. *[Give participants the mock-up to interact with]*	Divestment webpage	• *What do you think about seeing this information at this stage of your purchase journey?* • *Would this influence your decision in any way? How?* • *Does this concept change how you think about getting rid of your old toothbrush?*
Use Phase		
Now, let's fast forward. You have placed your order, and after a few days, your new Sonicare toothbrush has arrived. You receive the package at home and open it for the first time. Let's take a look at how this part of the experience feels.	Product packaging	• *When you buy new electronics, do you usually think about what to do with the old one? Why or why not?* • *Does this information change how you think about disposing of your old toothbrush? If yes, in what way? If not, why?* • *Would you typically read this type of information when unboxing a new product?*
	New brush head storage bag	• *If this bag were included in your Sonicare package, where in your home would you keep it? Why?* • *If this bag were part of your routine, would it change when or how often you dispose of brush heads?*

Scenario	Design Focus	Question/Probes
Divestment **Phase** *You have unboxed your new Philips Sonicare toothbrush. As you open the flap inside the packaging, you come across information about Philips' circular efforts and how returning your old device can contribute.* *As you take in this information, you start thinking about your previous toothbrush. The packaging directs you to the Philips website, where you find a return process facilitated by Philips. You see that you can either drop off your old device at a PostNL location, use a locker, or even mail your brush heads in a small return package.* *At this point, let's take a moment to imagine how this return process would play out in your daily life*		**Continued scenario:** *Imagine that on this day, you decide to return your old electric toothbrush using the PostNL service. Based on your daily routine, how do you think this process would unfold?* • *Would you prepare your old device immediately, or would you need time to gather everything? Where would you keep it in the meantime?* • *If using a PostNL drop-off point or locker, when would you fit this into your routine? (e.g., during grocery shopping, commuting, or making a special trip?)* • *How convenient or disruptive does this feel compared to your usual waste disposal or recycling habits? Why?*

Scenario	Design Focus	Question/Probes
Let's explore what happens after you return your old device. Here are three ways you could receive updates about your contribution to Philips' circular initiative…	Post-collection update	• *Would a follow-up message like this make the collection process feel more complete?* • *Which one would make you feel that returning your old toothbrush was worthwhile? Why?* • *Does seeing this type of update change how you view the process?* • *Would this information make divestment feel more like an active contribution rather than a passive disposal?*
Let's explore what happens after you return your old device. Here are three ways you could receive updates about your contribution to Philips' circular initiative…	Referral campaign	• *How do you feel about referring friends or family to return their electric toothbrushes through this program?* • *What concerns, if any, would prevent you from sharing this referral with others?*