E-NVIRONMENTALLY FRIENDLY

A design tool towards positive consumer perception of recycled plastic in electronic products

Master thesis

E-nvironmentally friendly - A design tool towards positive consumer perception of recycled plastic in electronic products

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EXECUTIVE SUMMARY

An essential step on the way to a circular economy is utilizing recycled materials for new products. Even though the use of recycled plastic has been increasing for the past decades, electronic products have been largely overlooked in this context.
Currently, there are no design strategies on how to use recycled plastic in electronic products. Therefore, this master thesis aims at investigating consumers' perception of recycled plastic, and based on the findings, create recommendations for designers on how to implement the material in their products. According to the aim, the following research question was developed: How can a designer stimulate a consumer to opt for an electronic device made from recycled plastic?

In a first step, the available literature on sustainable behaviour, the factors influencing the behaviour-intention gap as well as existing findings on the overall perception of recycled plastic were reviewed. Additionally, consumers of Generation Z, who have been deemed to have strong, pre-existing environmental values, were determined as the focus group of this study.

An analysis of e-products on the market provided information on how the share of recycled plastic is currently communicated. These different communication strategies were subsequently investigated through qualitative interviews. Seven participants were interviewed as to how different product aesthetics and communication strategies influence their perception of the product in question. Insights from these interviews yielded four clusters: aesthetics, trust, sustainability, and quality.
Together with the findings from literature, these research outcomes provided 20 insights into the consumer perception of recycled plastic in electronic products, thus concluding the research phase of this project.

The ideation phase commenced with brainstorming sessions on the detected insights. Eight design students participated and generated over 300 as to how the underlying research insights could be applied in practice. The majority regarded the product directly, but other ideas were related to a product's "surrounding", such as promotion of the product, its price or place of purchase.

In an iterative process, these ideas were transformed into 10 product-related design recommendations and 8 additional, price-, place-, promotion-related recommendations.

The total framework of insights generated throughout the research process can support designers in creating well-perceived e-products from recycled plastic. The three distinct types of information are relevant in different phases of the design process:

• The 20 key insights may be seen as an enriching source of background information for designers, who are getting started on a project and are yet to build their knowledge on the overall topic.

• The 10 recommendations provided may be used in the case, where a designer needs concrete tips and action points for developing a product's design.

• The 8 additional recommendations can be valuable when the design of a device is already finalized, yet it should still be enhanced in terms of consumer perception.

To transfer this study's research findings and make them readily available for product designers, a website was deemed to be most suitable means of presentation. This format allows for a structured displaying of the previously mentioned findings and recommendation categories.

ACKNOWLEDGEMENTS

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Next, I want to thank everyone who participated in my interviews, brainstorming and evaluation sessions. My thesis is based on your participation and I highly appreciate it.

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Lisa

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INTRODUCTION

The first chapter of this report aims to illustrate the scope of this project, its context and the linked issues. It also states the goal and the relevant research questions to tackle those issues.

1.1. Plastic world - plastic waste

Plastic is an amazing material.
It is lightweight, strong, durable, flexible, does not conduct electricity or heat and can be moulded into any shape at relatively low costs. It has improved our lives in many ways and currently it is impossible to imagine a world without plastic.

Unfortunately, there is a flip side to the coin.
Fossil fuels are used to produce common plastic and they are a finite resource, which makes plastic an unsustainable material. Yet, we use it as if there was endless supply.
Only about 30% of the post-consumer* plastic waste in Europe is recycled, which means that the remaining 52,6 million tonnes (Mt) of the annual plastic waste is lost material. It is incinerated or ends up at the landfill (Plastics Europe & EPRO, 2019).
Due to this linear system, the European plastic industry relies heavily on the import of virgin* materials (Interreg North-West Europe, 2018).

One way to reduce our reliance on imports, revalue waste and make a step towards a circular economy* is to recycle. The necessity for a circular economy has been recognized by many individuals, companies and nations. The Dutch government has set a goal to cut its use of primary resources by 50% by 2030 (Government of the Netherlands, n.d.).
Indeed, there is improvement. European recycling rates are increasing, consumer awareness of plastic waste is growing yearly and so is the market of recycled plastics. The amount of plastic waste that was sent to recycling facilities doubled within 12 years. It grew from 4,7 Mt to 9,4 Mt of recycled plastic waste. At the moment, plastic packaging has the highest recycling rate of all European plastic waste (Conversio Market & Strategy GmbH, 2020).

1.2. Scope: Electronic products in the EU

Even though the recycling rates are increasing, a part of the problem has been overlooked for years: plastic waste from electronic devices.

When we think of plastic waste, consumer electronics might not be the first type of product that comes to mind. But have a look around. The laptop you are probably reading this report on contains around 30% plastic. If you want to print the report; 50% of the printers are plastic and if you use a mouse to scroll through the pages, it is 80% to 90% plastic.

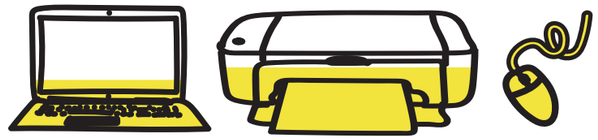


Figure 1.2.A: The colour indicates the share of plastic each product contains.

post-consumer = after being used by consumer. Opposed to pre-consumer which refers to material waste during production processes in factories e.g.

virgin material = unused, raw material

circular economy = an economy that produces no more waste or pollution. All that is used and produced comes from renewable sources and can be repaired, reused and/ or recycled.

Introduction

Every year billions of electronic devices are produced, sold, used and disposed of. This business model brings short-term profits for the companies, but causes long-term harm to the environment (Greenpeace, 2017).

Each year, 12 Mt of electronic waste accumulate in Europe, of which about 20% are plastic. That makes 2,5 Mt of plastic waste from electronic devices yearly. That equals the weight of 250 Eiffel Towers, as figure 1.3.A illustrates. What is more is that the amount is increasing as the consumer electronic market grows. Within the last 20 years, the amount of e-waste increased by 250%.

From all the electronic products currently on the market, only 1% contains recycled plastic (Polymers for a Circular Economy, 2020).

1.2.1. Type of consumer electronics

It appears that there is no clear definition of the term consumer electronics.
All sources refer to products such as computers, tablets, televisions and smartphones (Carpenter & Balija, 2010), but some also include home appliances, such as washing machines, ovens, toasters etc. Wikipedia describes consumer electronics as electronic devices “used for entertainment, communication and recreation” (Wikipedia contributors, n.d.). Similarly, Li, Zeng & Stevels (2015) define it as all home electronics equipment that primarily fulfil the purpose of information processing and communication, from audio systems to home automation.

Since home appliances fulfil a different need and purpose, their purchase criteria might differ from products that are used for entertainment, communication and recreation.
For that reason and in order to clearly define the scope of this project, the term consumer electronics will not encompass home appliances. In this report the term consumer electronics refers to products such as TVs, laptops, computers, tablets, speakers, headphones, digital cameras, game consoles, etc.

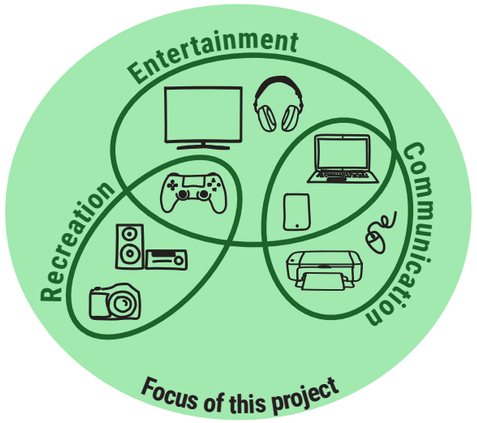


Figure 1.2.B: Illustration of the type of products this project encompasses.

1.3. Problem definition: The problem is twofold

A sustainable economy can only exist when there is opportunity and willingness to buy sustainably.
The good news is that more and more companies are adding a “green” product line to their portfolio. This increases the opportunity for consumers to purchase an environmental-friendly product. At the same time consumers report an increased willingness to do so (Petersen &

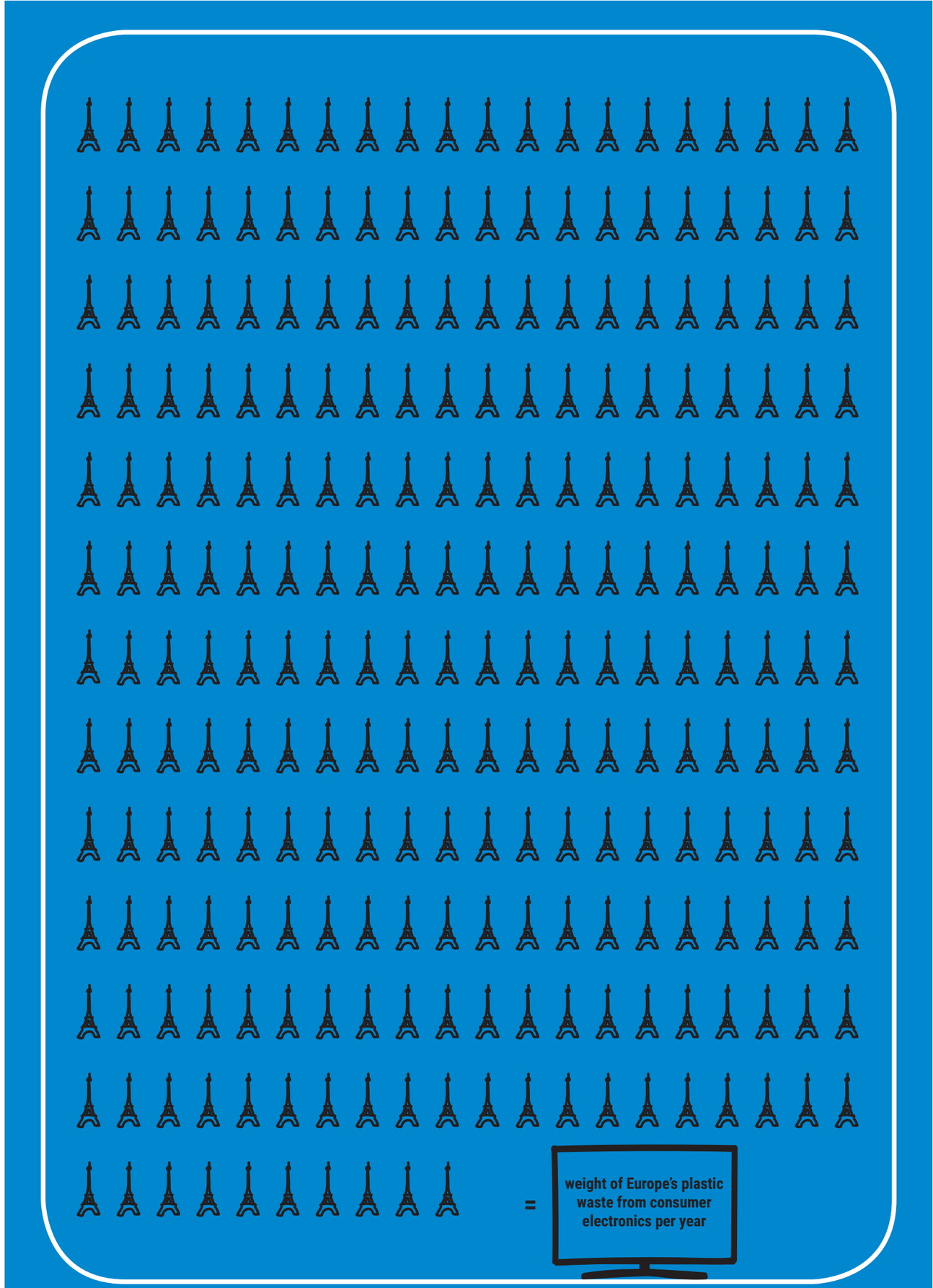


Figure 1.3.A: Illustration to visualise the extent of the issue.

Brockhaus, 2017).
The problem is, however, that even though companies and consumers might have good intentions, it does not necessarily lead to more sustainable purchases.
On one hand, product developers do not know what consumers expect from a sustainable product. They often do not have a clear understanding of how to design and market a sustainable product in a way that is appealing to their customers (Petersen & Brockhaus, 2017).
On the other hand, consumers state positive attitudes towards sustainable products, but when it comes down to actual buying behaviour, they still tend to go for the "standard" unsustainable product (Petersen & Brockhaus, 2017; Thøgersen & Schrader, 2012; White, Habib, et al., 2019; Young et al., 2010). The reasons for this lie in the way humans think and make decisions and will be further explained in chapter 2.

1.4. Design challenge & research questions

Many factors are influencing (un-)sustainable behaviour, both on the designer's and the consumer's side.
When looking at the focus of this project: consumer electronics made from recycled plastic, another factor plays a major role: this type of products hardly exists yet.
As mentioned, only 1% of the electronics currently on the market contains recycled plastic (Polymers for a Circular Economy, 2020). It is clear that the availability of a product strongly affects the likelihood of it being bought.
However, considering the increasing use of recycled plastic across all product categories, it can be assumed that it will be a widely available product type in the near future.

Therefore, this project considers the designer's and the consumer's side in a future-oriented context.
The aim is to research consumers' perspective of and preferences for electronic products containing recycled plastic and transforming those insights into strategies for designers. I believe it is a great advantage to do this project now – before those products are omnipresent – because it can prevent a mass production of devices that might or might not be bought. Currently, insights into consumer's perception of recycled plastic are on a theoretical basis. I argue that clear design guidelines, that help designers to practically implement those insights, can even accelerate the use of recycled plastic.

The main research question is:

How can a designer stimulate a consumer to opt for an electronic device made from recycled plastic?

In order to answer this question, the following sub-questions need to be investigated first:

- What is people's current perception of recycled plastic?
- What are people's purchase determinants for consumer electronics?
- What do people expect from a recycled-plastic product?
- What are current design strategies for sustainable products/ recycled products?

1.5. Design process

The process of this project follows the approach of the Double Diamond that was developed by the British Design Council in 2004. This process allows its user to explore an issue and its many facets (diverge) and then to narrow the scope again and focus on a defined part (converge). As seen in Figure 1.5.A, this method has four phases of action:

• Discover: the first phase is research to understand the problem and its context.

• Define: the results from the discovery phase are meant to shape and frame the challenge and give design directions.

• Develop: this phase is for solution inspiration and iteration and can be triggered by generative sessions or co-designing with other people

• Deliver: The different ideas and concepts of the previous phase will be evaluated and promising ones will be developed further into a final concept.
(Design Council, 2019)

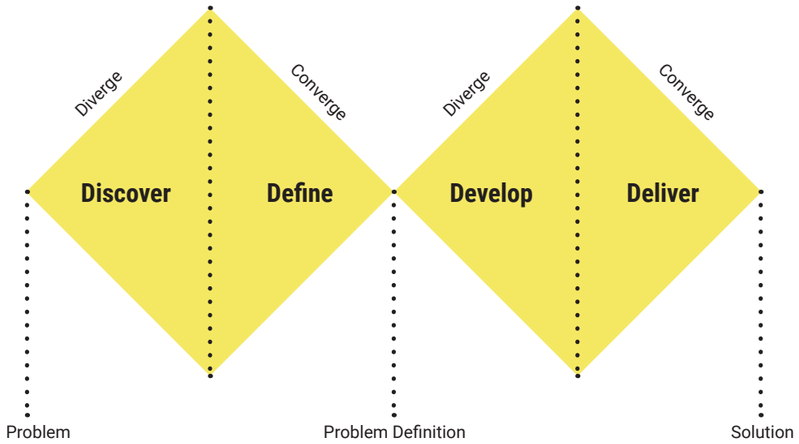
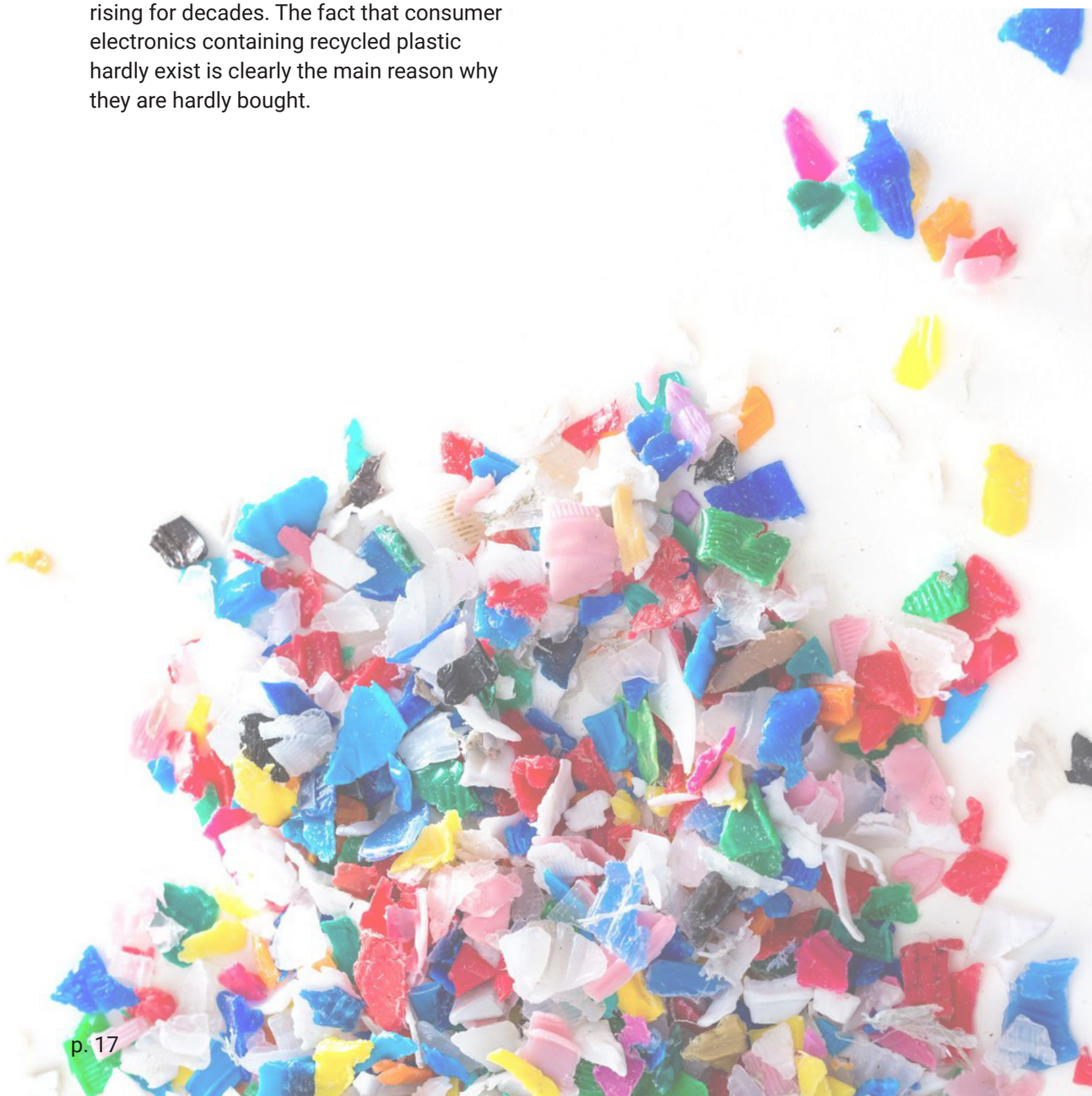


Figure 1.5.A: Double Diamond project approach.

1.6. Chapter conclusions

In Europe, more and more plastic is being recycled each year and the amount of products containing recycled plastic is rising as well. However, this does not hold true for electronic products. Only 1% of e-products on the market contains recycled plastic. That product category has been neglected in this respect, even though the sales numbers of electronic devices are rising for decades. The fact that consumer electronics containing recycled plastic hardly exist is clearly the main reason why they are hardly bought.



2

LITERATURE REVIEW

Generally, people want to live their lives and consume the products they want without purposely harming the planet. However, our consumption patterns are based on the exploitation of the environment (Trudel, 2019).

Due to the importance of consumers' buying decisions, the literature review devotes to understanding human decision-making and sustainable behaviour.

2. Literature Review

The first subchapter of the literature review shines a light on the type of consumer that this project focuses on. The chapter 2.2. discusses which factors drive people to act in favour of the environment and unravels which barriers make these actions difficult to carry out. The chapter 2.3. gives insights into the research that has been done on consumers' perception of recycled plastic. Chapter 2.4. explains how humans make decisions and why they are not always rational. Furthermore, we have a look at decision-making in the context of consumption in chapter 2.5. and, more specifically, discuss factors that influence people when buying a new electronic device.

2.1. Behaviour segmentation and focus group

In his segmentation model, Verplanken (2018) divides consumers into four categories, along two axes that stand for the motivation and opportunity to act sustainably. As seen in figure 2.1.A, the categories are "high potential and willing", "high potential but unwilling", "low potential and unwilling" and "low potential but willing". In this model, motivation (willing) refers to the intention to act sustainably, as well as to pro-environmental attitudes and values. Opportunity describes whether or not a person is able to execute the behaviour. This includes structural factors, such as the availability of a product, as well as personal constraints like a limited budget.

Verplanken describes category B ("high potential and willing") as people who have already strong pro-environmental attitudes and can therefore be motivated to act upon it and maintain these actions. More importantly, they are most likely to pick up sustainable behaviours in the future, which is the focus of this design project. With more sustainable options emerging in the future, they will be the first ones to adopt it and possibly inspire others to do so too.

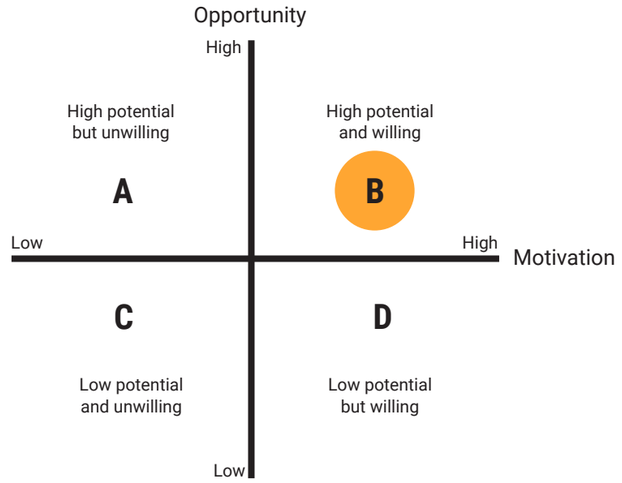


Figure 2.1.A: Verplanken's (2018) segmentation model of sustainable behaviour. The highlighted segment B is the focus group of this master project.

Who is category B?
According to Ballew et al. (2019) and White & Hardisty et al. (2019), Millennials (born between 1981-1996) and Generation Z (born between 1997-2012) are the generations that are most concerned with the environment and increasingly want sustainable product options. Greg Petro (2020) mentioned in a Forbes article that the demand for sustainability seems to rise for each generation.
Focussing on late millennials and generation z as future users has another advantage: they grew up with consumer electronic products (Francis & Hoefel, 2020a; WP Engine, 2017).
In short, the focus group of this project are pro-environmental consumers between the age of 18 – 30.

Designing for this focus group
In order to understand how to design for this group, we need to look into their values regarding brands and purchasing behaviour.
As mentioned earlier, decisions can be influenced by other people. For example, fitting into a social group is a strong motivation to buy a certain product. For Millennials and Gen Z'ers, the opposite is motivating: self-expression through consumption (Francis & Hoefel, 2020a).

Their wish for individuality is reflected in their buying behaviour, as they are willing to pay a premium for personalised products or services (Francis & Hoefel, 2020).
The wish for expression is also shown in their interaction with companies. Millennials and Gen Z'ers want to play an active role by sharing their opinions and co-create together with the brands. Regarding consumption, both generations appreciate experiences that should also be individualized to them. For them, consumption is also a way to express themselves, for example ethical concerns. Starting dialogues and communicating openly are core qualities (Francis & Hoefel, 2020a; IBM Institute for Business Value, 2018).

Figure 2.1.B: Illustration of the focus group's main characteristics: they care about the environment (top), want to express themselves (right), value truth (bottom) and are well familiar with electronic devices (left).

Truth is the basis of the generations' values. They treasure transparency, trustworthiness and authenticity (IBM Institute for Business Value, 2018).

Take away

This project is concerned with electronic devices that contain recycled plastic and will be more widely available in the coming years. The first consumers to buy these devices and motivate others to do so, will be people that already have pro-environmental attitudes and demand sustainable product options. According to market research, those people are found in the generations Gen Z and Millennials; they are currently between 18 – 30 years old. This focus group is familiar with the use of electronic devices and cares increasingly about the environmental impact of the products they buy.
They need their products and services to be personalised, so they can express themselves through their purchases.

Most important to them is truth. In their personal life but also when interacting with companies, they expect open communication, transparency, and trustworthiness.

Knowing that the focus group treasures the truth is important information for this project, however, research did not provide enough insights into when something is seen as transparent or trustworthy. To find out when claims about recycled plastic are credible to consumers, I will question participants about their perception of transparency and trustworthiness of different products and communication strategies in the interviews later on, in chapter 3.2.

2.2. Drivers for sustainable behaviour

What is sustainable behaviour?
There are many definitions about what sustainable behaviour means exactly. Some focus more on the intention of the consumer (Trudel, 2019) and others on the net result of the action (Verplanken, 2018; White, Habib, et al., 2019). The definition by Paço and Laurett (2018) includes both and seems therefore more precise. Their definition reads as follows: "This behavior involves adopting attitudes and behaviours aiming to minimise any adverse effects on natural environment" (p. 1).

In their research, Wang et al. (2014) describe several factors that influence sustainable consumption behaviours. If the following seven factors are highly present in a person, the chance for a sustainable behaviour intention is high as well:

Environmental knowledge is the basis of pro-environmental behaviour. The factor does not strongly influence sustainable behaviour, but knowing about environmental concepts, existing problems and strategies to solve those problems is the first step towards a sustainable behaviour.

Environmental value is described as a belief in certain environmental concepts. It refers to a steady understanding of issues, such as the planet's finite resources to support a growing world population.

Environmental sensitivity refers to people's love and care for nature, based on previous experiences.

Perception of consequences describes an individual's perception of the consequences that a certain behaviour might have on the environment. E.g., if you think that an action you might take, is a great threat for nature, you are less likely to take this action.

Environmental responsibility is based on the perception of consequences and refers to the feeling of responsibility to protect the environment. The higher the sense of responsibility, the higher the readiness to purchase eco-friendly products.

Perceived behaviour control is a term that describes the perceived capability to perform a certain action. Simply put: if you think you are able to perform a certain action, you are more inclined to actually perform it.

Response efficacy is one's perceived degree to which an action can bring change. People who believe that their action can make a difference, are significantly more likely to engage in pro-environmental behaviours.

The research of Wang et al. (2014) gives an overview of intrinsic factors that influence human behaviour. Even though these factors might be inherent in people, it does not automatically lead to sustainable behaviour. The reason for this will be discussed later on, in chapter 2.4.

2.2.1. Barriers to sustainable behaviour

Consumers care increasingly about the environment and are willing to buy

sustainable products (Paparoidamis et al., 2019; Park & Lin, 2020; White, Hardisty, et al., 2019). Bei and Simpson published their research in 1995 and found back then already that people's consciousness towards environmental issues has continued to grow over the past years. However, just like there are internal factors that facilitate sustainable behaviour, there are also cognitive barriers that make the behaviour unlikely:

External focus can also be called "other-focussed" and is the opposite of a focus on oneself. Sustainability is a collective goal and does not always benefit oneself. It is difficult for us to keep the "greater good" in mind and prioritise the planet's or society's needs over our own (Paparoidamis et al., 2019; Verplanken, 2018).

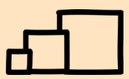
Future focus refers to the psychological concept that outcomes of (un-)sustainable behaviour are not immediately apparent and therefore require us to focus on the future, which is generally difficult for humans (Trudel, 2019; Wal et al., 2018). It is the same with doing sports: it can be hard to keep the behaviour up if the results take a long time to be visible.

Complexity of environmental impacts presents another barrier to sustainable behaviour. The impacts are abstract, inaccessible, difficult to understand and often also conflicting. (Trudel, 2019). Have you heard the argument that a plastic bag is more sustainable than a long-life bag? If scientists present contradicting arguments, it is almost impossible for regular consumers to know which argument is (more) true due to the multifaceted complexity of environmental issues (Koenig-Lewis et al., 2014). Moreover, due to busy lifestyles, it is increasingly difficult to stay well-informed about the latest findings regarding sustainability (Young et al., 2010).

Take away

Literature suggests that there are intrinsic factors that enable (drivers) or hamper (barriers) sustainable behaviour. The theory proposes that if the drivers are highly present and the barriers are low, a person will act in a pro-environmental manner. For that reason, the drivers, as well as the barriers should serve as a guideline and criteria for this project's design. However, not all factors are equally relevant for the project. I argue that some factors, such as caring about nature, are already highly present in the consumers of the focus group.
For this project, only the factors that are directly related to behaviour or are seen as the biggest issues when it comes to sustainable behaviour by researchers are considered. From this chapter,
the drivers include:

- ***The perception of the consequences that a behaviour might have on the environment***



- ***The efficacy of behaviour; the degree to which one believes the own behaviour can bring change***

the barriers include:

- ***The fact that sustainable behaviour often requires an external focus; putting a "greater good" prior one's own benefits***

- ***The complexity of environmental impacts that make them difficult to comprehend***

2.3. Consumer's perception of recycled plastic

In general, it can be said that people perceive recycled plastic positively. However, this cannot be found in every study. In some cases, people still believe that recycled plastic is inferior to virgin plastic (Bei & Simpson, 1995). Recycled plastic can have a negative impact on the perception of the product's quality, functionality and aesthetics (Luchs et al., 2010; Magnier et al., 2019; Park & Lin, 2020). However, also the opposite is true. Studies by Mobley et al. (1995), Petersen & Brockhaus (2017) and Magnier et al. (2019) found that participants were more favourable towards products containing recycled plastic. There are assumptions that the perception of consumers depends on the type of product. The three studies investigated this factor and could not confirm the assumption.

Even though Magnier & Schoormans (2017) found that consumers respond positively to packaging with a recycled appearance, this seems to hold true only for packaging. Petersen & Brockhaus (2017) argue that consumers do not particularly favour a "green" look. According to their research, products with earthy colours and natural fibre textures are perceived as inferior to virgin material products. When the products – a pair of headphones and a garbage bag – had a "green look", the participants rated the products' quality and aesthetics significantly lower than a fossil-based alternative.

Remarkably, this seems to be only due to the "green" look. When the products had the same appearance as the virgin material alternative, but were clearly labelled "recycled plastic", no inferiority could be found. For the garbage bags, the perception of aesthetics and product quality was actually significantly higher when labelled "recycled plastic". Both products were perceived environmentally friendly, in the case of the label and in case of the "green" look.

Figure 2.3.A: Images of the headphones and the garbage bag that were shown to participants for the study.

It appears that there is no definite answer to the question how recycled plastic is perceived by consumers. The look of the material can influence the perception of the product – positively and negatively. Nonetheless, in many cases, consumers do prefer recycled plastic over a fossil-based alternative (Petersen & Brockhaus, 2017).

This paragraph gives a summarised answer to the research question: *"What is people's current perception of recycled plastic?"*

Despite the positive attitudes, it is known that this does not automatically result in sustainable behaviour. The reason for this lies in the way that humans make decisions, which is explained in the following chapter.

Take away

Even though findings of researchers can be contradicting, this project targets a consumer segment that demands sustainable product options and states positive attitudes towards recycled plastic. Therefore, literature with such positive findings is given more attention. Especially the findings by Petersen & Brockhaus (2017) are relevant, as one of their study's product was an electronic device. Since they found that consumers perceived headphones significantly inferior in terms of aesthetics and quality when the product had earthy colours and a fibre texture, these exterior factors do not have to be investigated further in my research. When the headphones of the study by Petersen & Brockhaus (2017) had a "normal" look, but were labelled as recycled plastic, no clear inferiority was found, which is why this factor is explored further in the interviews. In chapter 3.2., the participants are presented with an e-device that looks like a virgin material product but carries the label recycled plastic in order to get deeper insights into their perception regarding quality and aesthetics.

2.4. Human decision-making process

It is a common belief in economical science that human decision-making is driven by rationally considering advantages and disadvantages (Koenig-Lewis et al., 2014). Yet, we have all made "stupid mistakes"; we made a decision that was not beneficial for us and we could have known better. Also literature has proven that humans do not follow rational decision-making strategies (Verplanken, 2018).
Psychologists and neuroscientists have found an explanation for this phenomenon. They distinguish between two different systems that are used for thinking and decision-making: the "intuitive-automatic" system and the "reflective-rational" one (Thaler & Sunstein, 2008).
The reflective system works in a conscious way; it gauges the advantages and disadvantages of an option. On the contrary, the automatic system reacts quickly, emotionally and instinctive. It refers to processes in the brain that we would usually not call "thinking" because it does not happen actively; it is more habitual (Thaler & Sunstein, 2008; Trudel, 2019).
Furthermore, we try to minimise the cognitive effort and use unconscious strategies that help us making a decision, e.g. when it is too complex to fully grasp. (Verplanken, 2018). These strategies are called "heuristics" and explain for example, why more people are afraid of plane flights than of car rides – even though the risk of a car accident is statistically much more likely (Thaler & Sunstein, 2008).

Another factor that keeps us from making the right decision is the so-called "behaviour- intention gap" and is explained in the following subchapter.

2.4.1. Behaviour-intention gap

Even when our intentions are right and we know what the right decision would be, we can still not always act upon it. We want to do sports, eat healthy and save money, but there is this gap between our intention and our actual behaviour (Saad, 2013).
This discrepancy might be due to a lack of willpower, motivation or knowledge, caused by the two different systems that direct our thoughts (Parkinson et al., 2014).
This behaviour- intention gap is very present in purchasing behaviour, especially when it comes to sustainable products (Luchs et al., 2010; White, Hardisty, et al., 2019). Young et al. (2010) mention a study in which between 46% and 67% of the participants show positive intentions towards buying organic food. The share of people who then actually exhibit this behaviour and buy organic food, lies between 4%-10%.

Factors that influence and potentially close this gap are presented in a framework by White, Habib & Hardisty (2019). They propose that the following psychological factors need to be facilitated in order to shift consumer behaviour towards pro-environmental purchases:

Social influence: behaviour is strongly influenced by other people. There are different ways others can have an effect on us: *social norms* are our beliefs about what is socially accepted, e.g.: not littering the streets, or by *social desirability* which means that people buy certain products in order to belong to a social group.

Habit formation: Many of our daily actions become automatic over time; they turn into habits. Very often these habits are unsustainable and a shift towards pro-environmental behaviour requires habit changes.

Individual self: The image of oneself plays an important role in behaviour change as well. We want to keep this image positive, for example, and therefore also prefer to consume information that reinforces our existing views. Furthermore, people generally want to be consistent in their behaviour. This means that if people have an environmentally conscious self-image, they are more likely to follow through with the associated actions in order to be consistent. The self-image is also strengthened by affirmation of others and can be communicated by green consumption (Magnier et al., 2019; Trudel, 2019). It might therefore be important, that a product signals this environmental consciousness to others.

Feelings and cognition: As described in the previous chapter, there are two ways of how humans decide: driven by feelings or by cognition. Regarding the feelings, positive as well as negative emotion can be effective in triggering a certain decision/ behaviour. Consumers might feel pride or another positive affect from behaving environmentally friendly. People who feel responsible for the environment are strongly influenced by the negative emotion of guilt. Cognition is especially

relevant when information is presented. It is clear that people need to understand a problem and its consequences in order to act upon it. Here it is important to know how different ways of framing a message are perceived by consumers.

Tangibility: An issue with sustainable behaviour is that its outcomes are abstract and not tangible for most of us. Consumers are more focused on the present and proximal impacts. In order to bridge the behaviour-intention gap, the consequences of a behaviour need to be perceived as relevant for oneself and one's future.

As this subchapter showed, many factors play a role when it comes to executing our own intentions. The following chapter focusses more specifically on buying behaviour and investigates factors that influence which products we buy.

Take away

The behaviour-intention gap is a great barrier to sustainable consumption, and it is important to know what factors "play against each other" when making a decision. The factors provide a set of criteria that should be used in order to increase sustainable purchase decisions. According to the framework by White & Hardisty, et al. (2019), five factors influence the gap, but for this project, only three seem relevant. Taking the self-image of an individual into account is especially important because of the consumer group this project focusses on. Self-expression through products is key for them. Feelings and cognition always play a great role for purchase decisions. Positive emotions, but also negative ones can motivate people to opt for a certain product. Cognition is relevant when the consumer has to comprehend information and has to make a conscious decision, which is the case when buying electronic devices. The fact that consequences of (un-)sustainable actions are usually not tangible, is a great barrier to sustainable behaviour that was detected as such by many researchers. It is therefore imperative to make the impact of purchasing a recycled e-device more concrete and tangible for the consumer.

This chapter also made clear to not be blinded by the intentions of people, as they do not reflect real-life behaviour. For the interviews later on in this project, it is crucial to dig deeper than the intention. Finding subtleties in preferences and potential concerns is necessary, as those might be the deciding factors of which product will be bought in the end.

2.5. Purchase decisions

The products we buy regularly are strongly influenced by convenience, price, value for money, risk concerns (e.g: personal health), our habits and by how well the product satisfies our intrinsic or social needs (Wang et al., 2014).

Depending on whether these influences are positive or negative, they can be seen as an advantage or disadvantage. The acquisition-transaction utility theory by Richard Thaler from 1983 suggests that consumers always try to have maximum advantages ("benefits") and minimal disadvantages ("costs") (Bei & Simpson, 1995). As already discussed in chapter 2.3., this theory is not always true, because humans often make decisions with their "intuitive-automatic system". However, if we do have to make a conscious decision, then the theory holds true. If a person considers buying a product that he/ she never bought before, he/ she probably considers the costs and benefits first (Magnier et al., 2019).
Since we cannot consider every single aspect of a product, as this would be a mental overload, we prioritise a few factors and those usually only consider our self-interest (Verplanken, 2018). We want to maximise the benefits for ourselves (Bei & Simpson, 1995). This presents a barrier to sustainable purchases: buying pro-environmental products benefits a collective interest in the future. For that reason, the sustainability-performance of a product is rarely considered as a purchase determinant (Verplanken, 2018).
According to Luchs & Kumar (2017), however, people are willing to trade-off aesthetics for sustainability. In their study, they found that participants found sustainability more important than the look of the product, but functionality and performance more important than sustainability.

The following subchapter focusses specifically on this project's product category: consumer electronics. It will be discussed what factors are relevant for consumers when buying these products and how they relate to sustainability.

2.5.1. Purchase criteria for e-device and sustainability

Since technological products are relatively expensive and not bought on a regular basis, we make these purchase decisions with our "reflective-rational system" (Young et al., 2010).

Literature suggests consumers care less about the environmental impact of such durable products (Young et al., 2010), possibly due to the fact that rarely bought products produce a smaller total amount of waste than daily bought products (Magnier et al., 2019). Consumer electronics in particular are the product category that is the least linked to environmental issues and even if they are, then foremost due to energy consumption (Fischer et al., 2019; Magnier et al., 2019; Young et al., 2010).

For electronic products, the main purchase determinants are very device-specific and about technical specifications, such as the performance, screen size or storage capacity, but also the price is considered highly important (Fischer et al., 2019; McGeevor, 2009). Further, the design, brand, product quality and technology are considered (McGeevor, 2009; Polymers for a Circular Economy, 2020; Rau & Fang, 2018)

This paragraph gives a summarised answer to the research question: *"What are people's purchase determinants for consumer electronics?"*

Young et al. (2010) identified five barriers for purchasing green technological products:

Lack of time: Consumers perceive the research of a product's sustainability performance as very time consuming. This is even more intense in an already stressful situation, such as moving house, which is often the reason for an electronic product purchase.

Price: A high price is a well-known purchase barrier. Many consumers would like to spend more for a more sustainable product, but find their options constrained due to their budget.

Lack of information: Many consumers want to buy the most sustainable product, but the information to do so is hardly available. Companies do not share much about their products' and their own environmental and social performance. This negatively influences the first factor; the required research time.

Cognitive effort: One participant of the interview sums it up: "It is hard work being green" (p.26). This barrier consists of several factors:

1) The lack of time, especially in stressful moments

2) Since e-devices are not bought frequently, we are not very experienced with this situation and it requires therefore more cognition.

3) Researching sustainability-information means learning about different types of impact, which can be complex and perplexing.

Non-green criteria: Even consumers who value eco-friendliness very high, have habits and desires that might conflict with a sustainable purchase, e.g.: product features, appearance, retailer choice or delivery costs.

Besides the barriers, Young et al. (2010) also found facilitators of eco-friendly buying behaviour:

Reduce cognitive effort: consumers try to reduce the research time and mental work by trusting certain sources, labels or companies that offer information and thereby help them to make a decision.

Availability in mainstream retailers: Also strongly related to trust is the retailer. E-products are relatively expensive, and consumers do not want to take any risks. A well-known retailer is trusted to ensure a certain product standard and a customer-friendly warranty.

Guilt: The feeling of guilt is a strong driver for sustainable purchases and motivates green consumers to keep their green values up. Even though the interviewees spent time and effort on finding sustainable options, they might still feel guilty for prioritising non-green criteria, not researching enough, discovering an issue after purchasing and often even for buying a product in general.

Take away

The identified barriers and facilitators by Young et al. provide information that is highly relevant to my project. However, it also includes factors that do not regard the product itself, but contextual factors. Even though price is clearly important and I also see availability in mainstream retails as a great way to build trust and credibility between a company, or a recycled plastic product and the consumer, these are factors that do not origin in the product and are therefore not considered. The relevant factors include the barriers of lack of time and lack of information, which lead to more cognitive effort and can be diminished by reducing the cognitive effort. Consumers find that the sustainability performance of e-devices is hardly available, or at least very difficult to find and presented in a complex way, which makes the search extremely time consuming and frustrating. Reducing these efforts must therefore be a requirement for this project's outcome. Also, the prioritising of purchase criteria can be highly important in order to find out what non-green criteria (such as performance or design) participants would prioritise under certain circumstances and if choices can be influenced by using the emotion of guilt.

2.6. Chapter conclusions

The literature research has given me a great understanding of what factors substantially influence consumers and their purchase decisions.
Due to the focus and the scope of this project, and the focus group's characteristics, certain factors are more relevant than others. From the discussed literature, ten factors turn out to be highly useful for this project:

- **Four drivers & barriers for sustainable behaviour**
- **Three factors influencing the behaviour-intention gap**
- **Three factors influencing purchase decisions of sustainable e-devices**

You can find them below, sorted by chapter and including a brief explanation of its meaning.
Hereafter are additional factors that have to be considered in the final design, as they are the key values of the project's focus group: Late Millennials and Gen Z'ers.

Drivers & barriers of sustainable behaviour (chapter 2.2. & 2.2.1.)

Drivers

Perception of consequences
It is an individual's perception of the consequences that his/ her behaviour can have on the environment. These consequences are often not tangible.

Response efficacy
This is the perceived degree to which an action can bring change. If consumers believe that their action can make a difference, they are more motivated to take this action.

Barriers

Complexity
Impacts that our behaviour has on the environment are mostly abstract, inaccessible, difficult to understand and often also conflicting.

External focus
It can also be called "other-focussed" and is the opposite of a focus on oneself. Sustainability is a collective goal and does not always benefit oneself. It requires to put one's own needs second.

Psychological factors influencing the behaviour-intention gap (chapter 2.4.1.)

Feelings & cognition
Positive as well as negative emotion can be effective in triggering a certain decision/ behaviour. Cognition is especially relevant when information is presented.

Individual self
People have an image of themselves and want to keep this image positive. They generally want to be consistent in their behaviour. This means that if people have a pro-environmental self-image, they are more likely to follow through with the associated actions in order to be consistent.

Tangibility
Outcomes of sustainable behaviour are abstract and not tangible for most people. Consumers are more focused on the present and proximal impacts.

Factors influencing the buying decisions of sustainable electronic devices (chapter 2.5.1.)

Drivers

Reducing cognitive effort
E-devices are not bought regularly, and it is a lot of mental effort to search for sustainable options and evaluate them. A lot of effort equals a lot of time. Effort and time can be reduced by trusting certain sources or labels that offer information.

Guilt
This feeling is a strong driver for sustainable purchases and motivates green consumers to keep their green values up. Even when consumers spend time and effort on finding sustainable options, they often still feel guilty for prioritising non-green criteria, not researching enough etc.

Barriers

Non-green criteria
Even consumers who value eco-friendliness very high, have habits and desires that might conflict with a sustainable purchase, e.g.: product features, appearance, retailer choice or delivery costs.

Core values of the focus group (chapter 2.1.)

Transparency
Starting dialogues and communicating openly are core qualities. Truth is the basis of the generations' values. They need companies to be honest and transparent.

Trust
The value of trust is related to transparency. The generations want to be able to trust others. Therefore they expect trustworthiness and credibility.

Self-expression
The consumers of these generations use consumption as a way to express themselves and their concerns (e.g. ethical concerns).

Design Requirements

After the literature research, the following requirements are seen as substantial for the final design:

→ **Design recommendations for consumer electronics containing recycled plastic have to be based on the drivers & barriers for sustainable behaviour (chapter 2.2. & 2.2.1.), the factors influencing the behaviour-intention gap (chapter 2.4.1.) and the factors purchasing of green e-devices (chapter 2.5.1.) that can be found on the previous page (p.28).**

→ **A design guideline for consumer electronics containing recycled plastic has to focus on transparency, trust and/ or allow for self-expression (chapter 2.1.).**

3 RESEARCH ACTIVITIES

After researching the theory and existing studies, research activities should give more practical information. This chapter elaborates on explorative methods that are used to get rich insights and inspiration from real life experiences.

3.1. Product analysis: Communication of recycled plastic in consumer electronics

The amount of consumer electronics on the market that contain recycled plastic stands at around 1%.
They are not the norm and are in most cases only found when actively searched for them. It appears that there are three ways of how the recycled material of an electronic device is communicated online:

Green look + description
The product itself has a "green" look by using natural materials, such as wood, bamboo or cork, has earthy colours or a "melted plastic flakes" look. Additionally, the sustainability of the material is communicated in the description of the product.

Standard look + description
The product has a standard look. There are no visual differences to virgin material products. However, the use of recycled plastic is clearly stated in the informative text about the product.

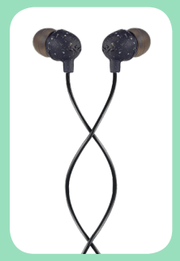
Standard look + no description
The use of recycled plastic is not communicated visually or verbally on the product's website. The information can only be found on a website of the company without clear connection to a specific product or on independent sources.

This paragraph gives a summarised answer to the research question:
"What are current design strategies for sustainable products/ recycled plastic products?"

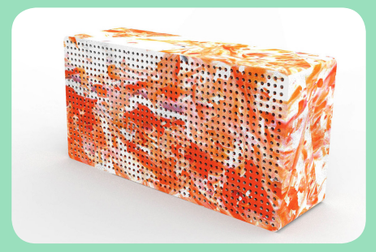
These three categories derived from an online research and analysis of different consumer electronic products. The aim was to get an understanding of current design and marketing strategies regarding recycled plastic in electronic products.

On the next page are the main findings from six analyses of example products; two examples per category. For the more detailed analyses, see appendix B.

Green look + description



• incorporated wood (-optics) or fibers communicate sustainability visually
• eco-friendly materials are clearly mentioned in products' descriptions on company's website, as well as retailer



• using the characteristics of the recycled plastic as design element
• materials' origins are stated clearly on producer's website

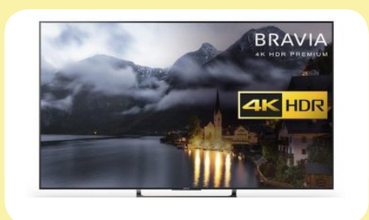
Standard look + description

• does not communicate its 40% share of recycled plastic visually **but** it is stated explicitly on the website
• the brand itself stands for sustainability in the smart phone industry.

• the name JBL Flip 5 Eco gives away that there is an eco-friendly component
• on its website the use of 90% recycled plastic is declared
• visually not different than its virgin material predecessors

Standard look + No description

• information about share of recycled plastic – including ocean-bound plastic*- is hardly communicated by the company
• information is mainly found on independent websites (e.g.: blogs)



• company created its own recycled plastic
• only on the material's website products that incorporate it can be found. On the product's website itself, there is no mention of any material

*ocean-bound plastic = plastic that was collected from maritime areas, like beaches, that would have ended up in the sea otherwise.

3.2. Interviews

De Pelsmacker et al. (as cited in Young et al., 2010) finds lack of availability, disbelief of green claims and lack of information to be reasons for less green consumption. As mentioned earlier in this report, the lack of availability is the main reason why environmentally friendly consumer products are not bought. The disbelief of sustainability claims and lack of information would correlate with the needs of the target group (chapter 2.1) and are factors that are investigated in the interviews.

The main research focus is on the preferences regarding the look and communication of recycled plastic in an electronic device.

The research questions for the interviews read as followed:

• *To what extent do participants want recycled plastic to be communicated in the product itself? Is the clearly preferred communicator?*

• *What do people think of pro-environmental claims? To what degree and under what circumstances are they believed?*

• *How does the perception of the recycled plastic impact the perception of the product?*

• *In what product categories do people care more/ less about recycled plastic? Can new categories be found?*

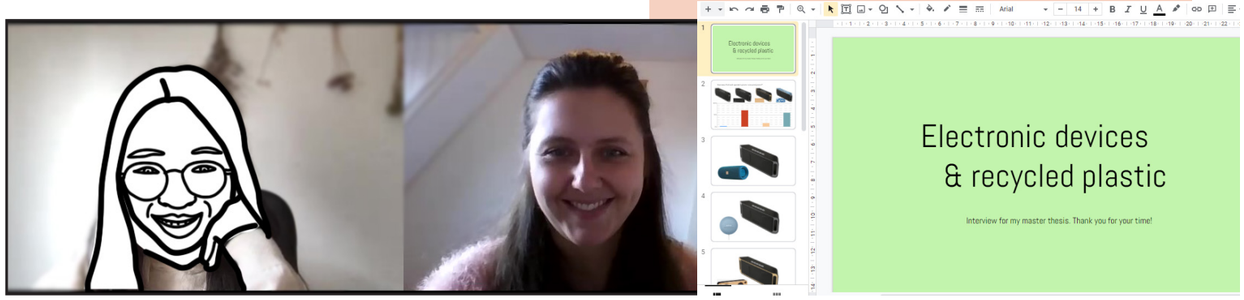


Figure 3.2.A: An anonymised snapshot from the Zoom recording of one interview (left). The participant and me could see each other, as well as the Google slides that were used as interactive collaboration platform (right).

3.2.1. Method:

A qualitative approach with semi-structured in-depth interviews is chosen to allow participants to express their thoughts and get rich answers.

The three ways of communicating recycled plastic identified through the product analysis in the previous chapter (3.1.), served as starting point for the interviews. Even though Petersen & Brockhaus (2017) suggest that the "green look" is not particularly liked, my product analysis showed that it is still very common to use this way of communicating the sustainability of a product. In their study, they used an image of headphones that had earthy colours and a fibre texture. However, this look appears to be more typical for bio-based plastic than for recycled plastic. From the product analysis, I found recycled plastic to be often combined with wood or to have a distinctive pattern. In the interviews, **the "green look" is therefore represented by one speaker that contains wood and one that has a "recycled pattern".**
The category *standard look + description*

is investigated by a product that contains a label. This was done as well by Petersen & Brockhaus (2017), but their results indicate that the findings could have been due to chance. For that reason, I wanted to include a **speaker with "normal appearance", but a recycled plastic-label** in my interviews and find out how the participants perceive the product in the context of this research. To hear participants' opinions about a product that gives absolutely no hint on a possible share of recycled plastic, one image of **a fossil-based audio speaker** is included (see figure 3.2.B).

Based on the research questions and previous research, I developed an interview structure that functioned as a guideline to cover the main questions of the research.

3.2.2. Participants:

The participants (n=7) were selected according to the target group: between 18 and 30 years old and with pro-environmental attitudes.

One participant was male, the other six female and they were from five different countries. Four participants were design students, who were chosen because they can typically express product preferences and their reasons in greater detail. The other three interviewees had mixed educational backgrounds.

3.2.3. Procedure:

Each interview took about one hour and was held as video call via Zoom. Google Slides was used as an interactive collaboration platform.

The introduction included the purpose of this interview and the verbal consent of the participant to record the call.
The first part of the interview related to the communication and the credibility of recycled plastic.
By manipulating a picture of an audio speaker, I made sure that the only different variable between the versions is the way the recyclability is communicated. The participants were asked to rate the

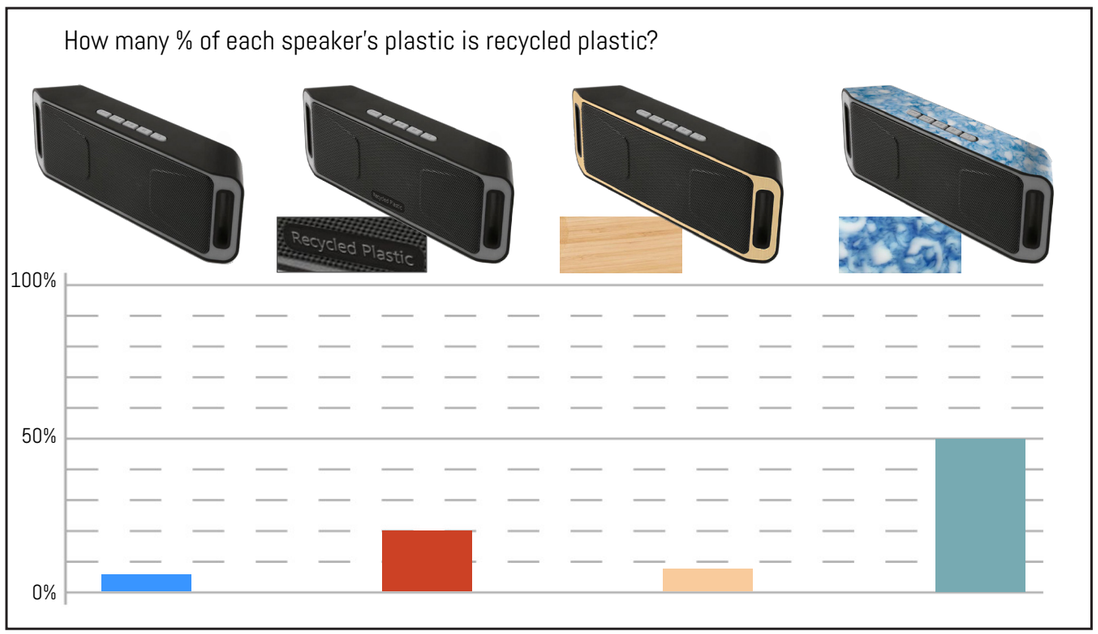


Figure 3.2.B: Four different versions one speaker: without any indications, with a label saying *recycled plastic*, partly made from wood and partly containing a "recycled look". The participants could use change the coloured bars to indicate the assumed percentage of recycled plastic in each version.

percentage of recycled plastic of each speaker (figure 3.2.B). This initial exercise should make the participants compare the different versions and make them form preliminary opinions regarding the credibility of the claim that each version contains recycled plastic.

After this initial exercise, each speaker version was discussed separately, including another example of an audio speaker that tries to communicate the recyclability the same way (figure 3.2.C). This second example was meant to inspire the participants in case the manipulated photo was not triggering enough. It also gave them a chance to compare the two speakers, which makes it easier to express preferences and allows for much richer insights. I also showed the participants one slide that contained 28 different looks of recycled plastic to give them examples how what recycled plastic could look like and ask them which patterns they find appealing. I created the five single-coloured

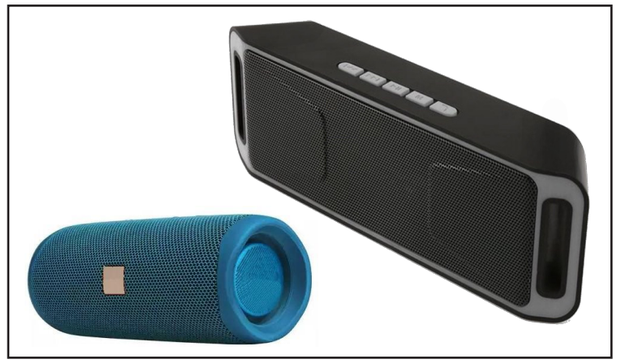


Figure 3.2.C: A slide showing one of the manipulated speaker versions (right) and another example product (left).

stimuli, because no sufficient sample pictures of single-coloured plastic could be found on the internet. The patterned stimuli were examples from different websites that I chose to provide a variety of colours and patterns.
The second part of the interviews tried to shed a light on potential differences between product types in the category of consumer electronics.

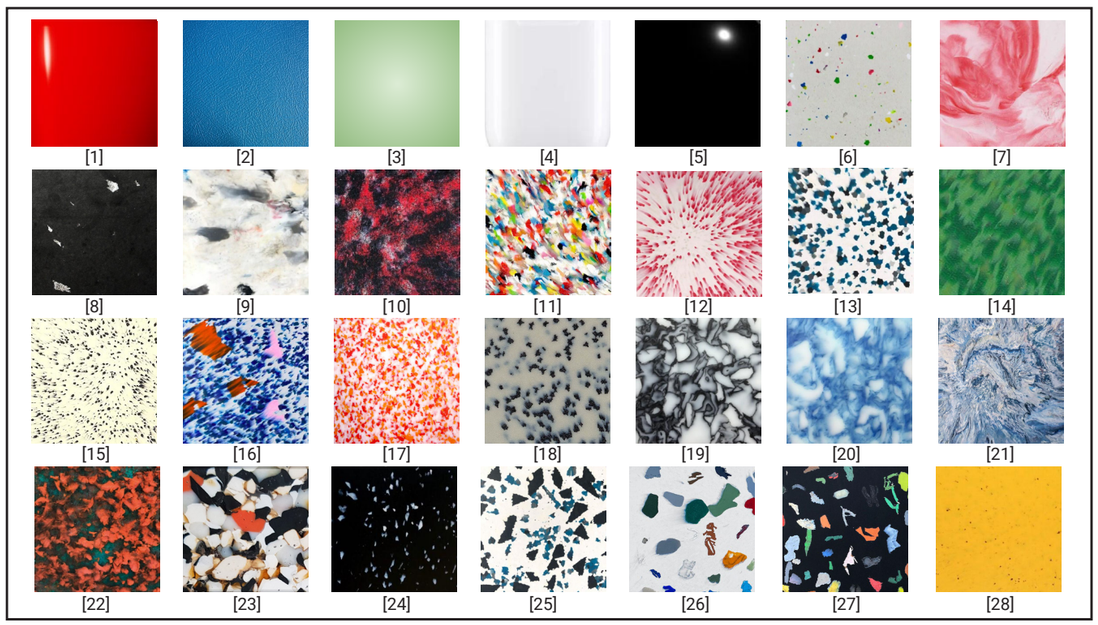


Figure 3.2.D: Colour and pattern stimuli used to present participants different possible looks of recycled plastic. The sources of the stimuli can be found in the credits, p. 116.

In an exercise (figure 3.2.E) the participants were asked to drag exemplary photos of e-devices to either side of the slide, depending on whether they wanted a product to be made from recycled plastic (left side) or to be made from “normal” plastic (right side). While executing the activity, they thought out loud, which allowed me to understand the reasoning behind their decisions. The product images that were used as stimuli and their sources can be found in the credits, on p. 116.

Figure 3.2.E: A slide filled out by a participant to find out more about thoughts and concerns about different products.

The last activity (figure 3.2.F) consisted of a Likert scale that had opposing categories on each side and participants were asked to rate in which they would rather have recycled plastic products in (e.g. “I prefer recycled plastic in products that are… expensive vs. cheap). Even though this method is usually used for quantitative research, the participants were made aware that the purpose of the exercise is to make them express their thoughts and not about the exact number they choose on the scale.

The complete interview template and question guideline can be found in appendix C.

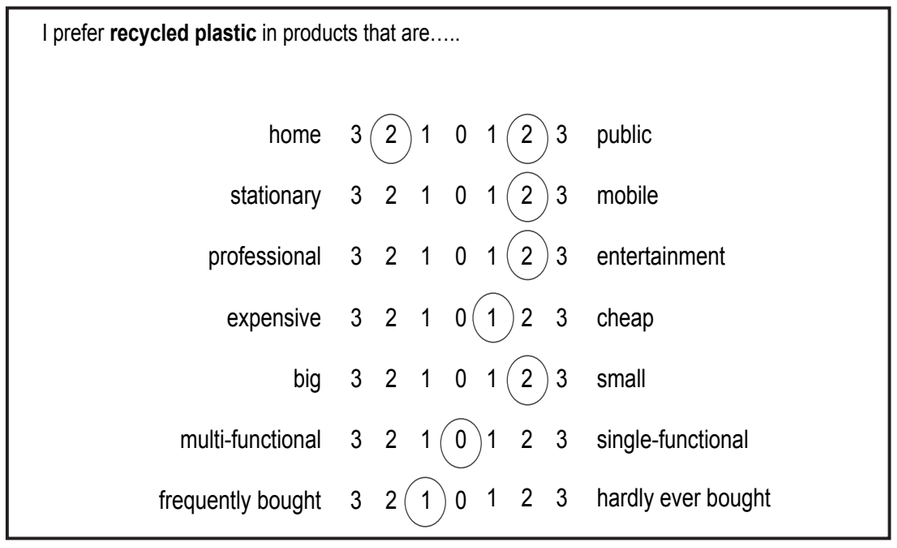


Figure 3.2.F: The Likert-scale exercise, filled out by a participant to see if differences between categories can be found.

3.2.4. Data analysis:

The interviews were recorded and fully transcribed in order to allow an analysis and categorisation together with fellow design student. A slightly changed version of statement cards (Sanders & Stappers, 2012) was used. A fellow design student and I individually read all seven interviews, marked relevant quotes, interpreted them and filled out digital statement cards (figure 3.2.G) on the interactive platform Miro.com. As a next step, we clustered the cards into categories and sub-categories. This approach was seen suitable to fit the explorative approach of the interviews and allowed to give a structure to the collected qualitative data.

3.2.5. Results:

On the right, and on the next page you can see the research questions that were formulated prior to the interviews and a summarised answer to each one. More detailed findings of the clustered statement cards can be found on the following pages.

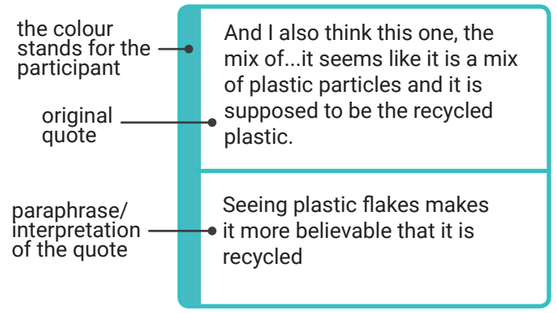


Figure 3.2.G: An exemplary statement card. More than 200 cards were created and clustered.

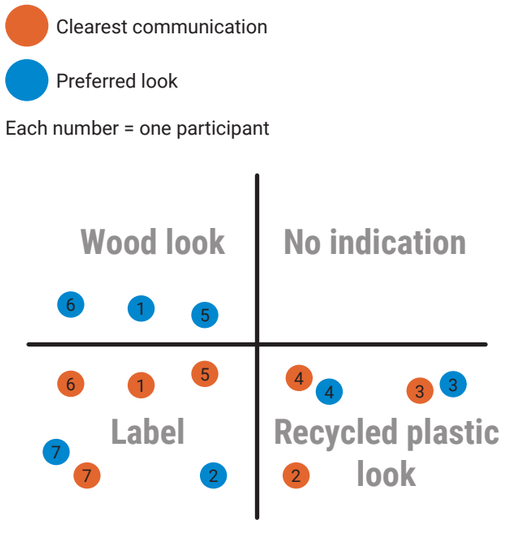


Figure 3.2.H: the chart shows which product look was aesthetically preferred (blue) by participants and which look communicated the share of recycled plastic most efficiently to them (orange).

To what extent do participants want recycled plastic to be communicated in the product itself? Is there a clearly preferred communicator?

Participants want transparency and the share of recycled plastic to be communicated clearly. However, what communicates the recycled plastic the best, might not be what is aesthetically preferred. During the interview, I asked each participant which of the four speakers he/she would like to have, if they all had the same price and amount of recycled plastic. Then, I asked which one communicates the recycled plastic share in the most efficient way. Figure 3.2.H shows the distribution of which look each participant picked for which question. Each number stands for one participant, which reveals that for some people, preferred appearance and effective communication went hand in hand, while for others, there were differences. **The figure shows that the label and the recycled look were seen effective in communicating the recycled plastic. The wood look was not seen effective, but regarding the appearance, it was liked as much as the label and the recycled look.** Two participants even stated that they would be perfectly happy if the wood look could be combined with the label.

What do people think of pro-environmental claims? To what degree and under what circumstances are they believed?

All participants were quite sceptical about claims made by companies. Most of them believed that a company would try to trick their customers and use every loophole to make claims that are technically not lies but very much deceiving. Regarding recycled plastic in an audio speaker, **claims were much more believed when the amount was indicated by a numerical system** (e.g.: percentages)**, much material information was given** (e.g.: types and origins of used materials, different recycled shares of different product parts) **and the design looked simple and homogeneous** (e.g.: simple shapes and use of only one material). The more information the customers get, the more honest and transparent the company seems. The design steps can help eliminating doubts by making the product visually more credible.
Furthermore, it would strongly increase the credibility of a claim if it was assessed by a third, independent party.

How does the perception of the recycled plastic impact the perception of the product?

Most participants perceived recycled plastic as less aesthetically appealing and less durable than virgin plastic. Even though some participants claimed not to care about the product's look as much as about its sustainability, the functionality and durability were more important than sustainability in all cases. In one case the undesired look of the recycled plastic negatively influenced the person's perception of the sustainability, and in one case it lowered the perceived quality of the plastic. Generally, it seemed like the perceived quality/ durability of the product is lower when the person has had previous experiences with recycled plastic (that had bad qualities). **Overall, it depended on the specific look of the recycled plastic (mainly the pattern), the part of application of the product** (e.g.: functional part vs. casing) **and the type of e-device to determine whether the product was perceived negatively or positively.**

In what product categories do people care more/ less about recycled plastic? Can new categories be found?

The only category that participants were clearly in favour of, was "frequently bought products". **Six out of seven interviewees preferred frequently bought electronic products to be made from recycled plastic (what products participants buy relatively frequently can be found in appendix D). This was largely due to the total amount of material used over time** and therefore, the perceived amount of environmental impact. The other way around this means that **participants preferred rarely bought products to be made from virgin plastic. The reason for this was mainly that the consumers want those products to last for a long time** and recycled plastic is perceived to not be very durable.
Furthermore, in the eyes of the participants, the total amount of material is lower for rarely bought products, which equals a lower environmental impact and justifies their choice for virgin plastic.
Other categories depend strongly on the perception of the recycled plastic (see previous research question).

Figure 3.2.I visually represents which specific products the participants preferred to be made from recycled plastic and which ones they would not want to be recycled. During the interviews, a third option emerged: a combination of both. **Some participants expressed the wish that products that are supposed to last long and are expensive, should have delicate parts (such as hinges) made from virgin plastic but can have casings from recycled plastic.** Three products do not have seven fields, as not all participants wanted to give their opinion about those.

The fact that **all seven participants chose the USB stick and the in-ear headphones**, suggests that they want very small products to be made from recycled plastic. However, this assumption was not supported by other statements during the rest of the interviews.

It is also important to note that three participants chose all products to be made from recycled plastic, even though they did state concerns regarding the quality or the look of the material earlier in the interview. This suggests that in this exercise, those participants did not express their real opinion, but their desires or intentions.

Figure 3.2.I: the chart shows how many participants wanted each product to be either made from recycled plastic, virgin plastic (="not recycled plastic") or a combination of both. Most products have seven cells, of which each one stands for one participant's answer to this exercise.

The main themes that emerged through the clustering of the statement cards were: **Trust, aesthetics, quality, and sustainability**. The categories *trust and aesthetics* were expected as those were the essence of the interviews.
By using sub-categories of those themes and tags for reoccurring opinions, a few relevant issues could be identified that also resonate with literature findings.
On this spread and the following ones you can find the main insights as statements, its explanation, a selection of quotes to give evidence and a brief indication of the corresponding literature in the form of call-outs.

Regarding innovation
Paparoidamis et al., 2019: new, special (innovative) features are important for purchase decisions. People associate innovative features with benefits. Therefore, implementing such features could enhance the consumer's perception of the product on different levels.
Park & Lin, 2020: the likelihood of purchase increases when the products (in this case upcycled products) are seen as more innovative than usual "green" products.

Regarding aesthetics of recycled plastic
Micklethwaite, 2004: people assume that recycled products are not as stylish and attractive as virgin plastic products. They are overall less desirable.

Findings, Aesthetics

Explanation

Quotes

The look of recycled plastic is perceived **negatively**, when:

- The pattern is messy
- The colours are intense
- The pattern or colour mix is suggestive of a low-tech production method

Figure 3.2.J: Three example images, partly taken from the interview stimuli for a more visual understanding of the finding.

• These looks were seen as too distracting by participants. A colour or pattern that is attracting attention might be conflicting with other products or the interior. One participant thought that it would make her eyes and herself restless.

• Even though a few participants stated that they do not know how recycled plastic is produced, they assumed that the manufacturing process of these patterns is easy and low-tech, which made the product look low-end to them.

"this one…looks a bit cheap... It just looks like it's coming out of the press."

"Throw all the plastics in a big bunch and melt it together and shape it, I don't like the look of that. It's not defined enough. It is too messy, too recycled... the little patterns I like better."

"I think, having the whole speaker patterned is generally too heavy. I guess I'd rather have the speaker single-coloured. Because such a strong pattern…that's just making me uneasy."

"But in the living room it should be calm, because I am there all the time and I have my own mess and if the things that are permanently there, are already messy, then it feels like there is not enough space for my own mess."

The look of recycled plastic perceived **positively**, when:

- It is single-coloured
- The product seems innovative
- There is a decent pattern
- The pattern is clearly defined

Figure 3.2.K: Three example images, all taken from interview stimuli for a more visual understanding of the finding.

• When the product seemed very new/ innovative in its shape or use of material, participants wouldn't compare it directly to similar (virgin plastic) products. Furthermore, innovative attributes made the design appear more modern, which was declared positive by a few participants.

• Patterns were not generally rejected. Patterns that hint at the recyclability of a material were often even preferred, as the visual clue was more believable than a verbal claim for some participants.

"...or this one is also rather decent. I'd prefer single-coloured"

"I wouldn't mind a completely plain looking thing, but a little texture would be nice. [...] or yeah, like little dots maybe. I also like the bottom row ones, because it literally looks like there are like small plastic pieces in it. It is then more believable that it's recycled plastic."

"But I think that recycled materials, also plastic…sometimes you don't see it as that. There are many opportunities to give it a new look, new aesthetic properties. And it is recycled but it can take so many different forms, that's why I think it should be used for anything, really."

"This black speaker looks like the one I have…and yeeeaah, there I don't like the label on it. Because I don't know that. But the blue speaker is totally different, new and modern. Now there I think "yeah why not, the label can be on that".

"I find it fascinating, if you think that there are snippets of a shampoo bottle in there. Then you press it together and have new raw material.

Three participants think that recycled plastic **cannot have the same aesthetic appearance** as virgin plastic.

• Drawing from previous experiences and online advertisements one participant received on social media, he thought it is simply not possible yet to produce recycled plastic that looks like "normal" plastic.

• Two participants found it hard to believe that a "normal" looking speaker contains 90% recycled plastic, as the share is very high but does not negatively influence the product's appearance.

"Until now, no one has managed to produce a product where I thought "ah okay, that actually looks as good, or almost as good, as a product that does not contain recycled plastic"."

"I think it is quite a lot and it still looks sturdy, like a real finished product. How many percent does it have? Does it actually have 90%?"

"It seems very difficult to believe...somehow it's a little too new and little too nice to believe that it has 90% recycled plastic."

Research Activities

Findings, Aesthetics

Explanation

Quotes

For some products, the **appearance is less important** than for others. USB-sticks or printers are examples of consumer electronics where some participants minded the appearance less.

• Some participants did not mind if the electronic device has an unfavoured look, if it is a product that is not typically seen as a prestige object.

• If the product is kept in places where other people do not see it and the user is not constantly confronted with it (e.g.: study room, storage room), some participants stated that the look of the product is not very relevant.

"if it is a product that looks like it was produced well, if it had a high quality, then of course I would want others to see it... but otherwise leave it at home, like something that you leave in the fridge."

"if it really looks like this, then I admit, then I'd rather hide it."

"the USB-stick can be also be super ugly, or the printer. No one cares how that looks, it just has to function."

"Well, in my home only a few people see it, so I can also buy products that are...it probably also has to do with prestige..."

"Oh this (printer) can also be every colour, because I am not going to put it in my living room..Yeah I would put it in a different room anyway, so it doesn't matter."

Regarding colour
Petersen & Brockhaus, 2017: Since the source suggested that consumers do not particularly favour earthy colours, this was not explicitly investigated in the interviews and can therefore not be fully supported, nor refuted. However, one participant did mention that muted colours appear more recycled to her. Another participant counts blue to be a "sustainable colour", as she associates it with ocean-plastic.

Dark colours, like black or grey, or muted colours were thought to be more recycled than white or bright colours by four out of seven participants.

• A dark colour would be the result of additive colour mixing. When many differently coloured plastic flakes are mixed together, the mix would become black

• Participants seemed to believe that the colour of a recycled product comes from adding colour in the material mix, dying or bleaching it. No participant mentioned sorting the plastic flakes by colour as an option.

"I think, it's easier to make recycled plastic black than for example white, because I think it is easier to give it a colour than bleach it."

"products that are black in colour probably use more recycled plastic because somehow they don't need extra dying."

"because...as far as I know, recycled plastic becomes darker. And these muted colours like the blue one..there you can imagine as well that it is recycled, even though I don't know."

"if you're making a blend from many things, it will be automatically black or grey".

"Muted colours, like this blue one...there I can imagine it is recycled. If a product is super shiny, I always think "hmm...I don't know about this one", I don't trust that to be recycled then."

Regarding individualism
Francis & Hoefel, 2020: These findings relate to the insights into the values of this focus group by McKinsey & Company: the consumers of this generation use consumption as a way to express themselves and their values. They appreciate personalisation and individualism.

Uniqueness is seen as a benefit of recycled plastic. Two participants made clear that for them, recycled plastic stands for individualism. However, they valued different aspects of the individualism.

• One participant clearly wanted to use recycled plastic to personalise products, in order to express her personal style and make her products more unique.

• Another participant saw great value in owning a product that exists only once in that exact version and she also appreciated what the recycled plastic look stands for in her opinion: local production. Seeing where the material comes from/ what it is made of, gave the product extra value.

"...and mostly it (recycled plastic) is only the back of your phone, so I would like it to be more unique by using recycled plastic."

*"But it would be very good to make it from recycled plastic because... sometimes your USB stick looks exactly like others and it is difficult to distinguish "is this one mine?" *laughs*, it would be nice to make some difference there."*

"and also, you could customize your speaker to fit in your own house. because maybe sometimes the white doesn't fit with your interior design and you want to adapt the speaker to your home. It would be a great opportunity for people to design the visual experience inside their home."

"I find it fascinating, because none is the same then. You always have your...it is very comprehensible where it is from, if they press it themselves. And that you have your unique one."

"...because it exists only once and because it is probably...well, it is probably a mass-product, but maybe it is still from... it has more personality. Maybe it was even produced locally. I don't know that but you could assume it."

"what I associate with this look...recycling or also small businesses or local production and that would be positive for me."

Research Activities

Regarding transparency
Institute for Business Value, 2018:
The claims about transparency being one the greatest values of these generations is supported by all interviewees stating how important details and credibility of companies' claims are to them.

Regarding trustworthiness
Institute for Business Value, 2018:
The interviews revealed a great mistrust of companies. However, trust is one of the most important values for this focus group. Having an independent party to assess claims, could help a company to signal trustworthiness and honesty to their customers.

Findings, Trust

Explanation

Quotes

Recyclability claims including **numerical indications**, like percentages, are much more trustworthy (as opposed to claims without percentages). **All seven participants** find it important to know the share of the recycled plastic in a product. Furthermore, some participants wanted to have more information about the material's composition and origin.

• Five out of seven participants clearly stated that they mistrust companies' claims. However, they don't think a company would explicitly lie, which is why numerical claims seem more binding.

• The more precise the information of the material and its sources is, the more honest and believable the company seems. Some participants expressed the wish to know precisely which part is meant by the percentage claim, what material it is (e.g. post-consumer plastic bottles) and even where the plastic comes from.

"I don't get why people aren't just honest. [...] if they are honest about everything, we also will believe them."

"And if it says "100%", then I believe it because…well, they can't lie 100%."

"It's nice to have like a number... like you know, you now have this Google home thing... whatever, I think that's the best way, to say "hey 70% recycled" or 80% or 40% recycled or maybe just 10%. I think that's more believable than just saying "recycled plastic"."

"And that you have recycled plastic in there is great of course, but the question is: how much?"

Participant: "I would say the company is just, you know, faking it." Me: "do you think companies do that?" Participant: "yeah sure because who is going to question them."

"...we live in a cheating-industry. In a world where chocolate pudding with 1% chocolate-share exists. So it is important how many percent are recycled."

Having a **third party** assess the sustainability claims, makes the claims and the company more trustworthy.

• Three participants clearly stated that they would believe a company even more if an independent party verified the claims. This is related to the finding that participants strongly mistrust companies.

"There should be some sort of certification that they need to go through or something, to sort of prove this number and claim."

"..but of course it is good if there are organisations that are independent and do verifications".

"It would probably make a difference if an independent consumer protection organisation would say that (the claim) too. Then I would believe it even more."

The **more homogeneous the design** of a product was, the higher participants would estimate the share of the recycled plastic. If a product consisted of several parts, materials or colours, participants thought that only one of those is recycled.

• Four out of seven participants said they assume that only the part of the speaker that carries the label "recycled plastic" (in this case the perforated front part) is actually recycled.

• Different colours or materials suggest that there is a difference in those parts and if there is only one percentage claim, participants related the claim to only one part and assumed the other part is made from virgin plastic.

• This finding is strongly related to the mistrust in companies.

"Sometimes I think it is only the exact part, only that part has recycled plastic."

"The one that says 'recycled plastic', there I always think that they only write it on the part that is actually recycled."

"I just realized that the recycled plastic... the second one (with label) has it only in the front of the speaker."

"A company probably uses recycled wood or something, or wood parts from a bigger wood on an already available new plastic and says "oh these are recycled speakers" but there is only 5% of it. You know, only a small part of it is recycled so essentially the damage is still higher."

"The black speaker also has many different parts, it will let me have this confusion, but the left one seems like it only has one material. So it makes sense it is 100% off recycled plastic"

"It is interesting, because here I focus more on the wood than on the plastic. In the previous slide I focused more on the plastic but here it's like the wood really catches my eye, so I didn't think too much about the plastic."

Research Activities

Findings, Sustainability	Explanation	Quotes
For three participants the **recyclability of an already recycled product** played a role as well.	• Two participants assumed/ hoped that if a product is recycled, that there is a system behind this product which allows for further recycling after its end of life.	*"And I also think that they will take my wristband, recycle it and use it for the next product and that would be very sustainable."* *"...because I would have a better feeling then, that if something is recycled, that maybe you can recycle it again because it is already in the recycle-system."* *"I find it also important to know to what extend the plastic, that you're recycling, can be recycled again."*
Sustainability (in this case the share of recycled plastic) is more important to some participants than the aesthetics of a product. They indicated to be **willing to trade off aesthetic qualities for sustainable qualities** - but not for functionality (see "findings quality" on the next spread for more quality related insights). **! Limitation**: people might say that they care more about the sustainable aspect of a product than its look because it is "the right thing to say". It might be their intention, but if they would act upon it, cannot be predicted.	• Four participants explicitly mentioned that they would buy the recycled product, even if its appearance is not particularly liked. • The percentage of the recycled plastic played a role for this finding. The higher the share is, the more willing participants were to trade-off aesthetic qualities. This might be due to the perceived pro-environmental impact their purchase would have.	*"Maybe sometimes it can be a bit awkward to put it (the label) on the product, because maybe it will influence its aesthetics. But for me it will really... if you add 100% recycled plastic, it will increase the desirability of buying the blue one."* *"personally...no, I think like aesthetically I wouldn't want to have this in my house. But then if you say it is completely recycled for example, it's 100% recycled [...] then yeah I don't mind having it in my house as long as it works."* *"Well, if I knew that I can support recycling with this, then I'd buy it anyway. If I really needed a speaker now. And if the printer has a pattern, but I know it is recycled, then I also wouldn't mind."* *"...but then I would pick this one, even if it looks like that, because well, I want to do something for the environment."*
Six participants preferred **recycled plastic in products that they buy more frequently** than others. This is mainly due to the total amount of material used and therefore, total amount of impact.	• One participant expressed that a frequently bought product requires less assessing. The decision poses less risk, probably as it can be replaced sooner in case it does not meet the expectations. • One participant named several products that she would prefer to be made from recycled plastic, as parts of those products wear off after some time due to frequent skin contact. E.g.: in inside/ soft part of over-ear headphones, the wristband of a smartwatch, buttons of a game console controller. • Two participants mentioned weather conditions, such as rain and UV-light as reasons why certain products might have to be bought more frequently. E.g.: portable speakers, headphones.	*"If it's frequently bought, I definitely want it to be more recycled plastic. There is no second thought to it. Because if I can reduce my plastic for something I frequently buy, then yeah. Hardly ever bought... I would give it more thought. If I hardly ever buy it, then it doesn't matter so much what the plastic is because then my footprint is also little."* *"I want the inside (of the headphone) to be made by recycled material because you need to replace it quite often because if you wear them a lot, they break quite often."* *"I don't actually care about how often I buy it. But if I never buy it, it also wouldn't have a (positive) impact."* *"I would lean to the frequently bored ones, because with the hardly ever bought products, I know that I use it for a really long time. So then the impact is a bit less."* *"I think that if you have something that you use for your whole life...well then you already make up for a lot because of the product's life-span. You just use less material if you always use the same product."*

Regarding trading-off qualities
Luchs & Kumar (2017): this insight relates directly to the study by the researchers that found as well that their participants would trade-off aesthetics for sustainability, because it is the morally superior thing to do.

Regarding perceived impact
Wang et al. (2014): the perception of consequence refers to the psychological factor that people are more or less likely to perform an action depending on the impact it has on the environment. If the consumers assume that a higher amount of recycled plastic has a greater impact, they could be more likely to take action and trade-off aesthetic qualities.

Regarding behaviour-intention gap
Petersen & Brockhaus, 2017: The researchers mention that many studies, especially on sustainability, have a problem called "social desirability bias", which refers to the fact that participants often present themselves in a better light and, in fact, report their intentions, rather than their actual behaviour. The behaviour-intention gap is a long known issue in behavioural science (see chapter 2.3.1.).

Regarding total amount of material
Magnier et al., 2019: Research found that the total amount of waste matters for the consumers' perception of the impact. A product that is bought daily seems to have a greater impact on the environment than a rarely bought one. Even though consumer electronics are bought relatively seldom, the total amount of material still plays a role for the perceived impact.

Research Activities

	Findings, Quality	Explanation	Quotes
Regarding perceived quality *Paparoidamis et al., 2019: Research regarding the perception of recycled plastic has revealed that consumers still attribute low quality to recycled plastic. Furthermore, there is a greater uncertainty regarding the functionality, which corresponds with my interview findings. Quality and functionality are highly important purchase criteria for electronic devices. It is therefore necessary to mitigate these concerns of consumer in order to successfully sell e-devices containing recycled plastic..*	Recycled plastic was **thought to have lower qualities** than virgin plastic by five out of seven participants.	• Participants had doubts whether recycled plastic was sturdy enough for delicate parts or parts that are exposed to mechanical pressure, such as hinges. • Some participants expressed that they prefer recycled plastic in frequently bought products, because those products do not have to last very long and recycled plastic does not last long either. Products that are supposed to last for a long time were preferred to be made from virgin materials.	*"With my phone...I would be more than happy if it's recycled plastic. Oh yeah, I think phones won't last long. 3 years is not a huge life-span for plastic. We should definitely use our plastic for much more longer."* *"I'd prefer it in products of which you don't think "that is a bit delicate". As I said, recycled plastic still has this stigma to be of lower quality and lower quality you expect to be more prone to errors."* *"Phone cases or also the case of a camera are mainly for protection and not...they don't have to withstand mechanical stresses. [...] I mean, recycled plastic is often not as strong and...when it's about functional parts, that have to withstand high strains over a long time, then I would find it justifiable that they are made from new plastic because it just has better qualities."* *"This one I would like to be recycled, because again, the function of this kind of speaker is mainly on the metal parts inside, so it is not necessary for the exterior parts to be so durable"*
Regarding trading-off qualities *Luchs & Kumar (2017): this insight complements the finding that people would trade-off aesthetics for sustainability, but not utilitarian value, such as functionality and performance. Like Luchs & Kumar, I also found the values of the participants to be ranked as followed:* *1) Functionality* *2) Sustainability* *3) Aesthetics*	**Functionality was the most important criteria for purchasing.** It was most important for participants that the recycled plastic does not impact the function or durability of the product. This criteria was more relevant than the sustainability performance.	• Several participants suggested to use recycled plastic only in product parts that do not fulfil a function itself, but are used as casing to protect the functioning parts. • For devices with a screen, a striking frame could impair the function because focussing on the screen would be difficult for the user.	*"I just pointed out on my laptop, it should be calm because otherwise I feel distracted"* *"If you say it is completely recycled, for example, it's 100% recycled [...] then yeah I don't mind having it in my house as long as it works."* *"It shouldn't influence the function of the product."* *"Like a USB stick, the case of the stick has no actual purpose because it only protects the metal stuff underneath."* *"...or for parts, maybe inside, are new plastic because they need to have I don't know-what, and outside recycled plastic, because that doesn't have a function or doesn't have to withstand much."*
	Previous experiences with recycled plastic had a big impact on the participants' perception.	• The participants that study design were in contact with recycled plastic and its properties before. From their experience, recycled plastic had worse qualities; its durability and sturdiness were lower. • One participant clearly stated that all her opinions are based on the assumption that the plastic is like the one she worked with before and the whole interview would change very much if she knew the material better that is used for e-devices. • The three participants that do not study design, did not relate the speaker with the marble look to recycled plastic, while all design students did so.	*"I think it's because of the course, I learned about recycled plastic for cutlery. But that Is not the plastic that is used in electronic devices. It's very different. You learn about one certain kind of plastic that is maybe shitty and then you're biased."* *"I studied the (recycled) material before and I knew that if the plastic is made by recycled material, the properties and the mechanics will be less good, less strong or less durable than the recycled plastic."* *Participant: "It is just a look for me, it doesn't raise the credibility."* *Me: "So you don't associate it with recycled plastic?"* *Participant: "No."* *Design student sees the marble look speaker: "Okay, this one looks super recycled."* *"So for me it looks similar like the ones on the Dutch design week, the marble pattern. It is not very innovative for me , because I have already seen it before. It builds the connection but I would want it to be more unique, different."*

3.3. Chapter conclusions

The interviews gave extremely useful insights into consumers' perception of recycled plastic in electronic devices. I got answers to all four research questions I prepared prior to the interviews and found many additional insights. Below you can find the additional findings and on the right page (p. 51), summarised answers to the research questions.

The 14 findings below are given a short title for easier recognition. In the following chapter they are used as base for brainstorm sessions.

Aesthetics

BAD LOOK & GOOD LOOK
The look of recycled plastic is perceived negatively when:
- The pattern is messy
- The colours are intense
- The pattern or colour mix suggests a low-tech production method

The look of recycled plastic is perceived positively when:
- It is single-coloured
- It seems innovative
- The pattern is decent
- The pattern is clear defined

SELF-EXPRESSION
Uniqueness is seen as a benefit of recycled plastic. Two participants made clear that for them, recycled plastic stands for individualism.

DESIGN IMPORTANCE
For some products, the appearance is less important than for others.

DARK COLOUR
Dark colours, like black or grey, or muted colours were thought to be more recycled than white or bright colours by four out of seven participants.

CANNOT LOOK NORMAL
Three participants think that recycled plastic cannot have the same aesthetic appearance as virgin plastic.

Trust

KNOWING DETAILS
Recyclability claims including numerical indications, like percentages, are much more trustworthy (as opposed to claims without percentages). All seven participants find it important to know the share of the recycled plastic in a product. Furthermore, some participants wanted to have more information about the material's composition and origin.

EXTERNAL ASSESSMENT
Having a third party assess the sustainability claims, makes the claims and the company more trustworthy.

KEEP IT SIMPLE
The more homogeneous the design of a product was, the higher participants would estimate the share of the recycled plastic.
If a product consisted of several parts, materials or colours, participants thought that only one of those is recycled.

Sustainability

RECYCLED = RECYCLABLE
For three participants the recyclability of an already recycled product played a role as well.

VALUE RANKING
Sustainability (in this case the share of recycled plastic) is more important to some participants than the aesthetics of a product. They indicated to be willing to trade off aesthetic qualities for sustainable qualities - but not for functionality.

FREQUENT BUY
Six participants preferred recycled plastic in products that they buy more frequently than others. This is mainly due to the total amount of material used and therefore, total amount of impact.

Quality

LOW QUALITY
Recycled plastic was thought to have lower qualities than virgin plastic by five out of seven participants.

PAST EXPERIENCES
Previous experiences with recycled plastic had a big impact on the participants' perception.

FUNCTIONALITY MATTERS
Functionality was the most important criteria for purchasing. It was most important for participants that the recycled plastic does not impact the function or durability of the product.

Figure 3.3.A: The interviews were based on these four different versions one speaker (from left to right): without any indications, with a label saying *recycled plastic*, partly made from wood and partly containing a "recycled look".

What do people think of pro-environmental claims? To what degree and under what circumstances are they believed?

All participants were quite sceptical about claims made by companies. Regarding recycled plastic, claims were much more believed when the amount was indicated by a numerical system (e.g.: percentages), much material information was given and the design looked simple and homogeneous. The more information the customers get, the more honest and transparent the company seems. Furthermore, it would strongly increase the credibility of a claim if it was assessed by a third, independent party.

To what extent do participants want recycled plastic to be communicated in the product itself? Is there a clearly preferred communicator?

Participants want transparency and the share of recycled plastic to be communicated clearly. However, what communicates the recycled plastic the best, might not be what is aesthetically preferred. The label was seen to be slightly more effective in communicating the use of recycled plastic than the recycled look. Regarding the appearance, the wood look was slightly more preferred than the recycled plastic and the label.

How does the perception of the recycled plastic impact the perception of the product?

Most participants perceived recycled plastic as less aesthetically appealing and less durable than virgin plastic. Durability and functionality were more important than sustainability and aesthetics. Here, the recycled plastic might negatively influence the perceived durability. Overall, it depended on the specific look of the recycled plastic (mainly the pattern), the part of application of the product (e.g.: functional part vs. casing) and the type of e-device to determine whether the product was perceived negatively or positively.

In what product categories do people care more/ less about recycled plastic?

Six out of seven interviewees preferred frequently bought electronic products to be made from recycled plastic. This was largely due to the total amount of material used over time. Rarely bought products were preferred to be made from virgin plastic. The reason for this was mainly that the consumers want those products to last for a long time and recycled plastic is perceived to not be very durable. In participants' perception, the total amount of material is lower for rarely bought products, which equals a lower environmental impact and therefore justifies their choice for virgin plastic.

4

IDEATION

The goal of this thesis is to create recommendations for designers to develop electronic products containing recycled plastic. The next step is to ideate on how the previously gained insights from literature and interviews could be applied, according to the scope of this project.

4.1. Brainstorming session on interview findings

While some findings from the interview analysis are quite concrete (e.g.: it is more credible that plastic is recycled when it's black/dark), other findings are rather vague (e.g.: previous experiences with recycled plastic influence the current perception). For that reason, the brainstorming sessions aim to gain deeper insights on the findings that I personally still had questions about. The overall goal of the sessions is to get different perspective and ideas on how the findings could be combined and applied.

4.1.1. Method:

The result chapter (3.2.5.) includes 14 findings from the interviews, but four of them are seen unfit to be used in the brainstorm (explained in appendix E). As mentioned before, I was still missing applied insights into some findings (see the findings with a green frame on the right). For that reason, each of those five findings was briefly explained to the participants and transformed into a question that would spark creative answers. The findings were rephrased and presented in a "card format", as you can see on the right, and each one was placed on a digital canvas. The method used for this part was *Brainwriting* (van Boeijen et al., 2013); the ideas were written down in words. In order to get as concrete ideas as possible, I chose three products that the ideation would be based on: in-ear headphones (high willingness for recycled plastic)[1], a printer (mixed opinions)[2] and a laptop (low willingness for recycled plastic)[3]. After the first part, I explained the

[1] Based on interviews: All seven interviewees stated that they would like this product to be made from recycled plastic. See figure on p.41.
[2] Based on interviews: Several participants mentioned that the functionality and durability are the most important criteria of a printer, while the look is not relevant. See p. 44-44.
[3] Based on interviews: The wish for laptops to be made from recycled plastic was expressed to be low. See figure on p.41.

Insight 1
SELF-EXPRESSION
Uniqueness and Individualism are important values for the focus group.

Insight 2
KNOWING DETAILS
Consumers want to know the amount/ share of recycled plastic in a product and also if different parts have different amounts.

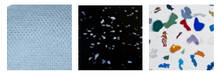
Insight 3
RECYCLED = RECYCLABLE
A product made from recycled plastic should be recycled again after its end-of-life.

Insight 4
DESIGN IMPORTANCE
Whether the look of the product is important depends on different factors.

Insight 5
PAST EXPERIENCES
When a consumer had negative experiences with recycled plastic, it influences the present perception of the material.

Insight 6
BAD LOOK & GOOD LOOK
The look of recycled plastic is perceived negatively when:
• The pattern is messy
• The colours are intense
• The pattern or colour mix suggests a low-tech production method

The look of recycled plastic is perceived positively when:
• It is single-coloured
• It seems innovative
• The pattern is decent
• The pattern is clear defined



Insight 7
DARK COLOUR
Some people find it easier to believe that recycled plastic has dark colours, like black or grey, or also muted colours, rather than white or bright colours.

Insight 8
KEEP IT SIMPLE
The simpler a recycled product is, the more credible it is. Many parts, different colour or materials suggest that there is a difference in those parts.

Insight 9
VALUE RANKING
Importance ranking of product values:
1. functionality/ durability
2. sustainability
3. aesthetics.

Careful: sometimes the aesthetics might be more important than sustainability though.

Insight 10
LOW QUALITY
Recycled plastic is still perceived to have low quality (not sturdy or durable). If delicate parts are perceived to have low quality, the consumer might be hesitant to buy it.

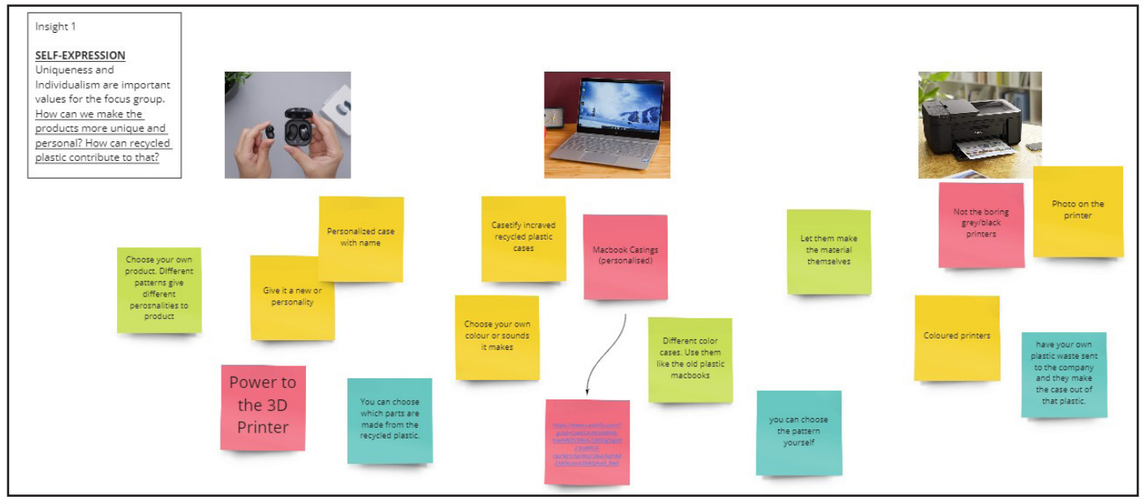


Figure 4.1.A: Screenshot of one exemplary canvas from the brainwriting exercise. Four design students ideating on how recycled plastic can contribute to making these products more unique.

remaining five findings (see the findings with a black frame) to the participants. The second part of the session consisted of the method called *Braindrawing* (van Boeijen et al., 2013); I asked the participants to choose at least two of the ten findings, combine them and apply them to the headphones, the printer and the laptop. Two sessions of this kind were held using the online platform Miro.com. Eight design students from different master programmes participated, including myself as a participant in one session.

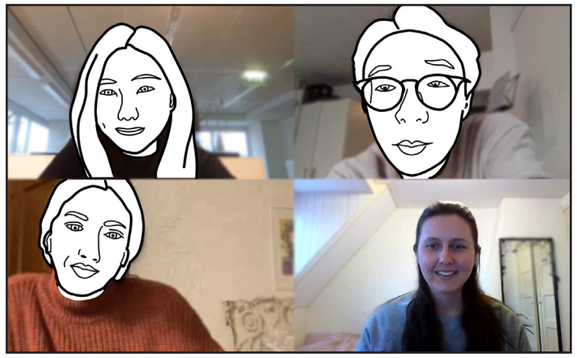


Figure 4.1.B: Anonymised screenshot from the recording of one brainstorming session.

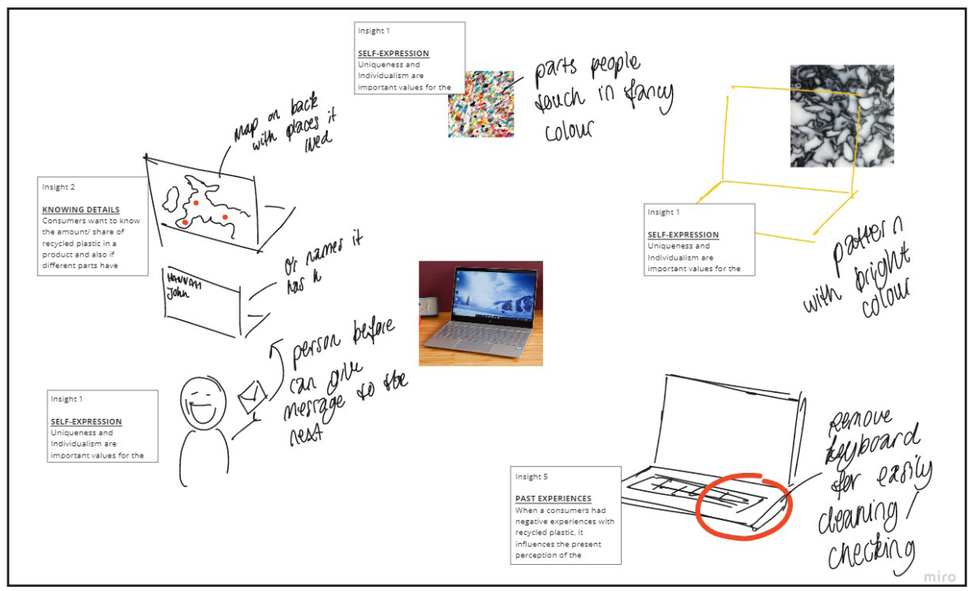


Figure 4.1.C: Screenshot of one exemplary canvas from the brainwriting exercise. Four design students ideating on how recycled plastic can contribute to making these products more unique.

4.2. Brainstorming session on literature findings

Even though the literature findings do not focus on recycled plastic, the insights gained from it are valuable. Getting consumers to opt for a product made from recycled plastic is strongly related to general sustainable behaviour concepts. The brainstorming session on these rather vague concepts is meant to give concrete ideas on how they could be applied in my context.
The core values of the focus group (self-expression, transparency & trust) were not included in this brainstorm as these values are covered by the interview findings.

4.2.1. Method:

Of the ten drivers and barriers identified in the literature review (see chapter 2.6.), a few are partly overlapping. Four (and a half) serve the same purpose as another factor (see below), which is why only six (green framed cards) were used as a base for the brainstorming session.
The was organised similarly to the interview-brainstorm. One online brainwriting session was held with a total of four design master students.
They were presented with the six factors that influence sustainable purchase behaviour and had about four minutes for each one to come up with as many ideas as possible.

Drivers & Barriers 3
FEELINGS &
COGNITION
Cognition is especially relevant when information is presented.

Drivers & Barriers 8
NON-GREEN CRITERIA
Even consumers who value eco-friendliness very high, have habits and desires that might conflict with a sustainable purchase, e.g.: product features, appearance, retailer choice or delivery cost.

Drivers & Barriers 9
GUILT
This feeling is a strong driver for sustainable purchases and motivates green consumers to keep their green values up. Even when consumers spend time and effort on finding sustainable options, they often still feel guilty for prioritising non-green criteria, not researching enough etc.

Drivers & Barriers 10
TANGIBILITY
Outcomes of sustainable behaviour are abstract and not tangible for most people. Consumers are more focused on the present and proximal impacts.

Drivers & Barriers 7
COMPLEXITY
Impacts that our behaviour has on the environment are mostly abstract, inaccessible, difficult to understand and often also conflicting.

Drivers & Barriers 1
REDUCING COGNITIVE EFFORT
E-devices are not bought regularly, and it is a lot of mental effort to search for sustainable options and evaluate them. A lot of effort equals a lot of time. Effort and time can be reduced by trusting certain sources or labels that offer information.

Drivers & Barriers 2
EXTERNAL FOCUS
It can also be called "other-focussed" and is the opposite of a focus on oneself. Sustainability is a collective goal and does not always benefit oneself. It requires to put one's own needs second.

Drivers & Barriers 3
FEELINGS
& COGNITION
Regarding the feelings, positive as well as negative emotion can be effective in triggering a certain decision/ behaviour.

Drivers & Barriers 4
PERCEPTION OF CONSEQUENCES
It is an individual's perception of the consequences that his/ her behaviour could have on the environment. These consequences are often not tangible.

Drivers & Barriers 5
RESPONSE EFFICACY
This is the perceived degree to which an action can bring change. If consumers believe that their action can make a difference, they are more motivated to take this action.

Drivers & Barriers 6
INDIVIDUAL SELF
People have an image of themselves and want to keep this image positive. They generally want to be consistent in their behaviour. This means that if people have a pro-environmental self-image, they are more likely to follow through with the associated actions in order to be consistent.

4.3. Clustering all brainstorm ideas

In the two interview brainstormings and the one literature brainstorm, the participants generated more than 300 ideas in total.
As a first step, I read every idea on a digital canvas, grouped those that fit together contentwise and named each theme (see figure 4.3.A). I repeated this step for every canvas.

Most themes reoccurred on different canvases, e.g.: the theme “modularity” was seen as a way for consumers to express themselves by exchanging parts (self-expression canvas), but modularity also makes it easier to recycle a product again after its end of life (recycled = recyclable canvas). I grouped those reoccurring themes, the purposes they serve and the corresponding ideas (on post-its).

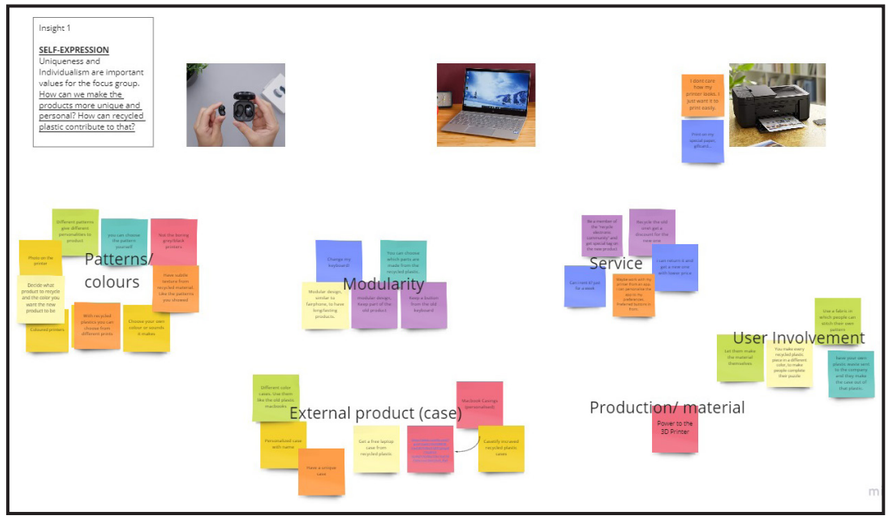


Figure 4.3.A: Screenshot of the canvas “self-expression” after the first clustering of the ideas according to themes.

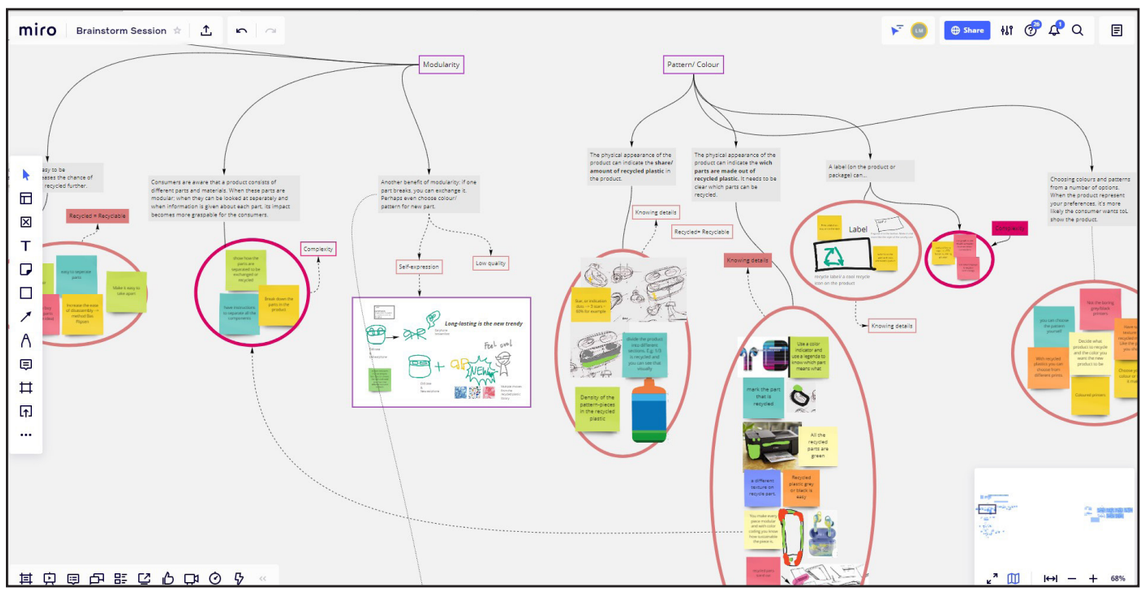


Figure 4.3.B: Screenshot of two clusters: the name of the theme on top with a purple frame, information about the purpose it can serve in the grey text box, examples and ideas of how it could be applied on the post-its and the name of the canvas with the rose (interview factors) and pink (literature factors) frames.

The marketing mix:
The themes developed from the brainstorming ideas were diverse and did not only regard the design of a product but also its “environment”: business models, advertisement, consumer relations, etc.
I used a common marketing model, called marketing mix (Hanlon, 2021) as framework to structure the clustered themes, because the model consists of four categories: product, price, place and promotion.

On the right you can find a short description about each P in the context of this project.

Product includes every aspect that regards the product directly, like material, design, quality and value for the users.

Price relates also to the business model that the product is part of. Price does not have to be monetary; time and effort play a role for consumers as well.

Place defines the distribution options. Nowadays there are many ways for a consumer to find and experience a product.

Promotion refers to marketing communications, which comprises advertisement, promotion sales, customer relations, etc.

Since the goal of this project is to give recommendations for designers to create products, a majority of the brainstorm session ideas fall into the *product* category. The other three categories; *price, place and promotion* contain valuable insights as well, but seem less relevant during the design phase and contain therefore fewer examples.
On the following pages you can find the clustered results of the brainstorm sessions phrased as recommendations, including more information, the research background (referring back to the literature and interview findings) and examples/ tips of how they could be applied in practice.

Figure 4.3.D: Iteration of the clustering process.

P Product

Give the possibility to exchange standard parts of the product.

Information - Giving the consumer the possibility to exchange standard parts of the product can make the product more unique, which is highly important for the consumers.

Research background

Self-expression - One of the most important consumption-related values of the focus group is the wish for uniqueness. They want their products to express their personality.

Bad look & good look - Many consumers assume that recycled plastic has a distinctive look. They assume it can be produced in various colours and patterns. In their perception it is easy to give it a unique look.

Examples/ tips

Making the product modular allows the consumer to pick varying colours for different parts

Make it possible to exchange broken product parts easily.

Information - Making it possible to exchange broken product parts easily can lower the threshold and perceived risk for the consumer to buy a product made from recycled plastic.

Research background

Low quality - Recycled plastic has a low quality in the perception of many consumers. They might be worried that the material breaks down easily.

Examples/ tips

Make the product modular to allow for parts to be exchanged

Give information about different product parts separately.

Information - If different parts of your product have varying types of plastic and/ or impact, give the information about each part separately. This makes it easier to grasp for the consumer.

Research background

Reducing cognitive effort - Searching for environmental options can be cognitively challenging. Presenting information as simple as possible reduces effort and saves time for the consumer.

Examples/ tips

Making the product modular is one way to clearly separate different materials from each other

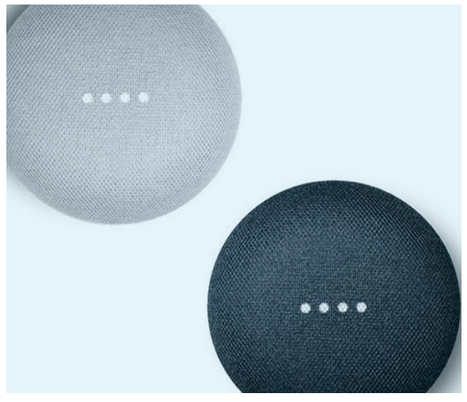
Use the design to indicate the share of recycled plastic.

Information - Using the physical appearance of the product (like colours or patterns) to indicate the share/ amount of the recycled plastic makes its use visible and potentially also more believable. Consider using dark or muted colours when the product has a high share of recycled plastic.

Research background

Knowing details - Truth and transparency are core values of the focus group. Regarding recycled plastics, they want to get as much information as possible, such as the exact share of the recycled plastics in the product.

Dark colour - When many different colours of paint are mixed, the result will turn out very dark, even black. Some consumers believe that the same is true for recycled plastic. When lots of differently coloured plastic flakes are mixed, the plastic turns dark. Therefore - in the perception of the consumer - the dark plastic must contain a high share of recycled plastic.



Examples/ tips

Use a (decent) rating system on the product itself, e.g.: 4 dots = 80% recycled

Divide the product into sections, e.g.: if 1/3 of product is recycled, give 1/3 of the whole product a different colour, pattern or texture

Use the design to indicate which parts are recycled.

Information - Using the design of the product to indicate what parts are made from recycled plastic is especially relevant if not all parts contain equal shares of recycled material. This way you could also indicate parts that can be recycled further.

Research background

Knowing details - Consumers greatly mistrust claims that companies make, especially regarding sustainability. Some of them assume that a claim should try to deceive them, e.g.: if a product claims to contain 80% of recycled plastic, consumers might think that only refers to a small part of the product.

Recycled = Recyclable - Consumers that value products made from recycled plastic tend to care as well about the material staying in the loop and being recycled again after the product's end of life.

Examples/ tips

Use colour indications and a legend (e.g. on the package) to explain what the colours mean

Give the recycled parts a different texture. Plastic could be turned into e.g. fabric as well

Use labels to indicate recycled plastic.

Information - Using labels on a product or on its packaging makes the claim of using recycled plastic more trustworthy to consumers. This is especially true when the labels are already known, clearly explained, or issued by an independent organisation.

Research background

Knowing details - Consumers want clear and honest information about the product's environmental performance. Clear words are therefore trusted more than "suggested sustainability" by using green exterior, e.g.: bamboo, cork, green colour.

Reducing cognitive effort - Finding the most sustainable option when buying e-devices is a cognitive challenge for the consumers. Information on the environmental performance is often not given, hard to find or not explained understandably. Labels help consumers to comprehend and compare the information (e.g.: EU energy label).

Examples/ tips

Have the product assessed by an external, independent organisation

Consider temporary labels (e.g.: peel off sticker, removable marker) on the product itself

Give options to personalise the recycled plastic.

Information - Let the consumers choose colours and patterns of the recycled plastic. It is a way to express personal preferences, which also increases the chance that the consumer wants to show the product to other people.

Research background

Self-expression - The focus group expresses personal preferences through consumption. This goes beyond "letting them choose between 5 colours". The more unique and individual, the better.

Design importance - Consumers who buy a product for its sustainability performance, might not always be happy with the look of it and would rather not have it on display in their homes. This issue would be resolved if the product represented their preferences.

Examples/ tips

Use the nature of recycled plastic as a benefit: it allows for unique colours and patterns if you use differently coloured post-consumer plastic flakes

Give the option to combine different plastic resins or to choose how big the share of each colour should be in the product to increase uniqueness

Give information about the used recycled plastic.

Information - The consumers want to get as much information as you can give about the material, including its journey: where it is coming from, whether it is pre- or post-consumer plastics.

Research background

Knowing details - Environmentally conscious consumers are aware that not all recycled plastic is equally sustainable. They want to know more about the origin of the material and appreciate production transparency.

Reducing cognitive effort - Researching the most sustainable product option is effort and therefore time consuming. Making all the information accessible to the consumers reduces their research time.

Examples/ tips

If possible, track the plastics of your products to have full information and control (e.g.: blockchain)

Keep your product's design simple.

Information - Keeping your product's design as simple and homogeneous as possible can prevent consumers' mistrust of your claim of using recycled plastic in the whole product.

Research background

Keep it simple - Due to the mistrust in companies, complex designs seem suspicious to some consumers. If a recycled product consists of many different parts, consumers are tempted to believe that the claim (e.g.: "made from 90% recycled plastic") refers to only one part, but not the whole product. A homogeneous design can prevent this perception of a loophole.

Recycled = Recyclable - For some consumers, the value of recycled plastic is the assumption that it is going to be recycled further. Recycling a product is easiest when the product is made from a single material. Therefore, a positive side effect of a homogeneous design is an easy recyclability.

Examples/ tips

Integrate buttons into the surface to make it look like "one", instead of external

Design the product in a way that the electrical components can be taken out easily to make the material separation efficient

Explain the product's impact clearly and detailed.

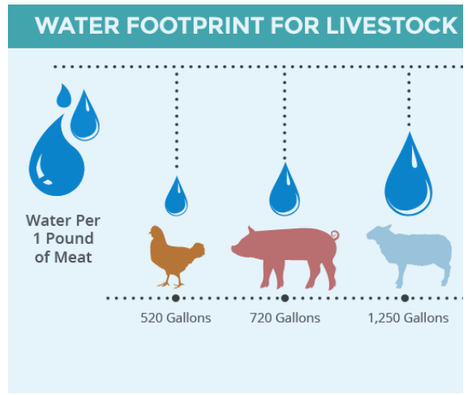
Information - Explaining the environmental impact of the product as clearly and detailed as possible can increase consumers' trust in your transparency. If that would be an overwhelming amount at once, consider presenting only the most relevant information first, but give access to the complete and detailed information. Also consider presenting the information in terms of how much lower the impact of recycled plastic is compared to a virgin plastic product.

Research background

Knowing details - The consumers want to know the truth about the products' environmental impact, and they also want the information to be communicated understandably. Withholding information or presenting it in legal jargon can lead the consumers to mistrust the company's intentions.

Reducing cognitive effort - Consumers find it very challenging to buy sustainable products. Firstly, because information on the environmental performance is often simply not given and secondly, because it is often explained in terms that are not tangible for the consumer (e.g.: kg of CO2, kilowatt, etc.). Giving the information in an understandable way can reduce the effort for the consumer to research the product's impact.

Perception of consequences - The consequences of (un-) sustainable behaviour are usually not tangible for consumers, because the outcome will only be visible in the future or impact people and nature far away from the consumer's life. Explaining these consequences to the consumers can help them to understand why they should opt for the more sustainable product.



Examples/ tips

Explain the information using easy language and comparable data (e.g.: CO2 equal to a flight from Berlin to Amsterdam)

Use digital technologies to let consumers to explore the product and its impact

Information can be given quick and easy with QR codes

Augmented Reality could show an exploded view of the product and let the consumer explore information about each part

Make the positive impact visible by comparing the recycled plastic with the impact of virgin plastic.

Virtual reality could "transport" the consumer to the mining or production location.

Even if the positive impact of one purchase seems neglectable, put it in a relation that matters: "impact of this product sold worldwide", "saves as much CO2 as if your whole town turned off heating", etc.

P

Price

Offer a service instead of the product.

Information - Offer the consumer the service (which includes using the product) instead of a one-time purchase of the product. With such a business model for your recycled plastic product you could guarantee high quality or a long product lifespan to your consumers.

Research background

Value ranking - Functionality and durability are the most important purchase criteria for consumers (sustainability ranks second). In a rental model, the company can ensure the product works well for a long time by doing maintenance and/ or repair works.

Perceived low quality - Some consumers doubt that recycled plastic has the same quality as virgin plastic. A subscription-based business model can resolve these quality doubts. It takes away the consumer's risk of the product breaking down and money being lost.

Examples/ tips

Use a subscription-based business model, where consumers pay monthly or half-yearly

Indclude the cost of maintenance or repair work in the subscription instead of letting the consumer pay extra

Be transparent about how the price of the product is made up.

Information - If the recycled plastic has a notable impact on the price, it is crucial to explain to the consumer what makes it more expensive than alternatives.

Research background

Knowing details - In the consumers' perception, recycled plastic should be cheaper than virgin plastic, however, they are often willing to pay a premium for a truly sustainable product. For that reason, it is necessary to be transparent about the price of the recycled plastic and explain to the consumer what their money is spent on.

Feelings - Positive as well as negative feelings can influence the consumer's product choice. For example, opting for the most sustainable instead of the cheapest product can evoke a feeling of pride. Negative emotions are strong drivers for sustainable purchase behaviour too. Many consumers can feel guilty when choosing a product because of its design or price instead of sustainable features, because they know that this is the morally inferior choice.

Examples/ tips

Explain what makes the material expensive in understandable terms, e.g.: was collected manually from beaches, time-consuming sorting of plastic types, etc.

If your product is equal in price to non-recycled options, point that out! It can trigger a positive feeling in the consumer when they have "made a good deal"

Place

Remind consumers of their environmental values.

Information - Using triggers before consumers purchase a product can remind them that their product choice has an impact.

Research background

Perception of consequences - It is difficult for consumers to estimate the consequences of (un-)sustainable choices. These consequences could be visualised in different ways and make it easier for the consumer to understand them.

Individual self - Sometimes, even environmentally conscious consumers need to be reminded of their values. E-devices from recycled plastic are not omnipresent yet and the consumers might not even be aware that they have the option to buy sustainably.

Examples/ tips

in store: turn on the screen of the products and use it as your canvas; choose a background image that can trigger customers

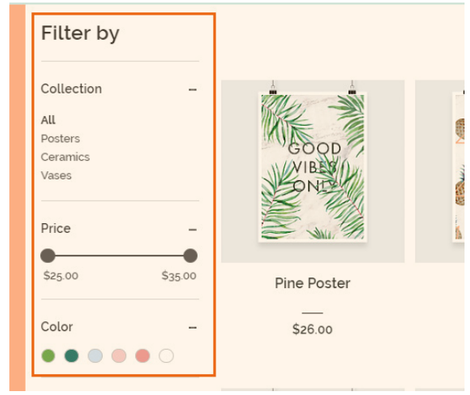
online: consumers often have to accept a website's cookies or close an ad. Similarly, you could have a nature clip running, a WWF ad, or ask the consumer to "shop responsibly"

Make it easy to find recycled plastic products.

Information - Making it easy to search (and find!) and compare products containing recycled plastic (online and in-store) and/ or other sustainable product criteria decreases effort for your customers.

Research background

Reducing cognitive effort - It costs consumers a lot of time and effort to find sustainable products that fulfil their search criteria. Making sustainable criteria as searchable and findable as price, or brand could reduce the effort greatly. Especially because new consumer electronic products are often bought when people move into a new house, which is already stressful and time consuming.



Examples/ tips

A simple way to find products on a website is to have the right search-filters in place, or give the option to sort the products by different criteria

In store there might be an option to group sustainable products together, or use the under- or background of the shelf spot in a creative, impactful way

P

Promotion

Trigger interaction between your consumers.

Information - Give the consumers a platform where they can exchange or even compete in some way. Create a sense of group membership for your consumers to make them feel part of something “bigger”.

Research background

Individual self - The consumers in the context of this research already have pro-environmental values. They try to live and purchase sustainably. However, sometimes the consumers need to be “reminded” that they have these values and prioritise them when purchasing a product. Being (figuratively) surrounded with people of the same mindset can enhance these values.

External focus - When buying products, consumers tend to forget they are part of a group and think that their purchase does not make a difference - in a negative and positive sense. Reminding them that there are many people out there who want to make a change can motivate a consumer to put “the greater good” before one’s own desires - and opt for the sustainable product.

Examples/ tips

Animate them to exchange photos of how the recycled plastic looks in one’s home

Create sustainable challenges for your customers to strengthen their “green” self-identity

Evoke the feeling of pride in your customers.

Information - Rewarding the consumers with the feeling of pride for choosing a product made from recycled plastic can increase the chance that they are returning customers.

Research background

Feelings - Pride is a positive feeling that can be a great motivator for sustainable behaviour. It can give the consumer self-affirmation, which reinforces that behaviour.

Response efficacy - It is extremely difficult for the consumers to estimate what change their sustainable actions can bring. Small actions of one individual might, in fact, not change the world but it is a good deed, nevertheless. Therefore, a rewarding feeling for “doing the right thing” can be enough to reinforce the behaviour.

Examples/ tips

Remind the consumers of the positive impact they had on another life, e.g.: fair paid worker

Give the consumers something that reminds them of the good deed, e.g.: nice looking card,”certificate”

Clear up assumptions about recycled plastic.

Information - Giving your customers insights into the process of a recycled product can make them understand that not all recycled plastic is the same. There are many steps until the final product and many ways what these steps can look like. Show the consumers how you produce your products.

Research background

Past experiences - Even self-declared sustainable consumers are not always sure which information about recycled products is true. Especially if the consumers have had negative experiences with recycled plastic in the past, it is important to show them your process and explain how you ensure good quality.

Examples/ tips

Create “behind the scenes” content, e.g.: youtube videos, social media posts, newsletters

Start with accessories to promote recycled plastic.

Information - If you have not used recycled plastic in your products before, consider starting with detachable product accessories to promote the material and get your customers acquainted with it.

Examples

Starting with cases (e.g. phone case) has many benefits:
• commonly used
• easy to produce
• should be looking special

Research background

Self-expression - Consumers want their products to represent personal preferences and to them, recycled plastic seems to be easily personalised. However, personalising a long-lasting product requires commitment and consumers tend to be more comfortable to do so with an accessory that can be detached and exchanged when it does not fit the personal preferences anymore.

Perceived low quality - Many consumers have doubts regarding the quality of recycled plastic. The perceived risk that the product might not last long negatively influences the willingness to opt for an e-device made from recycled plastic. For that reason, it can help to start using the material in products where the perceived risk is lower due to the price or expected lifespan.

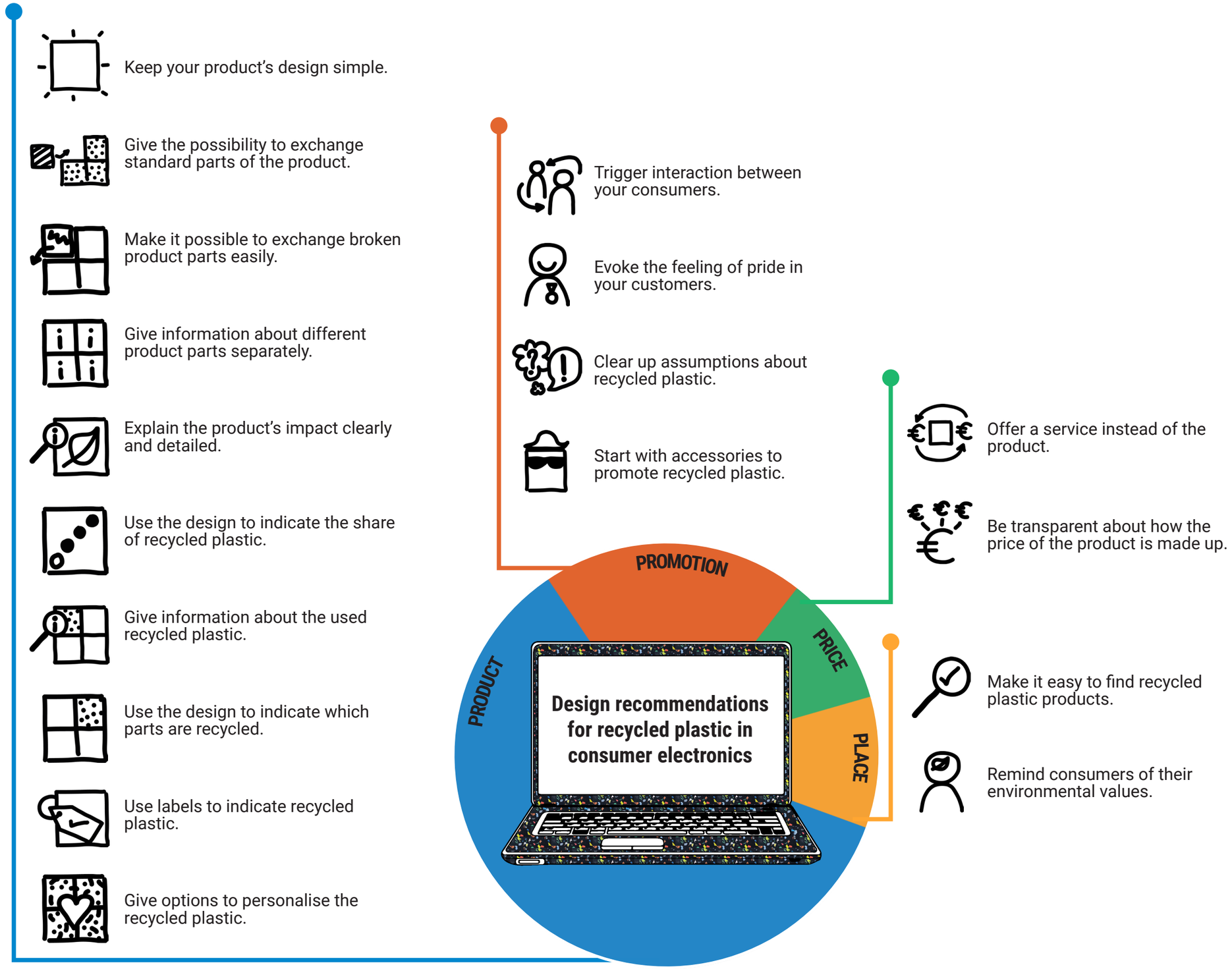
4.4. Chapter conclusions

With the support of 13 master students, over 300 ideas could be generated in three brainstorm sessions about the interview findings and the literature findings. First, they were clustered and categorising into product-, price-, place- and promotion-related insights. I came up with 18 recommendations for designers that can increase the chance of consumers opting for electronic products that contain recycled plastic. Each recommendation is based on at least one of the literature insights on sustainable purchase behaviour or on an interview finding about consumers' perception of recycled plastic and includes examples of how the recommendation could be applied (see the previous pages).

Here you can find the recommendations, structured according to the four categories.

It is important to note that these are only *recommendations*. Some of them might even be contradicting. Some focus on similar aspects and some address different issues. **It is not possible to apply all recommendations in one product** and there is no guarantee that a product becomes more desirable the more recommendations are applied on it. Designers are still asked to think critically and decide for themselves which recommendations can benefit their projects.

Ideation



5

CONCEPT DEVELOPMENT

The previous chapter introduced the recommendations for designers to develop electronic products containing recycled plastic. Now, that the content is ready, the next step is to find a way of presenting it to designers that is useful to them.

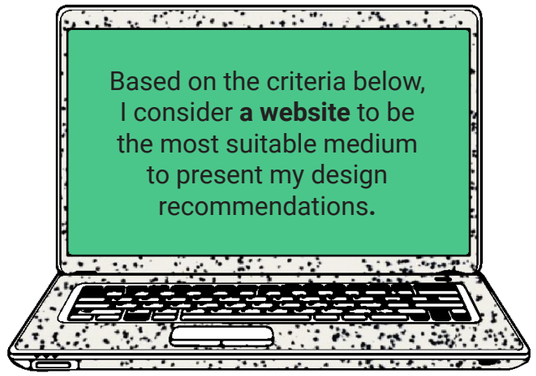
5.1. Bringing all insights together

The main research question (p. 12) in the beginning of this project was:

How can a designer stimulate a consumer to opt for an electronic device made from recycled plastic?

After several design activities, I found an answer to this question in the form of 18 design recommendations.

The question now is: How should the recommendations be presented in order to be useful for designers?



5.1.1. Finding the right medium

For the final design I formulated three design requirements:	From the requirements, these design criteria for the medium derived:
Easily and quickly accessible for any designer who works on electronic products containing recycled plastic.	Nowadays the internet is accessible by almost anyone – and most likely accessible by every professional designer. **Therefore, my final concept has to be online.**
Fit realistic research routine of designers	Designers are usually creative thinkers that are not too keen on reading text-intensive research papers. **Therefore, my final concept should present the research in bits, keeping the content concise and clear.**
Address different stages of the design process	Even though there are plenty of different design processes, every project has a start, a development phase, and an end. The designer should be able to explore the content, tailored to his/ her stage of the project. **Therefore, my final concept has to be interactive.**

5.1.2. Structuring the research content

Throughout the project I accumulated a lot of data that can be useful for designers who create electronic products made from recycled plastic. However, not all research is “on the same level”; it serves different stages of a design project. Figure 5.1.A roughly represents the process of this master thesis and shows what parts of the research I consider relevant for what stage of a design project.

This approach fits with the previously formulated requirement that the final design should address different stages of the design process.

The **findings from the interviews** give great insights into the consumers’ perception of recycled plastic in e-devices. I see this information as background knowledge for designers who create such products, but it does not yet give them concrete tips on what to do with this information. For that reason, I understand the interview findings as **information that designers can have a look at when they get started with a project** and do not know much about the topic.

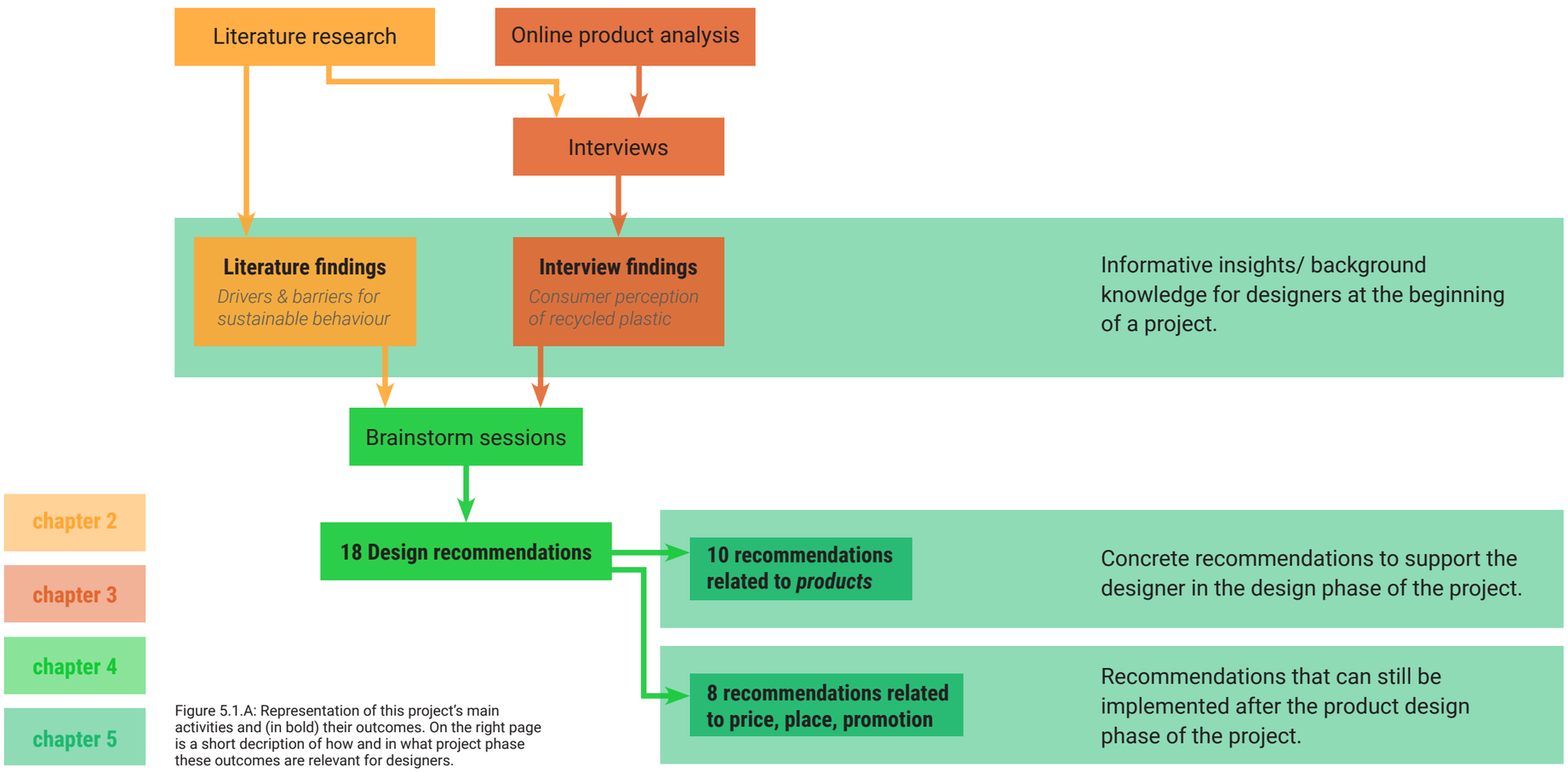


Figure 5.1.A: Representation of this project’s main activities and (in bold) their outcomes. On the right page is a short decription of how and in what project phase these outcomes are relevant for designers.

The brainstorm sessions lead to the formulation of 18 design recommendations that were divided into the four categories product, price, place and promotion. Since the aim of this project is to give recommendations for designers to create products, a majority of them falls into the product category. These **ten recommendations directly concern the design of a product.** Therefore, I consider them **useful when a designer already started designing a product** and needs support in form of concrete recommendations.

The eight recommendations in the other three categories; **price, place and promotion** contain valuable insights as well, but seem less relevant for designers during the design phase. Since they do not influence the product design directly, they **can be seen as recommendations to be implemented when the product design is already definite.**

The division into three parts – start, during and end of a design project – serves as structure of the final design:
the website.

6

FINAL CONCEPT

This chapter marks the highlight of the project: the final concept.
The goal of this *thesis* is to create recommendations for designers to develop electronic products containing recycled plastic.
The goal of the *concept* is to appropriately communicate the recommendations and additional insights to the user group: product designers.
This chapter focusses on presenting the design and explaining its intended use.

6.1. Concept description

The aim of this thesis is to give recommendations to designers that help them create e-products from recycled plastic, which will be perceived well by consumers. The final concept is a means to communicate these recommendations to the designers.

As explained in the previous chapter (see p. 78-79), the data gathered in the course of this thesis is divided into three parts and can be seen as different phases of a design process. Below you can find the phases, what I envision relevant in that phase and the data that will be used, including the full list of insights and recommendations. These are the content for the website.

"Start" phase

= Informative insights/ background knowledge for designers at the beginning of a project

= The 20 findings from the interviews and literature research

Interview insights (p.50)

Aesthetics:
- *Good look & Bad Look*
- *Self-expression*
- *Design importance*
- *Dark colour*
- *Cannot look normal*

Sustainability:
- *Recycled = Recyclable*
- *Value ranking*
- *Frequent buy*

Trust:
- *Knowing details*
- *External assessment (or "Independent assessment")*
- *Keep it simple*

Quality:
- *Low quality (or "Perceived low quality")*
- *Past experiences*
- *Functionality matters*

Literature insights (p.55)
- *Reducing cognitive effort*
- *External focus (or "Other-focus")*
- *Feelings*
- *Perception of consequences*
- *Response efficacy*
- *Individual self (or "Self-image")*

"During" phase

= Concrete design recommendations to support the designer in the design phase of the project

= 10 recommendations related to products

Design recommendations (p.58-63)
- *Keep your product's design simple.*
- *Give the possibility to exchange standard parts of the product.*
- *Make it possible to exchange broken product parts easily.*
- *Give information about different product parts separately.*
- *Explain the product's impact clearly and detailed.*
- *Use the design to indicate the share of recycled plastic.*
- *Give information about the used recycled plastic.*
- *Use the design to indicate which parts are recycled.*
- *Use labels to indicate recycled plastic.*
- *Give options to personalise the recycled plastic.*

"End" phase

= Recommendations that can still be implemented after the product design phase of the project

= 8 recommendations related to price, place, promotion

Recommendations (p.64-70)

Promotion:
- *Trigger interaction between your consumers*
- *Evoke the feeling of pride in your customers.*
- *Clear up assumptions about recycled plastic.*
- *Start with accessories to promote recycled plastic.*

Price:
- *Offer a service instead of the product.*
- *Be transparent about how the price of the product is made up.*

Place:
- *Make it easy to find recycled plastic products.*
- *Remind consumers of their environmental values.*

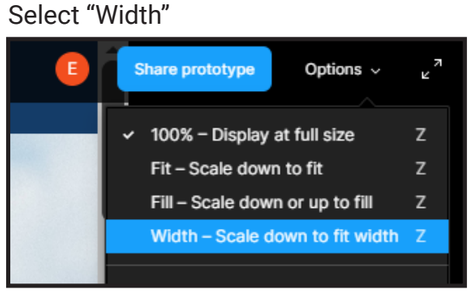
The structure of the website reflects the division into three phases: each design phase is given one page, which can be accessed through the “card”-buttons on the landing page and on the bottom of every phase-page.

On the following pages, each website page is presented separately and interactive or animated elements are explained.

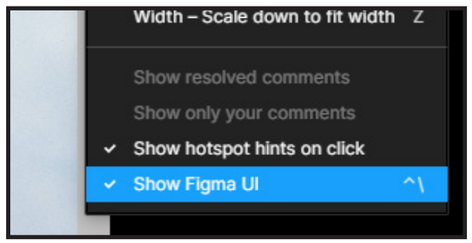
The prototype was created with the software *Figma*.
Below is the link to the functioning prototype:

Website Graduation Lisa

For optimal use of the prototype, go to “options” in the upper right corner.
Select “Width”

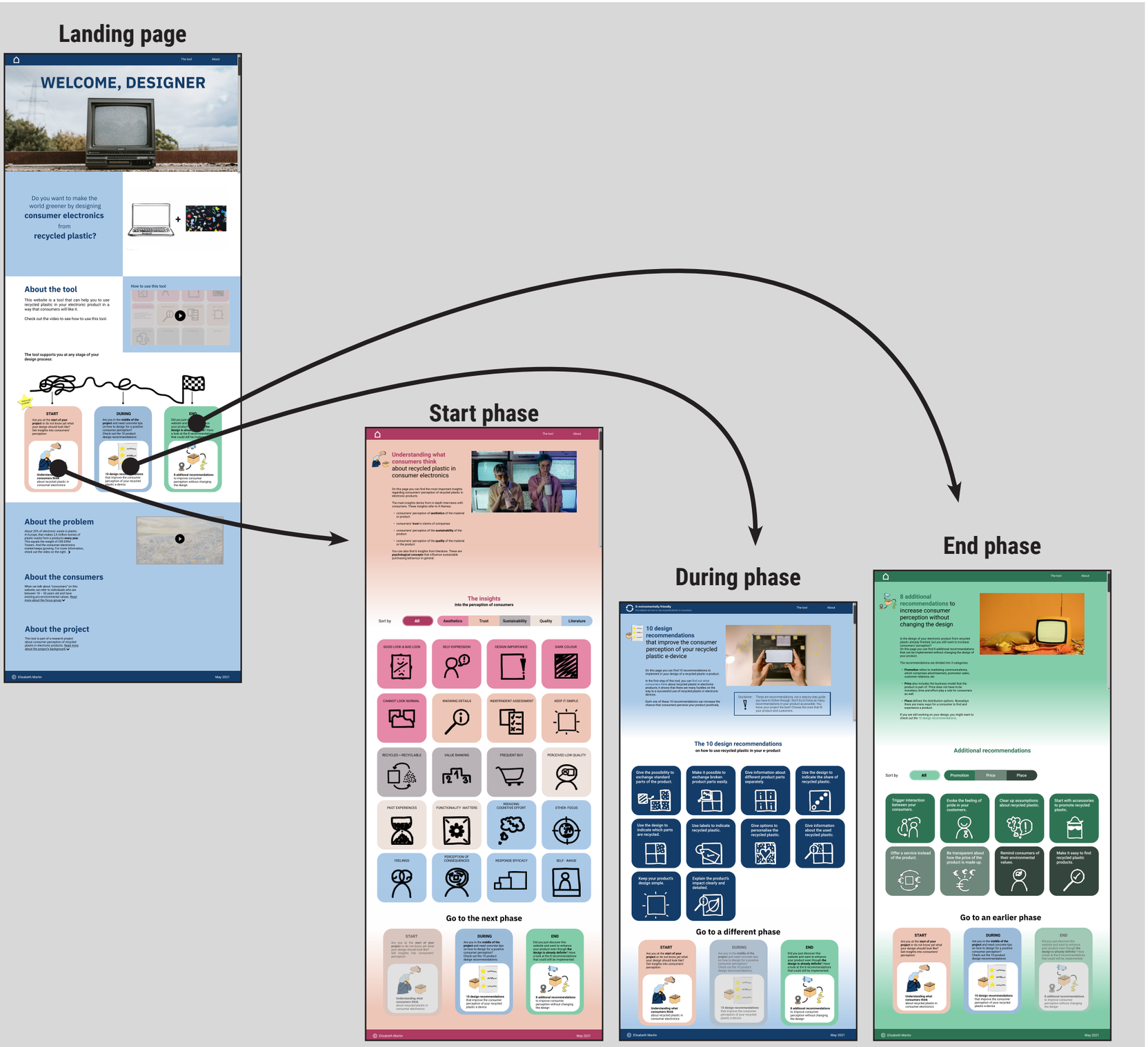


and deselect “Show Figma UI”.



Access prototype manually through:

https://www.figma.com/proto/EyaIEy3Mu8gjlTDtgsBJXJ/Website-Graduation-Lisa?page-id=0%3A1&node-id=6%3A39&viewport=-3863%2C-220%2C0.13828231394290924&scaling=min-zoom



Final Concept

6.2. Landing page

The landing page is the first thing users see when they enter the website. It is important that the target group – product designers – feels addressed and knows immediately what the website is about. This first page is meant to provide an overview of the site's content, but also give background information on why it is relevant and how it came about.

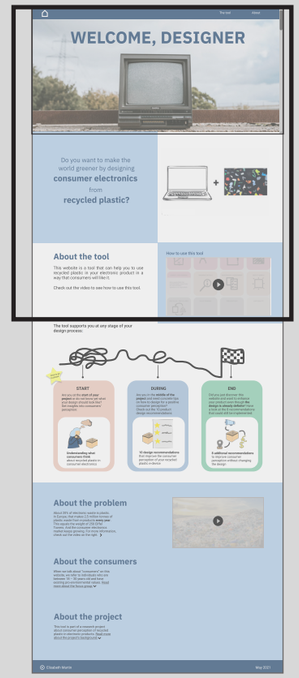
indicating a hover-effect

indicating an action by clicking

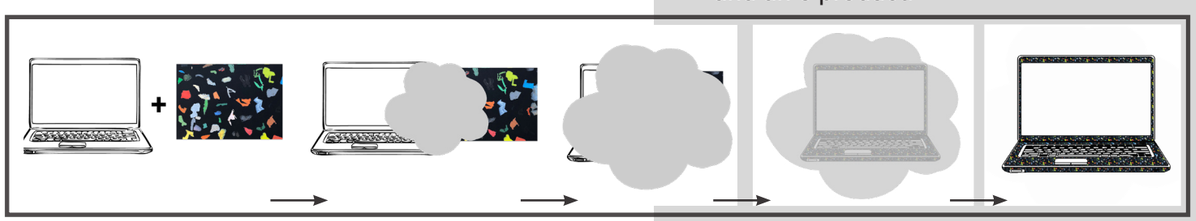
A hamburger menu opens that can be used as a shortcut to get to the 3 different phases by clicking on them. This element is present on every page.

The toolbar is fixed at the top of the screen, even when scrolling. This allows the user to use the shortcuts whenever needed. This element is present on every page.

This is a GIF: the TV screen is flickering slightly. Every page has a GIF at the top to make the webpage more dynamic.



This is a GIF: it visualises the combination of recycled plastic and an e-product.



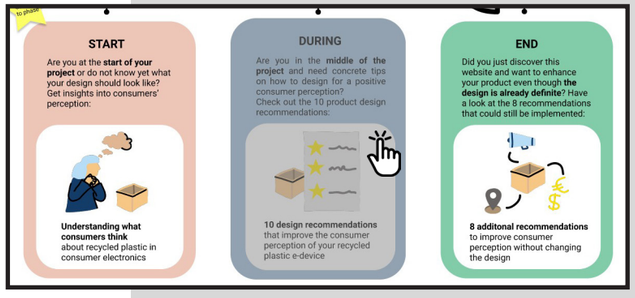
This video is the part of the showcase deliverable that explains how to use the website.

Final Concept

These 3 “cards” are the main elements on the landing page.

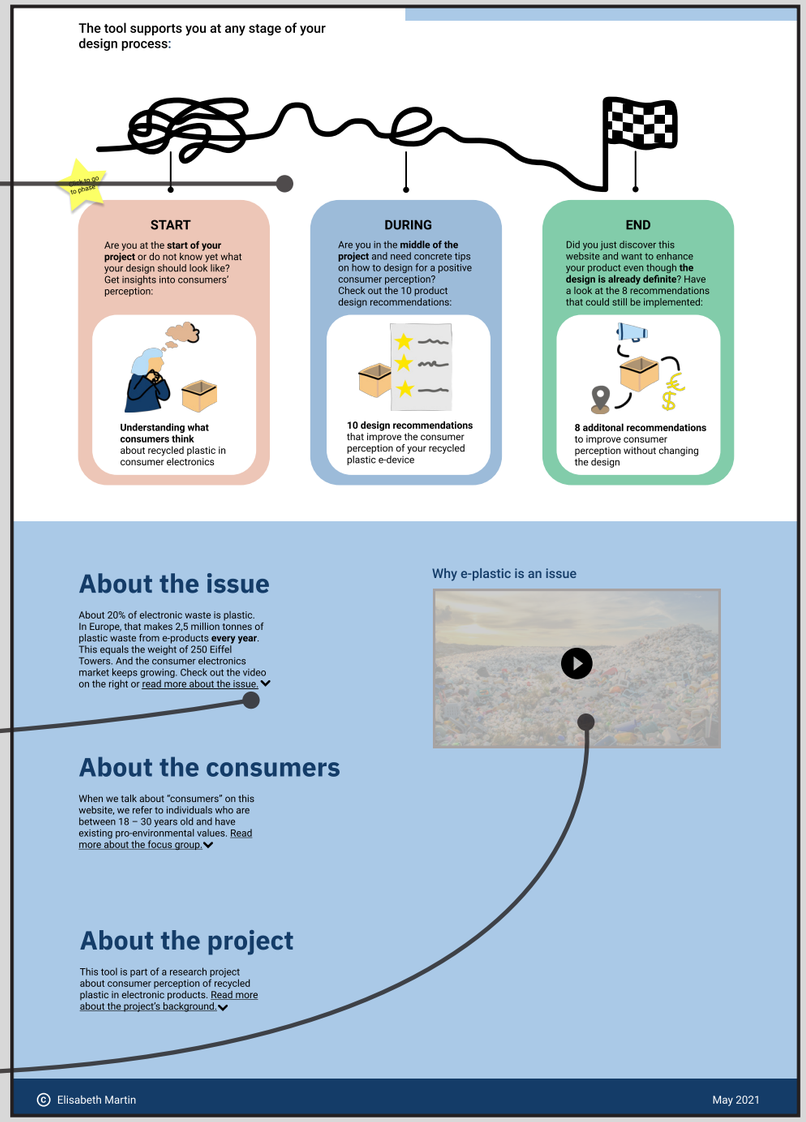
By hovering: It expands slightly to show that an interaction is possible.

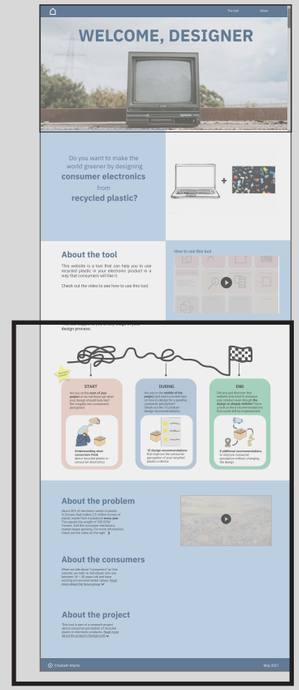
Left click: While pressing the mouse down, the “card” greys out to indicate an action is about to happen. When releasing the mouse, you are navigated to the according phase-page. These elements are present on every page.



By clicking on the underlined text or the caret (downward-facing arrow), the text box expands and displays more information.

This video is the part of the showcase deliverable that explains the issue with plastics from electronic products.





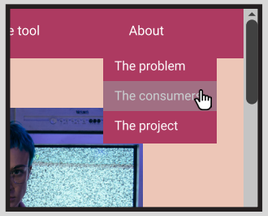
Final Concept

6.3. Start-phase page

This page is meant for designers who are in the start phase of their project. It can support them at finding a direction and make basic decisions for their potential product.
The content is a combination of the interview findings (p. 50) and a few relevant factors identified in the literature review (green framed ones on p. 55).

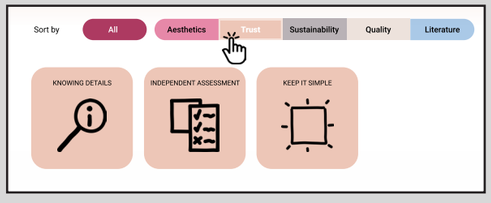
On this page, the insights can be sorted by the themes that they derived from: aesthetics, trust, sustainability, quality, and literature.

An overlay opens. Clicking one of the options directs you to the according text box on the landing page. This element is present on every page.

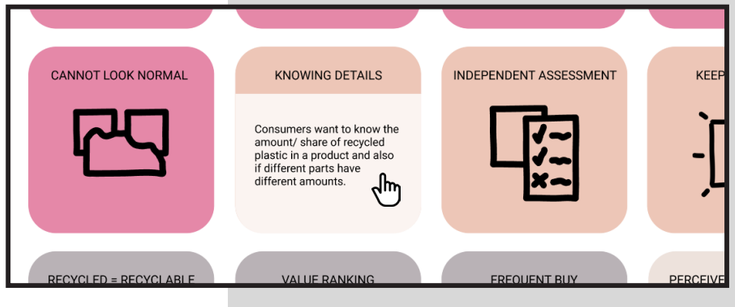


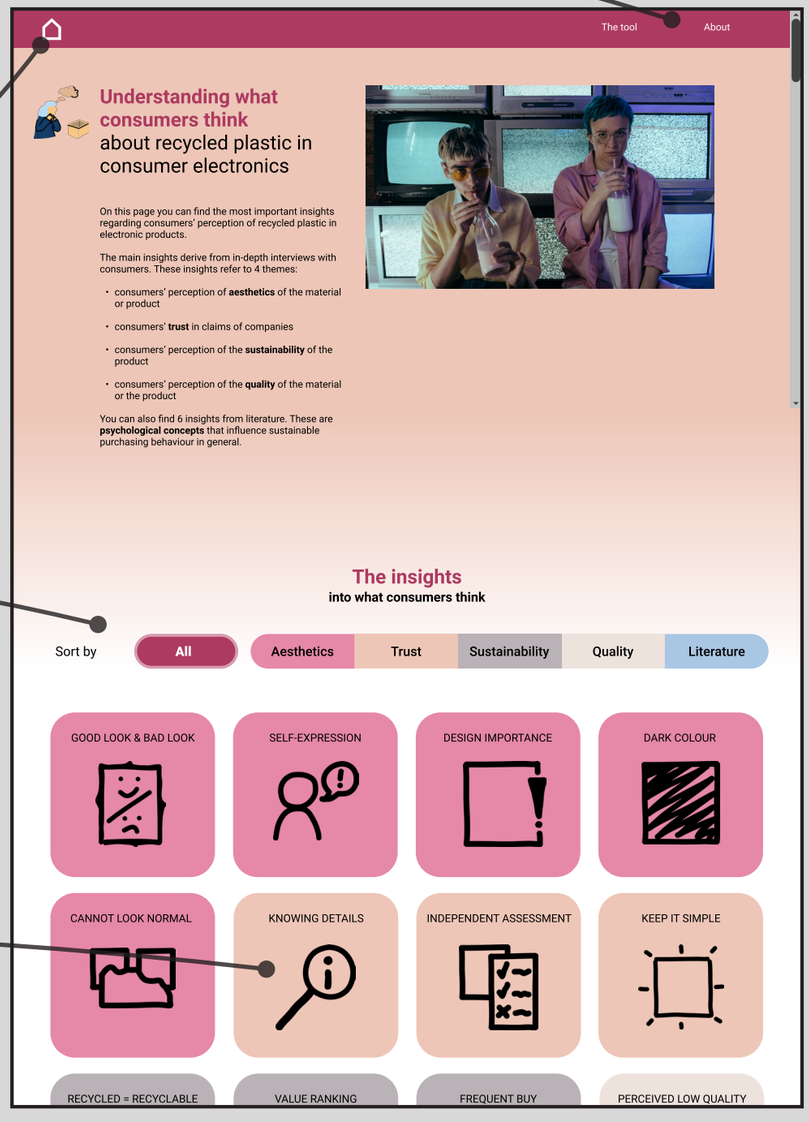
The house icon directs you back to the landing page. This element is present on every page.

The “sort by”-function can be used to only display tiles that belong to the selected category. This can help to reduce the information load.



By hovering over the tiles, information about this insight becomes visible.



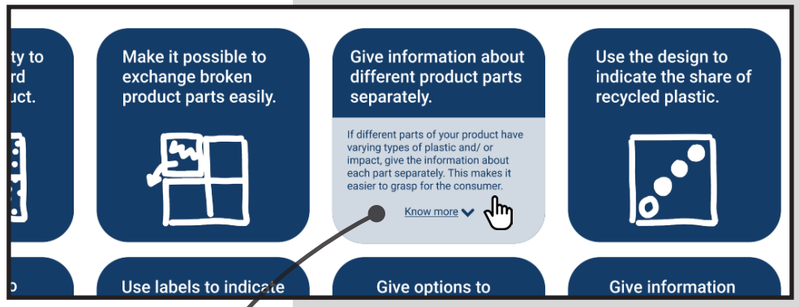


Final Concept

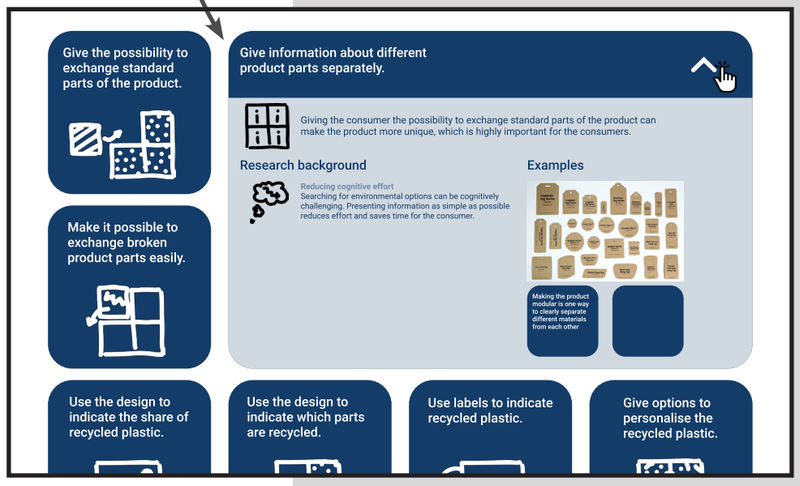
6.4. During-phase page

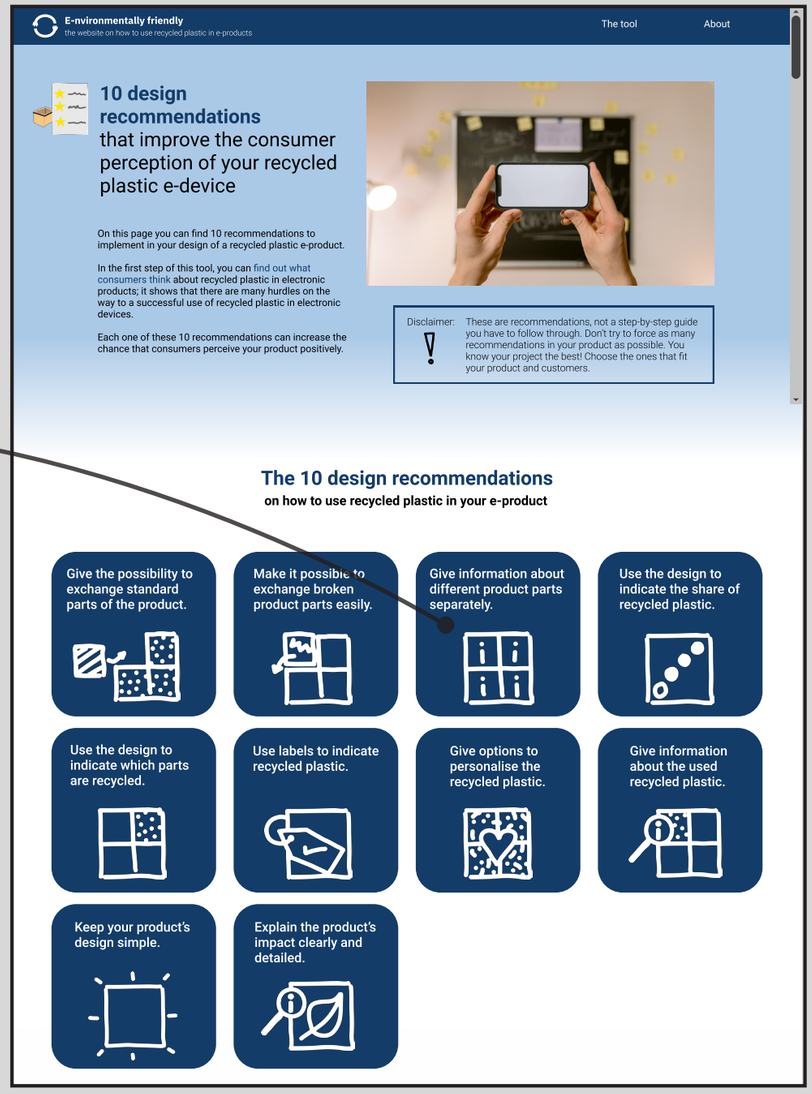
These ten recommendations directly concern the design of a product. They are meant to support designers when they already started designing a product and need support in form of concrete recommendations.
The fold-out tile contains the recommendation, information on how it relates to research and examples of how it could be applied in practice.
The recommendations on the website are the same as in the report from p. 58 – 63.

Like the tiles on the previous page, also these display more information about the recommendation when hovering over it.



The “Know more” message and the caret hint that there is more to find out. The tile unfolds and gives information about the research background and shows an image and examples.



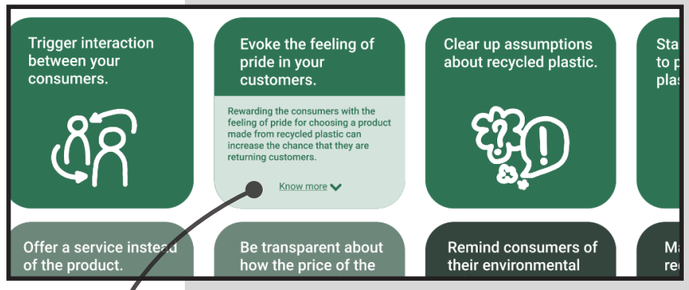


Final Concept

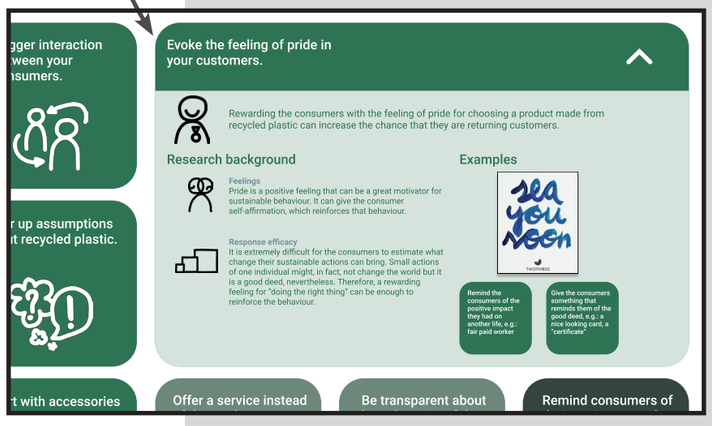
6.5. End-phase page

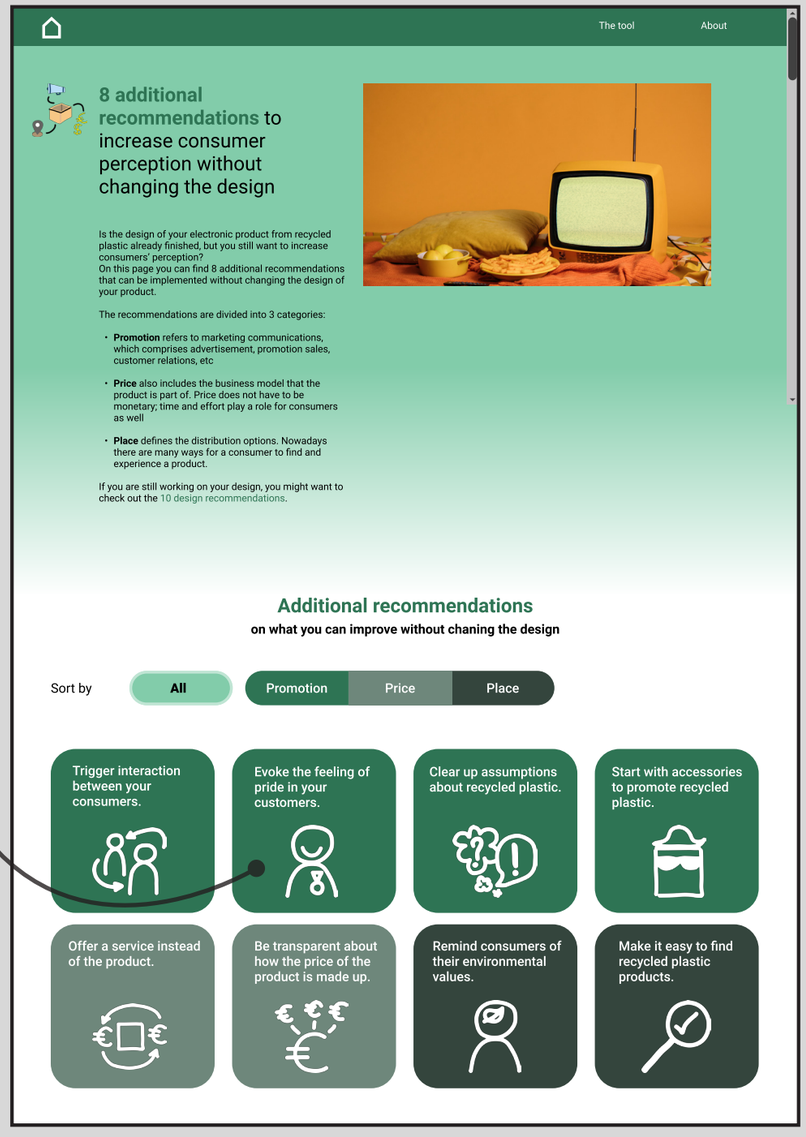
The recommendations on this page do not influence the product design directly, they can be seen as additional recommendations to be implemented when the product design is already definite. They correspond with the recommendations from p. 64 – 70 of this report.

As on the previous pages, the user can find more information on a recommendation when hovering over it.



The research background and examples of how to apply the recommendation can be found when clicking on the tile.





7

CONCEPT EVALUATION

The final concept derived from research I conducted in the course of this project. Two types of evaluations should now assess whether the transition from research into a design was successful. UX/UI professionals evaluate the prototype itself, focussing on the website flow and design elements. The content is evaluated by product designers. They provide feedback on the recommendations and on how the website supports them in the design process.

7.1. Content evaluation

The goal of the content evaluation is to assess whether the final concept fulfils its purpose: support designers in creating electronic products from recycled plastic. Furthermore, the concept should support designers in different phases of the project.
The idea of the evaluation is to give participants tasks that would put them in a specific design phase. Then, the participants should make use of the website-prototype and find the information they need to fulfil their task, which would include designing a product.
The following subchapters provide more information on the evaluation process.

7.1.1. Method

Three *Integrated Product Design* students participated in one evaluation session.
The method used for the evaluation session is called “concept optimisation” (van Boeijen et al., 2013). Its aim is not to judge the concept idea as a whole, but to evaluate specific elements of it and give feedback on what could be improved.
The general idea of a website that provides insights and recommendations on a topic was not subject of the evaluation. Nevertheless, the participants also provided feedback on that matter.

Since my concept consists of three phases (start, during, end), each participant should focus on one of the three. For that reason I created three different scenarios in which all participants are product designers with different background stories. Each scenario included a task that was specific for one of the three phases. The scenarios can be found in appendix F.

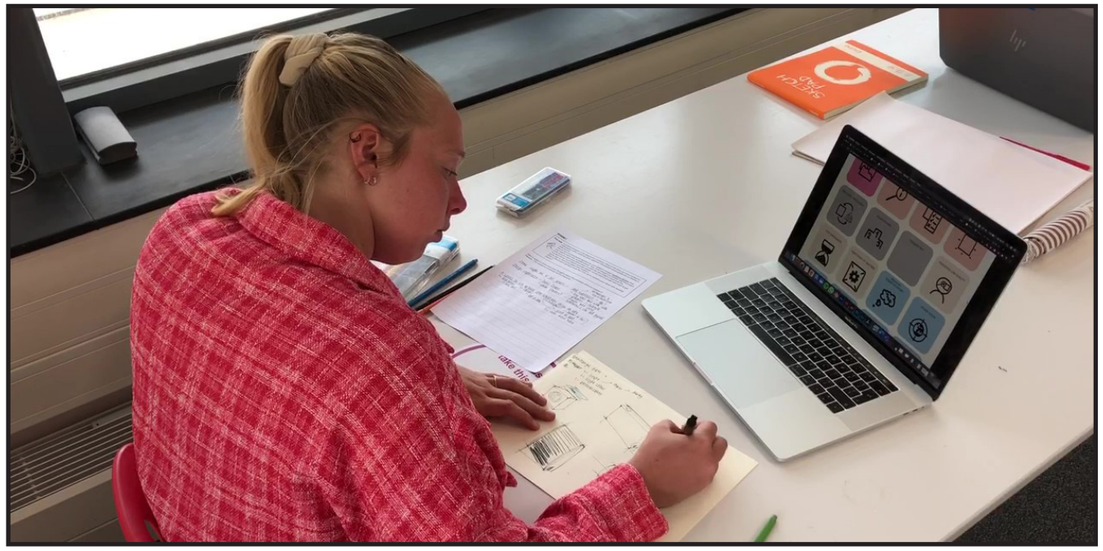


Figure 7.1.A: Photo of participant skeching an idea, inspired by the prototype. (The participant gave her consent to show her face).

7.1.2. Procedure

Below you can see an overview of the evaluation session's structure:

1) Introduction, including a brief pre-evaluation

The introduction did not give away what my project's concept is exactly. I told the participants my concept was: "An online tool for designers to create electronic products from recycled plastic that are perceived positively by consumers." As a "pre-evaluation", I asked them to write down what they think that would encompass. This way, I can compare what the participants envision with my actual concept. The filled-out forms can be found in appendix F.

2) Every participant gets a scenario that includes a task.

3) They explore the prototype by themselves.

I helped the participants make sure the website opens properly on their laptops and was there for potential questions, but I let them use the prototype on their own.

4) They are asked to write down notes of their initial thoughts about the prototype while exploring.

5) Participants work on their task with the support of the prototype.

6) Participants answer a few questions to evaluate the prototype and we discuss the feedback.

7) Every participant gets another scenario. Steps 4-6 are repeated.

8) Concluding discussion and after-drinks.

As a way to thank the participants for their contribution, I organised drinks and snacks for afterwards. Including a break before receiving a new scenario, the session took 2h.

7.1.3. Evaluation results

The three participants had very different expectations of my concept before experiencing it. One had a strong focus on material properties and data, another one expected the tool to trigger the designer by asking questions and one's expectation overlaps with the actual concept; provide user insights, give tips and examples of successful implementations.
Interestingly, the feedback the participants gave after using the prototype reflected very much the expectations that they had of the concept beforehand. What they declared to be missing in the concept was quite literally how they envisioned it prior to the evaluation.

Below and on the following page you can find the main points that were discussed after the evaluations.

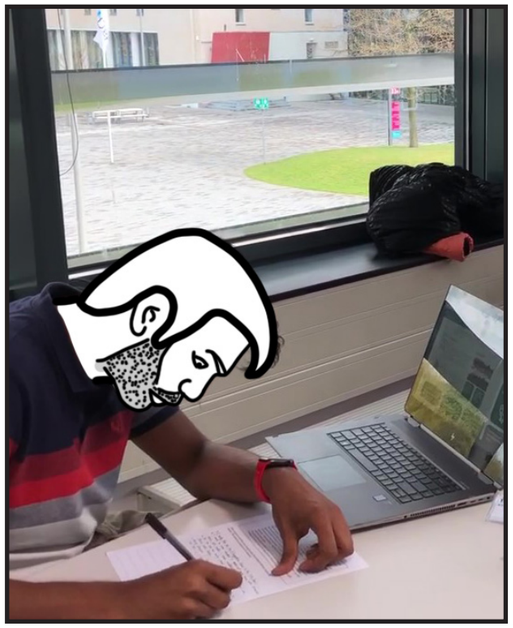


Figure 7.1.B: Anonymised photo of a participant evaluating the concept.

What participants thought was good:

Presentation

\+ Great variety of recommendations and insights combined in one page. They give a good perspective on what could be tried out in a product and can help giving direction.

"The thing which I really liked was that there are lots of suggestions, recommendations, which I think is good to have in one spot."

Well addressed

\+ The participants felt that the website was targeted at them as designers. The content was tailored at designers and their pre-knowledge and the design was friendly (colours and GIFs). The structure of the website was easy and clear.

"And I feel it's specifically targeted at me, as a designer with that big headline, that's very nice. I also really liked the GIFs."

What participants thought should be improved:

One-way

- I called it a “tool” in the introduction. For participants that means that you give input, and the tool helps you to improve it. But the website only works in one way: it gives standard recommendations that do not consider differences in individual projects.

”I was expecting more actionable things to do. Because, indeed, with a tool you, you think it could be like the business model canvas or so. But I was missing some actions, or maybe some questions to ask yourself.”

Real examples

- The recommendations are missing applied examples. It becomes much easier to apply a recommendation when it includes examples of other designers trying it and sharing their results. This can be in form of best practices but also seeing attempts that failed would be interesting to see.

”I’d like to see an example of a product. Like, “oh they tried this and this is the result”, then it becomes easier for me to understand it, like “ah, this is how it works” and I can apply it more easily.”

Connecting with others

- Following up on the previous point “real examples”: The participants stated that they would appreciate getting in touch with other designers who have already used the recommendations in order to exchange ideas or tips and tricks. Also contact details of experts would be a benefit. Connecting to researchers could help deepening the knowledge on certain recommendations, or material engineers could give concrete tips on what type of recycled plastic to use.

”I thought, exchanging with people who use these tips in their products would be really nice.”

”I’m working with one company to develop this product and there also, the thing that we miss is connecting to the experts. It would be nice to have some expert’s name, some way you can reach out to them.”

Exploratory phase

- All participants thought that the website would be most useful at the start of a project, or even earlier. The website focusses on consumer perception, which is most relevant in the research phase of a project, or when the designer is unsure about the project’s direction. For that reason, the website should emphasise that phase. However, one participant found it “refreshing” to get tips that she would otherwise never think of.

”I think this tool is more applicable in the early stage, when you are still exploring. Like, “what are my options, where am I going?” That’s what I experienced, because in that scenario [nr. 2], it was way easier for me to use it and to try like “ok, maybe another material, or maybe something else”, there is more you can still change and apply the insights on.”

7.2. User interface (UI) evaluation

Even though the focus of this project lies on the content, the usability of the prototype is still highly important. Especially in the field of UI design: users have a low attention span and patience; if the website does not immediately do what is expected from it, the user leaves. A good UI design is the base for a positive user experience.

7.2.1. Method

I conducted three separate evaluations with UX/UI professionals, following the method “Heuristic Evaluation” by Jakob Nielsen (1994). It is an informal way to test usability issues of an interface that requires only a small number of evaluators. They examine the prototype’s compliance with the ten heuristics of usability (Nielsen, 2020), which are explained later on.

The evaluation was done through a videocall on Zoom. I asked the participants to share their screen, so I could watch them going through my prototype and could easily see which elements they were commenting on. Each session took about one hour.

7.2.2. Evaluation results

The three evaluators gave highly useful feedback. Many of their comments were about details, which I partly implemented already in the latest version of the prototype. This chapter focusses on the evaluation regarding the heuristics.

In the following, the six heuristics that were discussed during the evaluation are briefly explained. They contain the related elements of my design that either already comply with the heuristic or should be improved to conform to it.

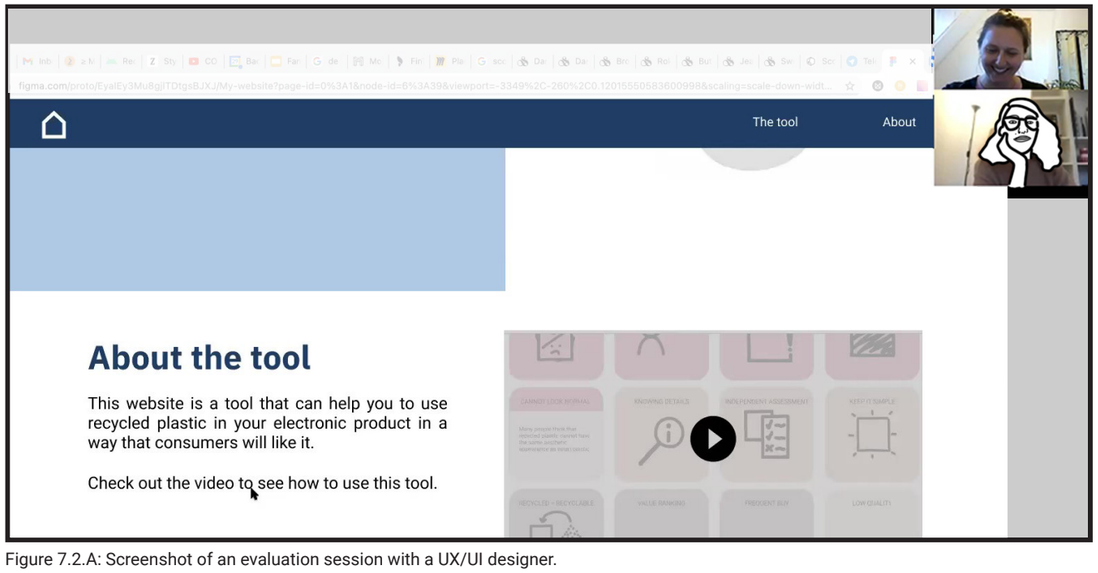
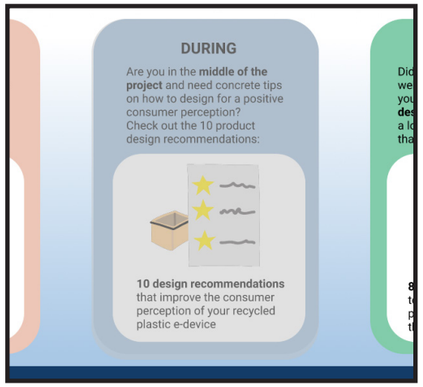


Figure 7.2.A: Screenshot of an evaluation session with a UX/UI designer.

Visibility of system status

The system should give feedback to the user about what is happening and where they are.

Where it is applied in the design:
• Phase-button of the current page is greyed out, which shows users on what page they currently are.



• The bar at the bottom of each page was added to clearly show the user that this is the end of the page. Otherwise they might assume a system error that prevents them from scrolling down further.

Where it can be improved in the design:
• Let the consumer see at all times where they are, e.g. have “Home > Start phase” on the fixed toolbar.

Match between system and real world

Speak the same language as your users, in terms of the design and wording.

Where it can be improved in the design:
• The wording of large parts of the content is quite academic and formal. It is the same wording I used in the report, even though the audience and the purpose are disparate. The insights and recommendations should be rephrased.

Consistency and standards

Follow common UI practices and be consistent with the meaning of design elements to reduce cognitive effort for the user.

Where it is applied in the design:
• My prototype maintains internal consistency. The structure and design of the phase-pages are consistent. All of them contain the main information in form of tiles that can display more content.

Where it can be improved in the design:
• The phase-buttons are not perfectly clear recognizable as buttons yet. This could be improved by changing their layout to one that is more commonly known, e.g.: plan selection UI. These elements often appear as a trio and would therefore suit my structure. They are basically rectangles that contain a title, bullet points, and the actual button at the bottom.

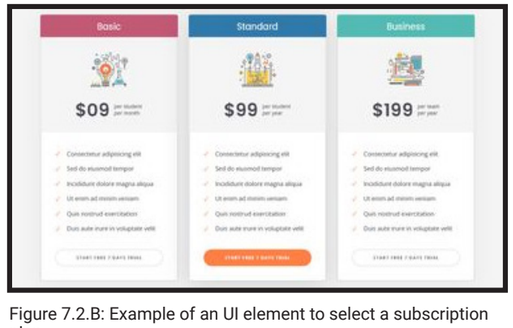


Figure 7.2.B: Example of an UI element to select a subscription plan.

Flexibility and efficiency of use

Provide shortcuts that make the use of the website more efficient for frequent users.

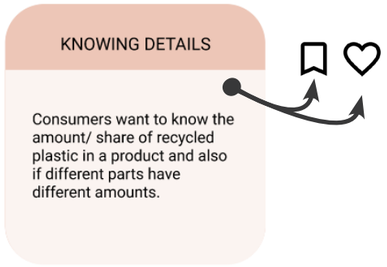
Where it is applied in the design:

• The toolbar has a dropdown menu that allows navigating through pages without having to scroll to the bottom of the page.

• A user should never reach a dead-end on a website and be forced to use the “go back” button. The phase-buttons at the bottom of every page allow the users to continuously move forward (or in a loop).

Where it can be improved in the design:

• It might be useful for frequent users to save their favourite insights and recommendations. That way they could have the information they need at one glance, instead of having to “collect” them from three different pages.



Recognition rather than recall

Users should not have to remember. They should be reminded of relevant information.

Where it is applied in the design:

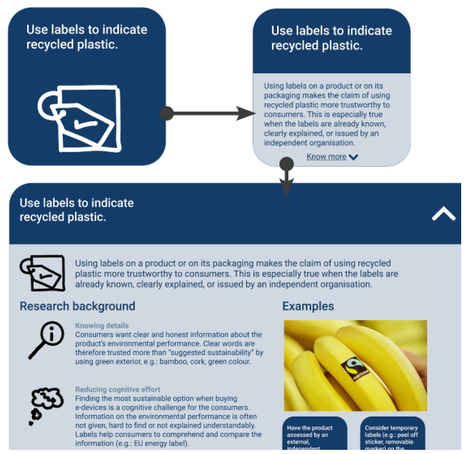
• The headlines above the tiles used to say “The recommendations”. After the evaluations I added the sub-headlines to make sure users know what they are looking at.

Aesthetic and minimalist design

Only present relevant information. Important information becomes less noticeable when the page is too busy.

Where it is applied in the design:

• Not all information is presented at first. The tiles allow the user to “randomly” explore the information bit by bit. There is no hierarchy in the tiles. This encourages exploring, which is a benefit.
My website first shows the most important information (recommendation), then a short explanation of it (hover) and then the background research (click).



Where it can be improved in the design:

• At the moment, the section of the tiles is a bit too busy. One simple solution could be to have less tiles in one row, which would create more “room to breathe”. Another option would be to sort the recommendations vertically. This so-called accordion might be easier on the eye. However, it would change parts of the interaction and lose its explorative character, which I personally view as a benefit of the tiles. Especially, because people “jump around” on websites; they do not read information chronologically – as I was told by the participants.

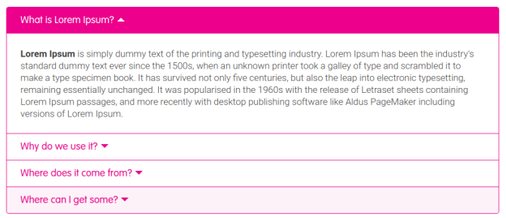


Figure 7.2.C: Example of an accordion UI element.

7.2.2.1. Accessibility

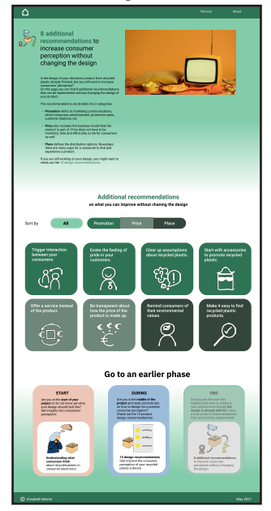
One of the design requirements is to make my design easily accessible, which I understood as “making it easy to reach”. In the context of UX/ UI design, however, accessibility is strongly based on inclusivity and refers to designing for people with various disabilities.

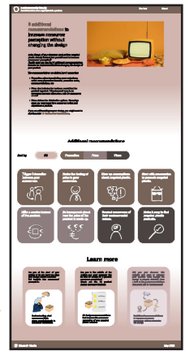
During the usability testing of my design, it became apparent that certain UI elements are not supporting this type of accessibility. E.g.: The colours of each page should support the differentiation between them. However, some colours would look very different for visually impaired users, or they might look the same and create an unintentional connection between the pages, as Figure 7.2.D illustrates.
The user can read extra information when hovering over the tiles, but the use of the hover effect could turn out to be unusable for motorically impaired people.

Without doubt, making websites inclusive and accessible to everyone should to be imperative for every UX designer. However, I do not regard it as a high priority for this project, as it is targeted at product designers. I argue that the number of product designers with an impairment that would limit them to use my website, is rather small. The argument is based on the assumption that the abilities needed to use the website, overlap with the skills that are required to work as a design professional. Unfortunately, I was not able to find information that could confirm or refute this argument.

Deuteranopia vision

Original





Tritanopia vision

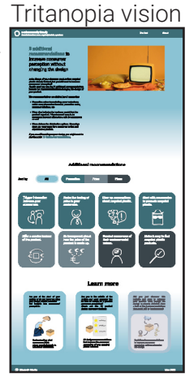


Figure 7.2.D: Depending on the type of visual impairment, the original green page would have different colours that could create an unintentional connection the the start-phase (pink) or during-phase (blue) pages.

7.3. Chapter conclusion

Even though the concept evaluation, as well as the UI evaluation provided valuable feedback, this project focusses strongly on research and making it useful to product designers. The UI design is rather considered a means to an end. Therefore, this conclusion only covers the concept evaluation.

The concept evaluation gave a better understanding of how product designers work and what type of information would support them in their process.

The product design participants had two main points of criticism. First, they were missing real examples to help them envision the application of the recommendation in a product. Second, they would have liked the option to get in touch with designers who applied the recommendations and could share their experience. Furthermore, they want to share their own attempts to apply the recommendations.

Additional feedback was that the content might be most useful in the exploratory phase of a project and could therefore emphasise the start phase. Furthermore, I introduced the concept as a tool to the participants, which raised their expectation for interactive elements. In their opinion, a tool has to be fed with input in order to give a result back.

Based on the feedback, the concept can be improved further. The next chapter addresses recommendations for improvement.

RECOMMENDATIONS

The final chapter of this master thesis concludes with recommendations for potential improvements in the future, based on the concept evaluation results.

8. Recommendations

The evaluation session uncovered the desirability for product designers to use the website and revealed how it can be improved for optimal use.
This chapter provides recommendations on how the participants' feedback could potentially be implemented in the future.

Two points of the feedback could be changed relatively effortless.

One-way
One argument was that I introduced the website as a tool, which led the participants to think that they would give input and the website responses with a tailored recommendation.
A simple fix for this misconception could be to introduce the concept as website, instead of tool.
Another solution would be to transform the *website* into an actual *tool.*

The website could contain a search filter that users can use to enter certain criteria they have for their product and only the corresponding insights are shown. This way, the content of the website is more tailored to the individual project.Figure 8.A shows an example of how this feature could look.
A search bar or a filter to select what type of information the designer wants to find is not recommended, as the user tend to use this website to explore content and do not have a clear idea yet of what they are looking for.

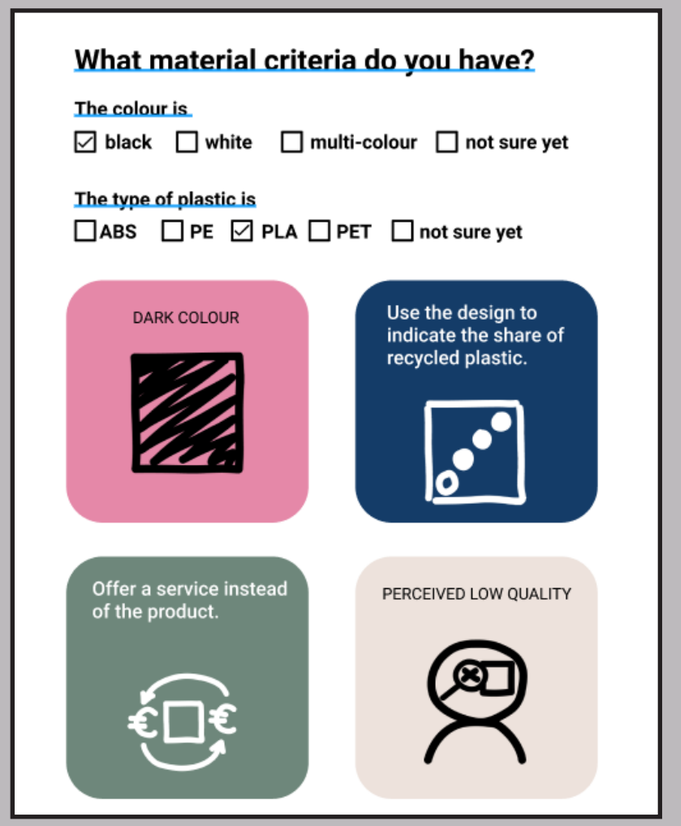


Figure 8.A: Exemplary image to illustrate how the website's content could be tailored to an individual project.

One participant had a strong focus on material properties and data. What he would have liked from the website is to give more information on material properties.
A way to turn the website into a tool and make it more interesting for design engineers could be to link it to a material data base and connect different types of material properties to the associated consumer insights. E.g.: If the material qualities of one plastic are low, connect it to the consumer insight “perceived low quality”. Figure 8.B gives an example of how this could look.
Implementing this change is more complex, however.

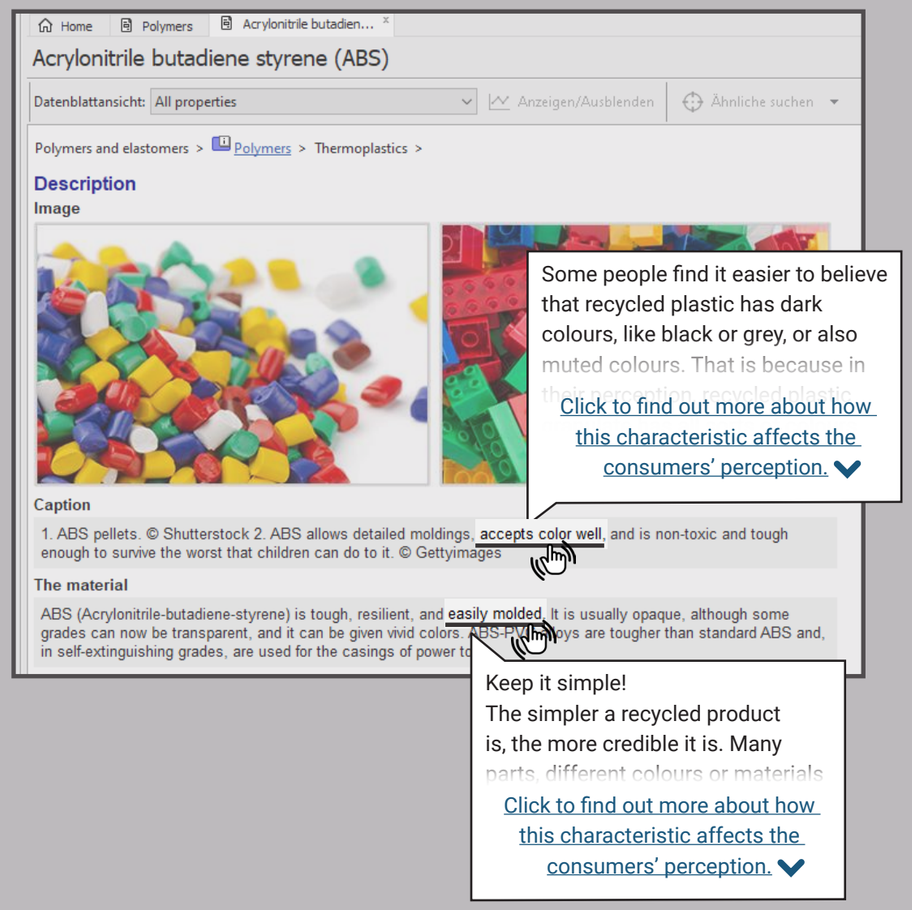


Figure 8.B: Example to illustrate how thiy project’s insights could be linked to a material database. The screenshot is from the database CES EduPack 2020.

Exploratory phase
The participants stated that they view the website mostly relevant in the early phase of a project. They would therefore appreciate more information on those insights.

The prototype the participants evaluated was partly incomplete, but there is in fact more information that could be used for the insights on the “start phase”-page. The insights only covered the findings section of the interview insights in chapter 3 of this report (p. 40 – 49). The section of the explanation and quotes, as well as the corresponding literature should be added to the website to enrich the insights. Figure 8.C shows how the information from the report (top) could be transformed into a tile on the website (bottom).
Perhaps this part could also contain questions the designers can ask themselves to trigger creative ideas of how they could use the insights in practice. Additionally, this would increase the sense of interaction, which can make the website feel more like a tool.

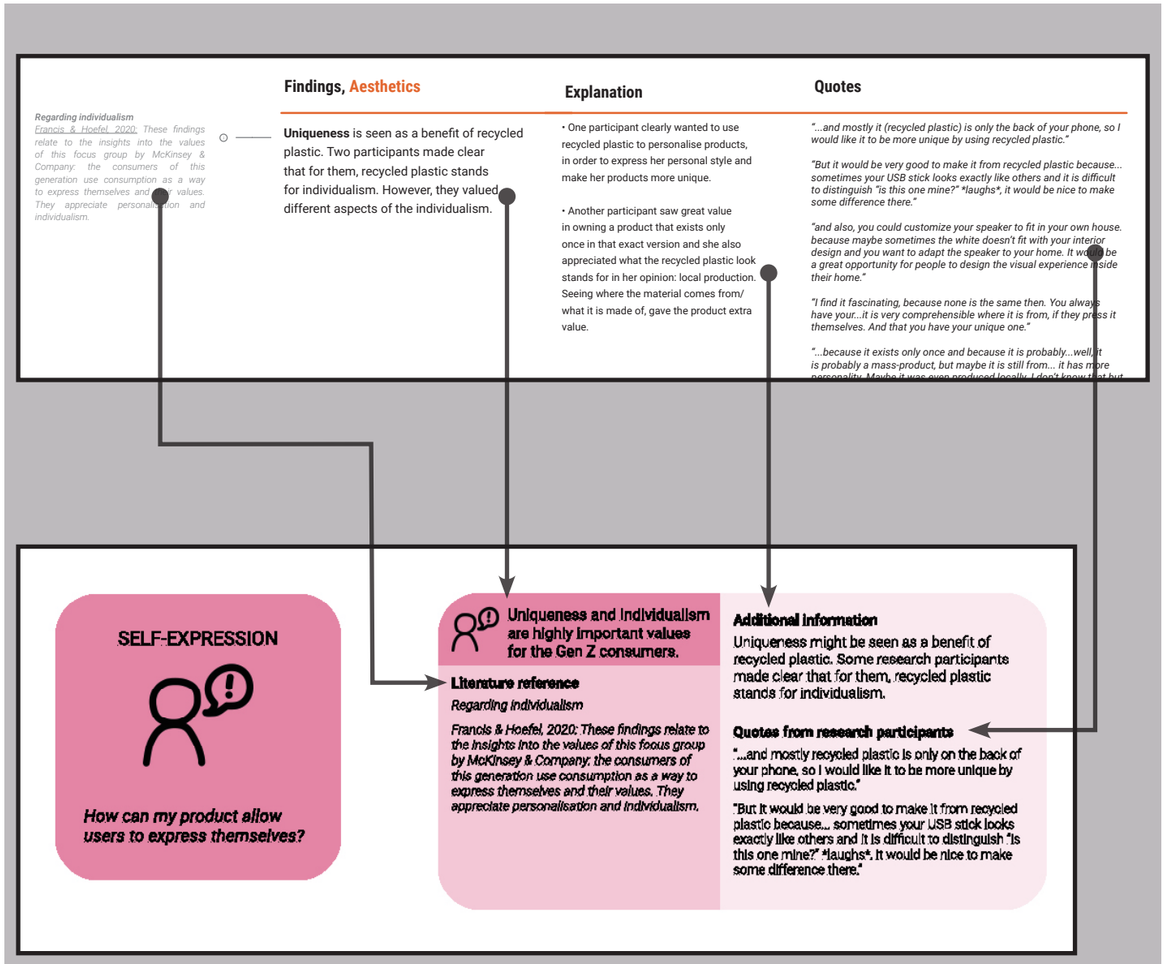


Figure 8.C: An example of how the information from the report could be transformed into a tile for the website.

Examples
A major point of criticism was that the recommendations do not show real-life examples that are related to the use of recycled plastic in an e-product. In theory, this issue can be resolved easy by researching more examples that fit the context. However, as mentioned in the very beginning of this thesis, only 1% of electronic products on the market contains recycled plastic. The challenge is that, at this moment, there are simply not many real-life examples.

Nonetheless, the issue of plastic in electronic products is not only addressed by this master thesis, but also by the PolyCE project by the European Commission. As this topic is given more attention, it can be assumed that more research is done and more examples of recycled plastic in e-products will be available in the near future.

How my website could help accelerate the availability of examples is to add features that encourage designers to apply the recommendations in a design. Perhaps solely in theory at the beginning, making sketches or describing the idea. A large quantity of premature ideas and attempts of designing with a recommendation might already help to get a better understanding of it. Figure 8.D shows an example of how a page that presents users' design attempts could look.
A possibility is to initiate a design contest before publishing the website online. Designers produce examples of how they would apply a recommendation and assess others' ideas on benefits and potential downsides. Furthermore, it is a way to inform designers about existence of the new website and promote its use.

This idea for future improvement relates to next comment from the evaluation session:

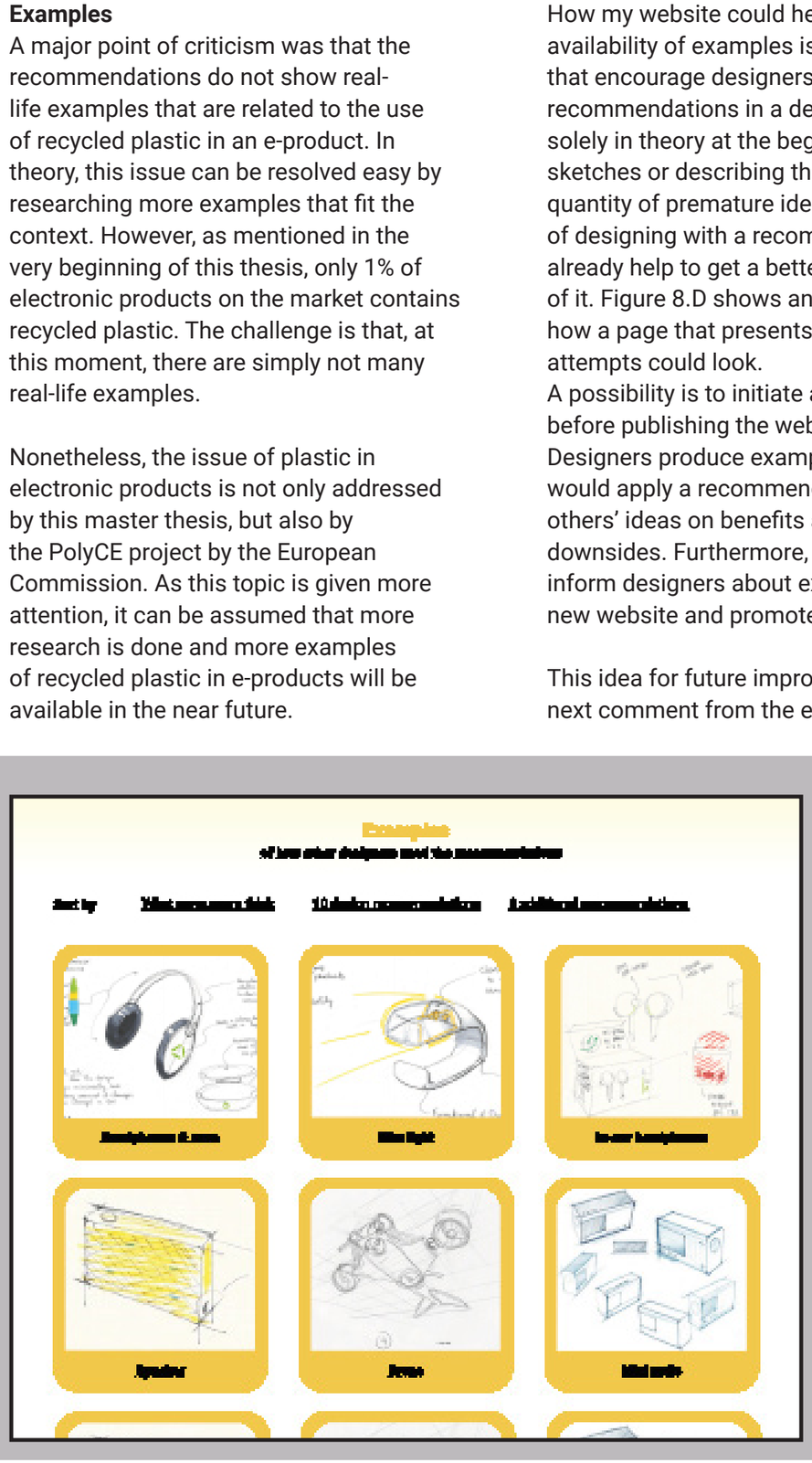


Figure 8.D: Example of how an additional page of the website could look that collects designers' attempts to implement the recommendations in a product.

Interaction with others
Next to the lack of real-life examples, the evaluation participants were also missing the option to get in touch with other designers. An exchange with people who applied the design recommendations previously, can help those who do not have much experience yet.
The implementation of this feedback can be included as part of the recommendation described earlier to encourage designers to share their design results.
A possible way to do so is to add a page to the website that acts as a forum. Users are asked to share images of their design, including a description and tags that make clear what insights or recommendation they based the idea on. Furthermore, they can share their experience of using the recommendations, potentially in the form of "do's & don'ts". To sustain the exchange and the continuous improvement of the recommendations, a comment function could be implemented for users to ask questions to the creator of a design.
An example of how this feature could look is shown in figure 8.E.

Implementing the recommendations of this chapter to optimise the website would increase its use to designers. Enabling them to successfully implement recycled plastic in electronic products is one step to accelerate the transition towards a circular economy.

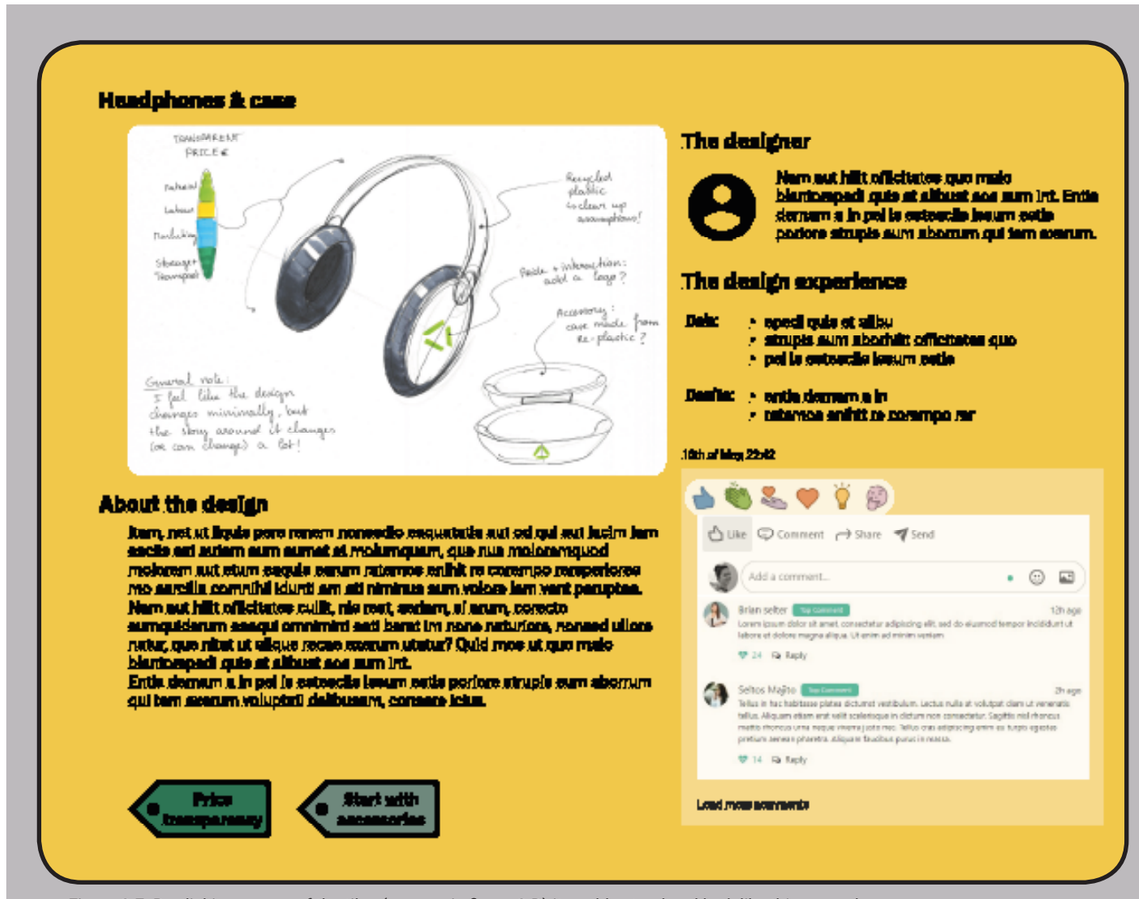


Figure 8.E: By clicking on one of the tiles (as seen in figure 8.D) it could extend and look like this example.

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CREDITS

Report

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• Image p.28-29: unknown. Found on https://mitte.co/2018/07/18/truth-recycling-plastic/

• Image p. 71: unknown. Found on https://bizbolts.co.za/recycling-business-ideas-for-south-africa/

• Image p. 103: Isabelle, participating in the evaluation session.

Image sources of *stimuli*, report p. 37:

[1] [2] [3] [4] [5] created in Google Slides
[6] [9] [10] [12] [13] [15] [16] [22] [24] [25] [28] accessed via: *https://thegoodplasticcompany.com/products/*
[7] accessed via: *https://www.abeltosh.com/helio-wall-design/*
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[21] accessed via: *https://i.pinimg.com/originals/cd/b1/e7/cdb1e7a646a0e40be7a9e06ae1651aac.jpg*
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[23] accessed via: *https://static.dezeen.com/uploads/2018/11/plasticiet-terrazzo-like-material-design_dezeen_2364_hero-1.jpg*
[26] [27] accessed via: *https://www.pyrasied.nl/en/product/plasticiet/*

Video/ Images on website (Figma)

• Tima Miroshnichenko. Found on Pexels
• Cottonbro. Found on Pexels
• KoolShooters. Found on Pexels
• Thirdman. Found on Pexels

APPENDICES

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APPENDIX A Graduation project brief

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

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

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME
Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name	Martin		
initials		given name	Elisabeth
student number	4856627		
street & no.			
zipcode & city			
country	The Netherlands		
phone			
email			

Your master programme (only select the options that apply to you):

IDE master(s): ○ IPD ★ DfI ○ SPD

2nd non-IDE master:

individual programme: - - (give date of approval)

honours programme: ○ Honours Programme Master

specialisation / annotation: ○ Medisign ○ Tech. in Sustainable Design ○ Entrepeneurship

SUPERVISORY TEAM **
Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair	Ruth Mugge	dept. / section:	DOS/MCR
** mentor	Athanasios Polyportis	dept. / section:	DOS/MCR
2nd mentor			
organisation:			
city:		country:	

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

comments (optional): Dr. Mugge and Dr. Polyportis will coach me on different aspects of the project. Dr. Polyportis' expertise is people's acceptance of recycled products, while Dr. Mugge's design background allows coaching on design questions.

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

TU Delft

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF
To be filled in by the chair of the supervisory team.

chair Ruth Mugge date 18 - 09 - 2020 signature Ruth Mugge Digitally signed by Ruth Mugge Date: 2020.09.18 12:00:30 +02'00'

CHECK STUDY PROGRESS
To be filled in by the SSC E&SA (Shared Service Center, 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: 30 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 30 EC

List of electives obtained before the third semester without approval of the BoE

YES all 1st year master courses passed

NO missing 1st year master courses are:

name C. van der Bunt date 21 - 09 - 2020 signature

FORMAL APPROVAL GRADUATION PROJECT
To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: APPROVED NOT APPROVED

Procedure: APPROVED NOT APPROVED

comments

name Monique von Morgen date 29 - 09 - 2020 signature

TU Delft

Personal Project Brief - IDE Master Graduation

Improving consumers'perception of e-devices made from recycled plastic project title

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

start date 10 - 09 - 2020 27 - 03 - 2021 end date

INTRODUCTION **
Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

60 million tonnes of single used plastics (SUP) were produced in the EU in 2016, of which only 8 million tonnes were recycled. The rest is incinerated or ends up on landfills. Not only is the plastic waste a burden to our environment, it is also lost potential. Recycled SUP could replace the imported virgin material that the European industry relies on at the moment. Using low and high value plastics from household waste to recycle them and giving the material back into a production loop is the aim of the European Union-funded project "TRANSFORM-CE", in which the TU Delft is involved as well. The TU Delft's part is to "investigate consumers' perceptions and adoption of these new, recycled plastic solutions and how designers and marketers can influence these perceptions". (Interreg North-West Europe, 2019)

Within this context, my thesis will investigate consumers' perception of electronic devices that contain recycled plastics.
Consumer electronics are a big polluter that did not receive much attention yet. Europe is responsible 12 million tonnes of e-waste every year. Plastic accounts for more than 20% of the e-waste, which makes about 2,5 million tonnes of plastic from e-waste (Kinver, 2019). Compared to 20 years ago, that is an increase of 250% and rising. According to the United Nations University, up to 3 tonnes of CO_2 emissions could be avoided per tonne of recycled plastic (Reducing, Reusing Europe's Annual 2.5 Million Tonnes of Plastic Components in Electronic Waste - United Nations University, 2019).

In general, Dutch citizens care increasingly more about sustainability and the responsibility of brands. The percentage of people who pay attention to sustainability when buying a product rose from 30% in 2013 to 53% in 2019 (B-Open, 2016; B-Open, 2019). Research carried out by the project "PolyCE" showed that even though consumers say they are willing to buy a product with recycled plastic, their engagement is still rather low (Reducing, Reusing Europe's Annual 2.5 Million Tonnes of Plastic Components in Electronic Waste - United Nations University, 2019).
People have different attitudes towards sustainable products. There is a range between people that are willing to pay more for an environmental-friendly product to consumers that reject sustainable options (B-Open, 2019). That results in different target groups that need to be addressed differently in order to purchase a (more) sustainable product. My master thesis will provide research about those target groups and strategies on how to address them.

space available for images / figures on next page

Personal Project Brief - IDE Master Graduation

introduction (continued): space for images

image / figure 1: ELECTROLUX project creates vacuum cleaner cases from recycled sea plastic.

image / figure 2: Passers-by are asked if they notice differences between two vacuum cleaners (1 recycled, 1 virgin)

Personal Project Brief - IDE Master Graduation

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

For more than half of the Dutch consumer market, sustainability is not the main priority (b-open, 2019) and will, therefore, not be considered when purchasing a product.
Some consumers do not only not-consider sustainability but have actual objections to recycled plastics. Their concerns relate to low material quality or contamination, for example. (Magnier et al., 2019)

However, concerns like these are often only perceived and not necessarily rational. To overcome this common consumer behaviour, thus a more emotional approach of persuasion can be useful. Emotions are a stronger driver for sustainable purchasing behaviour than rationality (Koenig-Lewis et al., 2014).

At the moment it is still a challenge for product designers to design for those emotions and to create a positive perception of products with recycled materials. The perceptions and emotions of consumers regarding the recycled plastic are not taken into account during the design process. Designers of sustainable products often do not know how to influence their costumers' purchasing behaviour in a persuasive way. (Petersen & Brockhaus, 2017)

For this graduation project, overcoming possible negative emotions and boosting positive ones presents a human-centered approach to stir sustainable purchasing behaviour through design.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

The research will focus on consumers' perception of products made out of recycled plastic and on design for positive emotions. The goal of the ideation phase is to create a quantity of ideas, which will - once they are structured and categorized - support designers in developing design strategies that address the consumers appropriately and persuade them to opt for the (more) sustainable product.

This graduation project aims to generate several strategies that positively influence the consumers' perception of electronic devices containing recycled plastic and create a framework to structure those strategies. It is meant as a guide for designers and researchers to know which strategy will work best for their target group. To make the framework more credible and the graduation project more tangible, I will pick one of the theoretical strategies and develop it further into a more concrete concept. This can then be tested in a study.

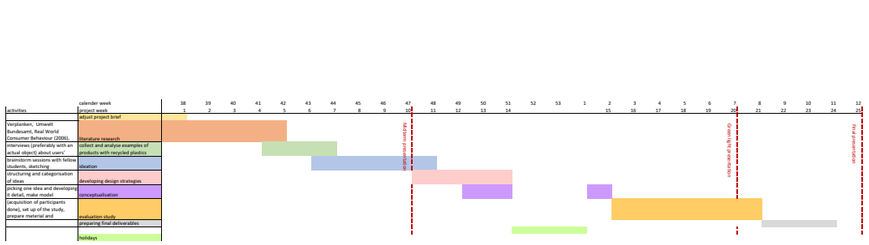
Personal Project Brief - IDE Master Graduation

TU Delft

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and 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 activities.

start date 10 - 9 - 2020 27 - 3 - 2021 end date



For this project I plan to work 4 full days per week, thus I take 25 weeks to complete the 100 days. In between I will take 3 weeks of holidays in total.

I will start my project with a comprehensive desk research that consists mainly of the following parts:
- Contacting experts/ companies for information (e.g. PolyCE for research of recycled plastic in electronics)
- Literature Review:
  - o Gather already collected information about consumer decision making
  - o Basics about positive emotions and human needs
  - o Influence of emotions on product perception
  - o Consumer perception of recycled resources

To get a better understanding of the consumers' needs and concerns, interview or a co-creation session will support my research phase.
Based on the insights of the literature review and the sessions, I will produce numerous ideas during the ideation phase. Those will be structured and categorized in design strategies.
Next, I will pick one of the strategies to develop further.
Its effectiveness can be tested with participants in a study. Preparing the study includes recruiting participants, making a prototype and planning the set-up.
The final deliverables will be finished at least one week before the graduation day.

Initials & Name Martin Student number 4856627

Title of Project Improving consumers'perception of e-devices made from recycled plastic

Graduation project brief

Personal Project Brief - IDE Master Graduation

TU Delft

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

It was clear for me that I want to do a graduation project on sustainable consumer behaviour, as this is what I truly care about and want to work on after graduating. I am rather interested in discovering insights and contributing to knowledge, rather than designing one specific object.

I aspire to gain more knowledge and skills in academic research. A personal goal is to conduct a study at the end of my project, as I have never done this before. I am eager to know how a study is set up and how participants are usually recruited.

In my electives and previous projects I already learned a lot about nudging and persuasion, which I can apply now. However, I still need and want to know more about sustainable behaviour and how to appropriately communicate sustainability to the consumers. Furthermore, I want to improve my reporting and communication skills of insights, e.g. by using graphics or illustrations.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name Martin Student number 4856627

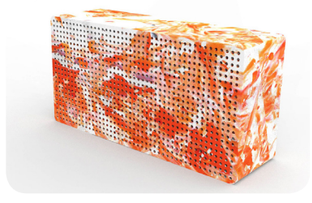
Title of Project Improving consumers'perception of e-devices made from recycled plastic

APPENDIX B

More precise product analysis:

House of Marley headphones
When looking for headphones made from recycled plastic, a brand that keeps popping up is *The House of Marley.* By incorporating wood (-optics) in their audio products, they give a visual cue towards the sustainability of the product.
On their website they explain all the materials used. Their products are also available in online retailers, such as MediaMarkt.de or Bol.com, where the eco-friendly materials are mentioned in the description.

Gomi speaker
The Kickstarter company *Gomi* produces products, such as a speaker and a power bank from collected plastic waste that is considered “unrecyclable” by officials. The marble optics and colours their products have, derive from the melted plastic. The characteristics of the material are used as design element; the products overtly present the recycled material.
On the design studio’s website its mission is clearly stated: *“We mine plastic waste that is not widely recyclable, and convert it into a raw material to create with”* (gomi design, n.d.).



Fair Phone smartphone
The company *Fair Phone* is known to produce the most socially responsible and environmentally friendly smartphone on the market since 2013. For a consumer who is not familiar with the brand, the sustainability endeavours would not be recognizable by looking at the phone only. It is communicated in the product information on the website though. The descriptive text and specification highlights of the Fairphone 3+ state 40% recycled plastic.

JBL speaker
JBL is an international headphone and speaker manufacturer. Only this year they released their first portable speaker made from 90% recycled plastic. Mainly the name *JBL Flip 5 Eco* gives away that this product has an extra eco-friendly component to it. Visually it is not possible to tell the recycled version apart from its virgin material predecessors, the JBL Flip 5. Even though the Eco spin-off is only available in the colours “Ocean Blue” and “Forest Green” it does not necessarily suggest environmental friendliness, since many other JBL products are available in blue and green as well.
In the product features of the Flip 5 Eco webpage, the company proudly mentions the “new eco-friendly design” that is made from 90% recycled plastic.

HP laptop
This year’s released laptop, the *HP Elite Dragonfly*, is the first ultrabook that contains ocean-bound plastic. Even though this type of plastic accounts for only 5% of a small speaker enclosure inside the housing, the rest of the laptop contains “normal” recycled plastics as well. 50% of the keyboard plastic is sourced from recycled DVDs and the bezel of the screen contains 35% recycled plastic.
This probably makes it the laptop with the highest share of recycled plastic.
However, this information is not easy to find. Independent technology-related websites wrote articles and reviews about it. You might find a brief mention on one of HP’s websites but that also depends on whether you are on the U.S. website, Germany or Netherlands.
In conclusion, the information is not comparable and comprehensive.

Sony TV
Sony developed its own recycled plastic “Sorplas” from optical disks, film and post-consumer plastics, like water bottles.
On the Sony’s Sorplas website, there is a section called “products incorporating this new recycled plastic”, which features two TVs and one compact camera. Clicking on one of the three products redirects you to the product’s website. Nowhere on that site, not even in the full specifications, do they mention the keywords “Sorplas”, “recycled” or “plastic”. Unless you reach the product through the Sorplas information site, there is no way of knowing that this product tries to be sustainable.
All in all, the information is not transparent, difficult to find and confusing.

APPENDIX C

Interview guideline and slides

1) Hi, thank you for your time. My thesis is about people's perception of recycled plastic in electronic products. The goal of this interview is to find out how you would like recycled plastic to be communicated in a product and also if there are differences between products. I prepared some slides as a support, so I can give you examples but whatever I show you are just examples. So if you think of something that is not on my slides, please tell me. You are the expert of your own opinion and I want to learn from you.
I want to hear whatever comes to your mind. I would love to hear your thought process, so it helps me a lot if you could think out loud.

IS IT OKAY IF I RECORD?

2) All of them contain plastic. Of that plastic, how many % are recycled plastic?

3) So you indicated that you think that [...%] are recycled plastic. What makes you think so? If the website would say that it's 90% recycled plastic, what would you think about that claim?

4) If you see this product and the description says "made from recycled plastic!". How many % do you think it contains? If you were to make the rules about when a product is allowed to claim it's made from recycled plastic, how high would the percentage have to be? Which of the speakers looks more innovative to you?

5) What made you guess that this product contains [...%] recycled plastic? The product includes wood, which is already a renewable material. Is this more of a high-end or low-end product for you?

6) This is recycled plastic that has a marble-look. What do you think of it?

7) The marble look of recycled plastic that I showed you before is only one way the plastic could look. Here I just want to show you a few other examples of what it could look like. Do you have a favourite?

8) Could you give me a short summary of what you think about each product?

If they could get one for free, which one would you prefer? Why? Which one would be your second choice? And why is [this] your last choice?

These products communicate their sustainability in different ways. You said you like this one the most. Do you like the way it communicates the recycled plastic, or would you like a different way?

9) Here I have pictures of different products. I can imagine that you would like certain products to made out of recycled plastic but others not. Again, it would really help me if you could think out loud and maybe tell me why you place a product on a certain side.

10) Here I have different categories that electronic products could fall into. [explain categories]. 0 means that you don't have a preference. Please take your time to think about it, ask questions if you have some or if you want me to explain a category. And if it helps you, you can also go to the previous slide to get an inspiration from the pictures. Of what product could be
The reason why I am doing these categories is because I am trying to find out if there are certain types where you are not comfortable with the recycled plastic.

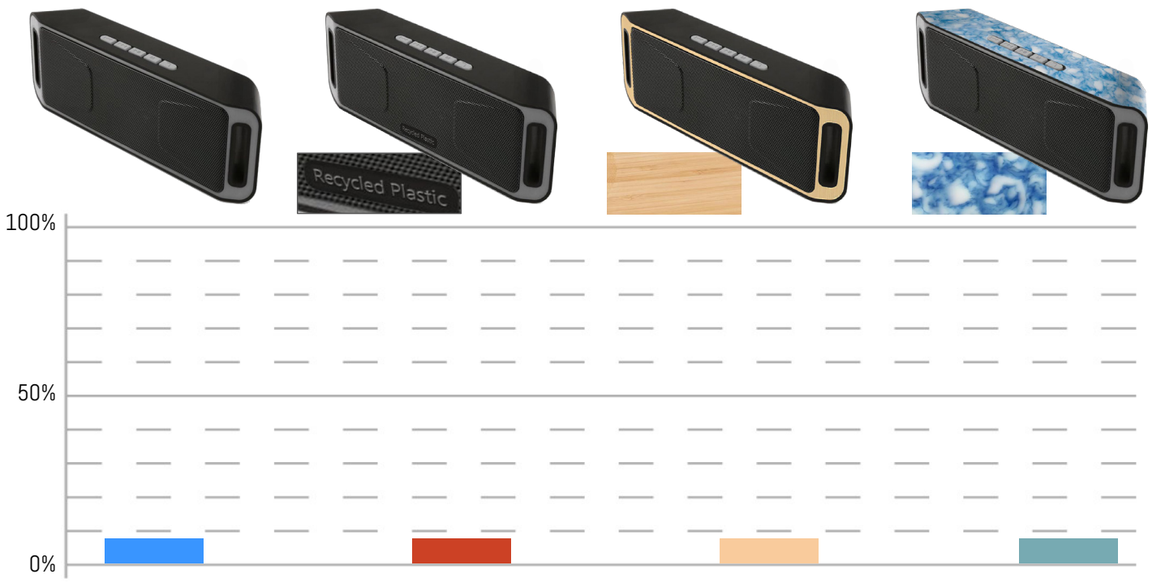
1)

Electronic devices & recycled plastic

Interview for my master thesis. Thank you for your time!

2)

How many % of each speaker's plastic is recycled plastic?



3)

4)

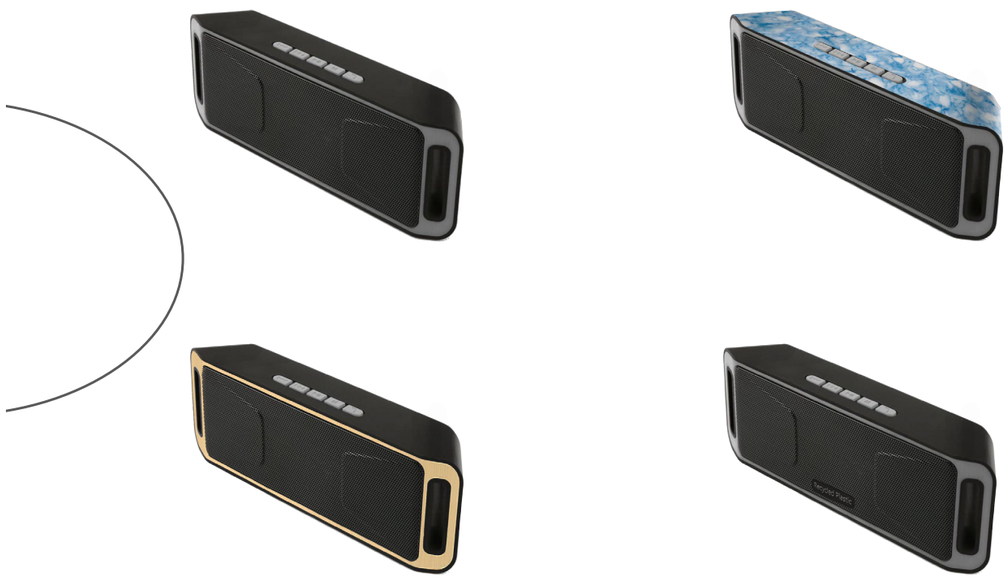
Interview guideline and slides

5)

6)

7)

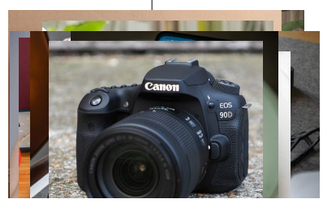
8)



9)

I would like these products to be made from **recycled** plastic

I want these products to be made from **"normal"** plastic



10)

I prefer **recycled plastic** in products that are…..

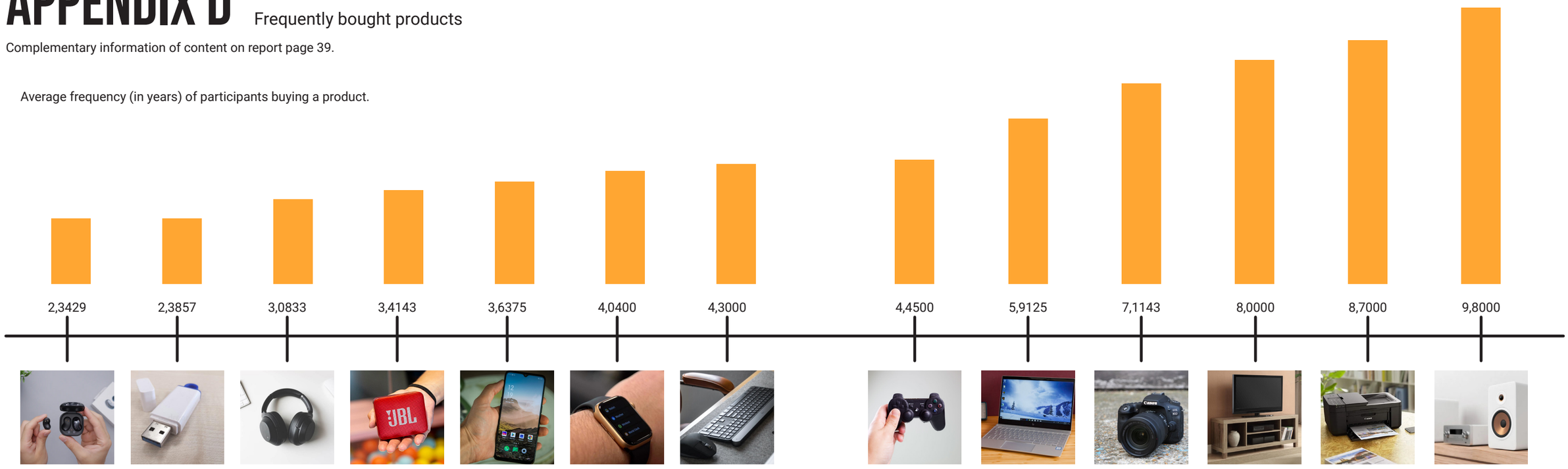
home	3	2	1	0	1	2	3	public
stationary	3	2	1	0	1	2	3	mobile
professional	3	2	1	0	1	2	3	entertainment
expensive	3	2	1	0	1	2	3	cheap
big	3	2	1	0	1	2	3	small
multi-functional	3	2	1	0	1	2	3	single-functional
frequently bought	3	2	1	0	1	2	3	hardly ever bought

APPENDIX D

Frequently bought products

Complementary information of content on report page 39.

Average frequency (in years) of participants buying a product.



Number of participants who included the product in their timeline													
7	7	8	7	6	5	5	5	4	7	5	8	5

Standard deviation													
,83152	,89043	1,73735	1,16823	1,49187	2,99166	3,53553	2,27156	2,27230	2,13106	,65803	,54756	1,64317

APPENDIX E

Excluded interview findings

Why four findings from the interviews were seen unfit to be included in the brainstorm session with designers:

External assessment:
Having a third party assess the sustainability claims, makes the claims and the company more trustworthy.
- This insight involves external parties on which the designer has no influence. The designer might only have an influence on which company should do the assessment.

Frequent buy:
Six participants preferred recycled plastic in products that they buy more frequently than others. This is mainly due to the total amount of material used and therefore, total amount of impact.
- This insight only influences the choice of the product on which the other insights should be applied on. The only question I could ask is what products people buy frequently, but this is a question for consumers and not designers.

Functionality matters:
Functionality is the most important criteria for purchase.
- This insight is basically the same as the insight “Value ranking”, which also describes that functionality and durability are the most important purchase criteria, followed by sustainability and then aesthetics.

Cannot look normal:
Three participants think that recycled plastic cannot have the same aesthetic appearance as virgin plastic.
- This insight didn’t seem valuable for the brainstorming because the fact that people think recycled plastic doesn’t look the same as virgin plastic is not something that has to be changed, as it is not negative or positive. The other insights on when it is perceived positively or negatively are more relevant for the brainstorm.

APPENDIX F

Evaluation session material

Pre-evaluation template

PRE-EVALUATION

An online tool for designers to create electronic products from recycled plastic that are perceived positively by consumers.

What do you expect this tool to be like? How do you think it could be useful to you?

.....

Pre-evaluation responses

What do you expect this tool to be like? How do you think it could be useful to you?

↳ Material Properties
↳ Specification / features / limitations
↳ What Modification can be done
↳ May be Way to visualize the product

What do you expect this tool to be like? How do you think it could be useful to you?

Miro board / business model canvas => concrete questions
to help myself think in the right direction
↳ room to express my expertise as designer
Or: website with random questions

What do you expect this tool to be like? How do you think it could be useful to you?

I expect this tool to provide me with user insights
So if I use plastic A consumers will think B etc.
Then followed by examples of successful useful implementation

SCENARIO 1

You are: a product designer who has worked for consumer electronics companies for many years. You are good at your job; your last position was lead designer. But you were increasingly dissatisfied with the practises in the industry. CO2 emissions are a global issue and plastic seems to be the greatest enemy. Yet, the electronics industry continues without batting an eye. You know about the great amounts of plastic waste that e-products produce every year, but within the companies, there is no mention of changing practises. You quit your job. You are dedicated to make a change. You want to prove that it is possible to design nice e-products made from recycled plastic. Perhaps launch a start-up?
But how do you even start this? What type of consumer should you target? What type of e-product should you start with? You don't know much about the perception of consumers of recycled plastic. You open your browser and search for some keywords: "recycled plastic... electronic products… consumer perception". Let's see what the internet says.
You get pen and paper to make notes of information that is valuable of your plan. Perhaps you already have some ideas for your future product?

SCENARIO 2

You are: a product designer at an electronics company. Most of the time you have worked on high-quality audio systems, shiny speakers that people would gladly put on display in their homes.
Due to new environmental regulations, your project manager suddenly decides that you need to work with recycled plastic. Now. Even though you already had the project brief, and you even have some ideas of what the new product could look like.
You don't know much about recycled plastic, so you start to google and hope to get some tips on how to go about this situation.
What is the product going to look like if you try to combine your ideas with recycled plastic?

SCENARIO 3

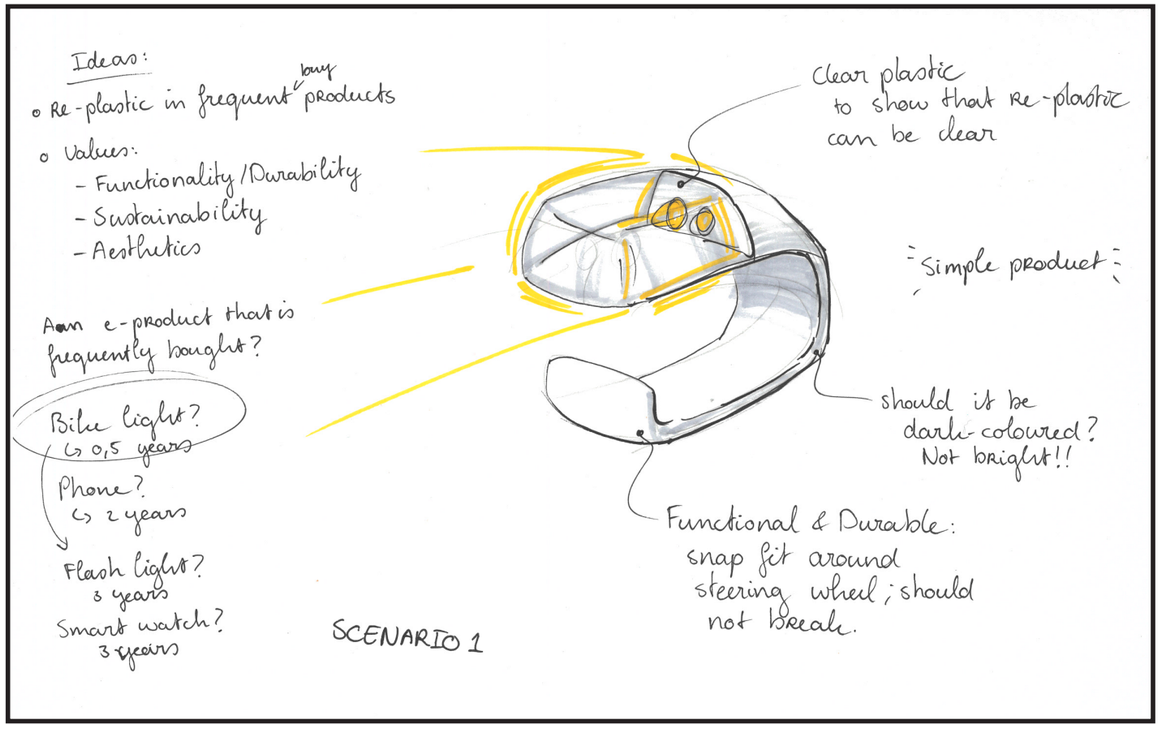
You are: working in a small company that makes headphones from recycled plastic. Since it is a small team, you have a lot of decision freedom and influence on the company's strategies. All colleagues decide together.
You are about to launch a new product. You are very happy with its design, it still needs a final touch, but it's pretty much ready.
In the weekend, you meet a friend and tell her about the new product launch. She is very interested and asks you what your research is based on. "I'm just asking because the other day, I came across a website that actually gives tips on how to use recycled plastic in electronics. This might be interesting for you, I can send you the link". You're curious and check out the website – even though your project is pretty much done. If the tips are very good, perhaps you can still make minor changes to your product.

Choose a product (design one or choose image from internet) and see if you can still make improvements regarding the consumer perception.

You get pen and paper to make notes of information that is valuable of your plan.
Perhaps you already have some ideas for your future product?

Here is space to write down your thoughts about the prototype while you explore it:
Eample: „This sentence confused me first because..."

- 4 themes: aesthetics, trust, sustainability & quality
- But also 6 from literature, psychological concepts
  → I feel like you should mention these 6 insights as well, to 'put them on the same level' so to say. OR: make the word 'literature' thick instead of psychological concepts.
- 'Design importance' → what factors are important?



CONCEPT EVALUATION

What would be reasons to use the tool or to not use it?

It provides handles to use as a starting point: it can give you a direction.

Do you understand the website? What is not clear?

It is very clear since I've used it for scenario 3 before. I am a bit confused by the additional literature insights: they 'float' separately. Are the other insights not derived from literature/research?

Is the website inspiring (why/why not)?

It is! It gives food for thought when you might be stuck or don't know how to start. Some examples would improve this even more.

What is missing on the website? How would you improve it?

Some links to detailed information. I would like to know all the sources, for example.
+ Again, an interactive forum.

There might be a different way of structuring the info: for example molecular-, component-, product-, ecosystem-, society level or something.

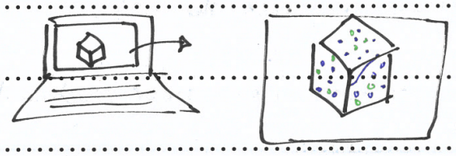
Was there something you liked about the website?

The colours, drawings & gif's

You get pen and paper to make notes of information that is valuable of your plan.
Perhaps you already have some ideas for your future product?

Here is space to write down your thoughts about the prototype while you explore it:
Eample: „This sentence confused me first because..."

↳ I really like the tips & Suggestion Given in the site/tool.
↳ I would be more intrested to ~~know~~ get some thing with Examples. which will make it more understandable.
↳ All the tips are really good but It will go better with Some case study.
↳ Being Designer It looks more like a tips page / As a tool kit I would expect Some thing which can be related directly with my product.
Ex → Upload the photo of the Design / Card model
↳ End visualize with different Material
→ Put the CAD and you see the ~~ponit~~ difference in weight or Something.



(Recycled Aesthetics).

↳ You can Also add thing about "Don'ts" Such as Some people don't like the recyled plastic in cirtain applications such as food packaging.
↳ Also you can connect with experts.

CONCEPT EVALUATION

What would be reasons to use the tool or to not use it?

1. If i am totally unaware of Consumer perception
2. Making decision at Earlier phase (Design)
3. Startup Entering the recycled plastic Market.

Do you understand the website? What is not clear?

1. For me website is more like a designer page than a tool kit. I would see tool kit as more software/. online tool.
2.

Is the website inspiring (why/why not)?

1. A lot, as It gives lot of suggestion in one page. As per my Experience. many websites are only talking about few aspects But you can see many thing here.
2. (Not) You can make it Aesthetically / Visually more Eco friendly.

What is missing on the website? How would you improve it?

1. I would add Forum.
2. I will add example from different Brand. ↳ More meaningfull +Trustable.
3. I will add more tools to integrate the designers product.
4. Better visuals./5| How to use the tips.

Was there something you liked about the website?

1. Dividing into Sub category like Price / Sustainability
2. All inclusive recommendations.
3. Disclaimers.

SCENARIO 2

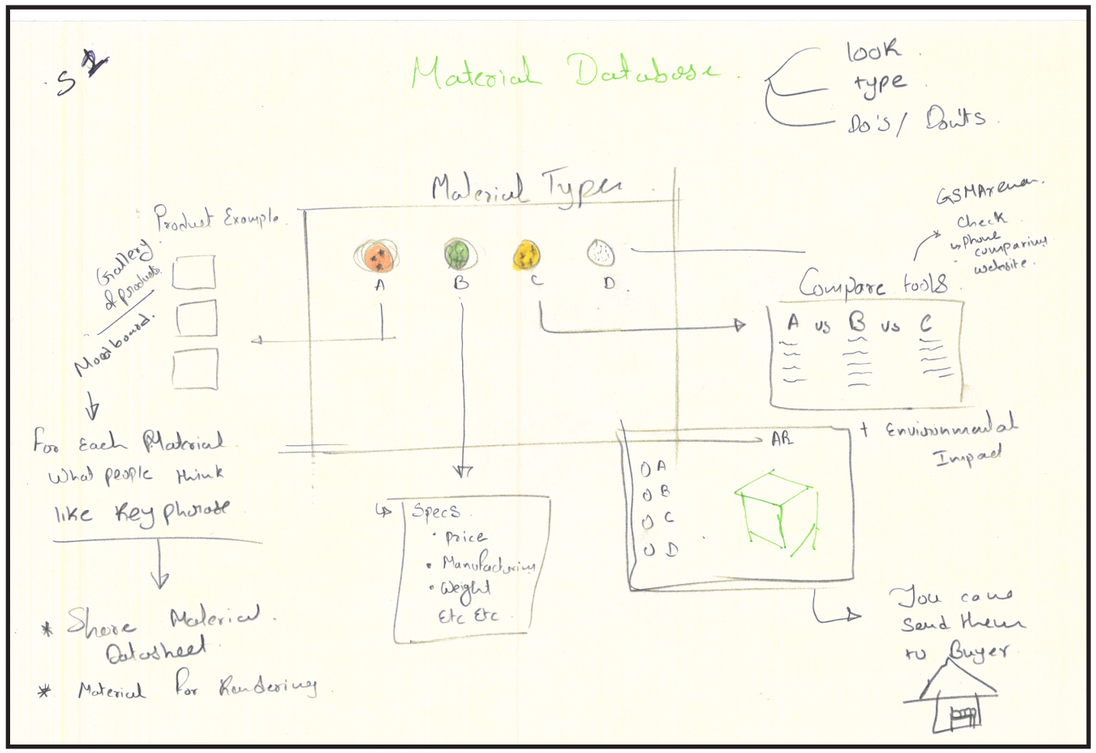
PARTICIPANT B

Here is space to write down your thoughts about the prototype while you explore it:
Eample: „This sentence confused me first because..."

Add.
↳ Different Material textures
↳ Material Which can Substitute with no visual indication
- Material Best Suited as Alternative
- May Be put options

Green Aesthetics. | High/ Premium Aesthetics | low Grade

- Definately AR tool
- Example of products with visuals



CONCEPT EVALUATION

What would be reasons to use the tool or to not use it?

↳ May be just as a guidence.

Do you understand the website? What is not clear?

↳ Yes :- As there are specific topics for me as example Aesthetics.

Is the website inspiring (why/why not)?

↳ Some What.
↳ As. Considering visual product designer for some people it will be very basic knowledge.

What is missing on the website? How would you improve it?

↳ Rather then dividing I would add tags.
↳ Make it like a wikipedia.
↳ May be you can add point if sudden change happen during Project like using the material How can people adapt without much ~~dif~~ Impact.

Was there something you liked about the website?

↳ Basic tips.
↳ Also directing it to Information about next. Stage gives Good nice overview to make it more sustainable.

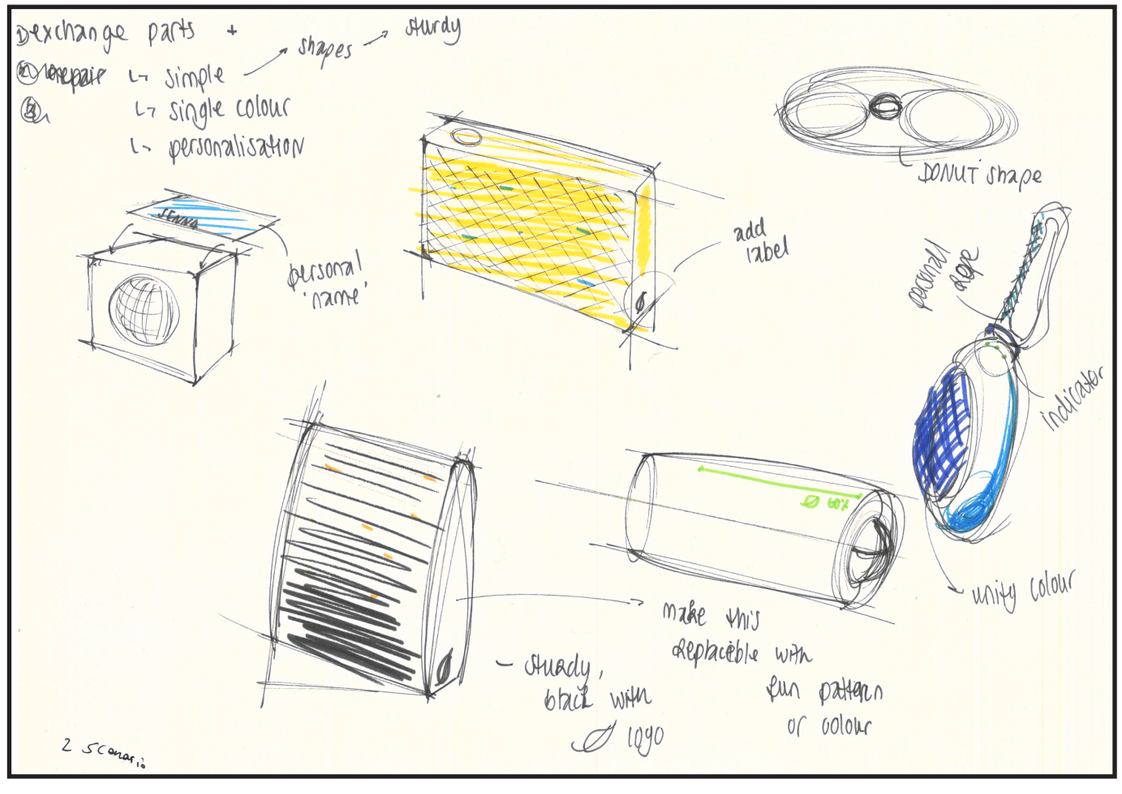
SCENARIO 2

PARTICIPANT C

What is the product going to look like if you try to combine your ideas with recycled plastic?

Here is space to write down your thoughts about the prototype while you explore it:
Eample: „This sentence confused me first because..."

some insight are a bit generic => self expression -> obe? (uniqueness & individualism)
↳ how does this work with plastics => example
Design importance -> 'many factors'
↳ what factors? -> maybe add some questions I can ask myself
it would be nice to have some actionable things to use
↳ questions ↳ canvas (↳ examples -> success vs. fail)
↳ how to's ↳ fill in box ↳ good vs. bad
↳ never mind haha
↳ how do I anticipate on bad experiences?



CONCEPT EVALUATION

What would be reasons to use the tool or to not use it?

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Is the website inspiring (why/why not)?

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What is missing on the website? How would you improve it?

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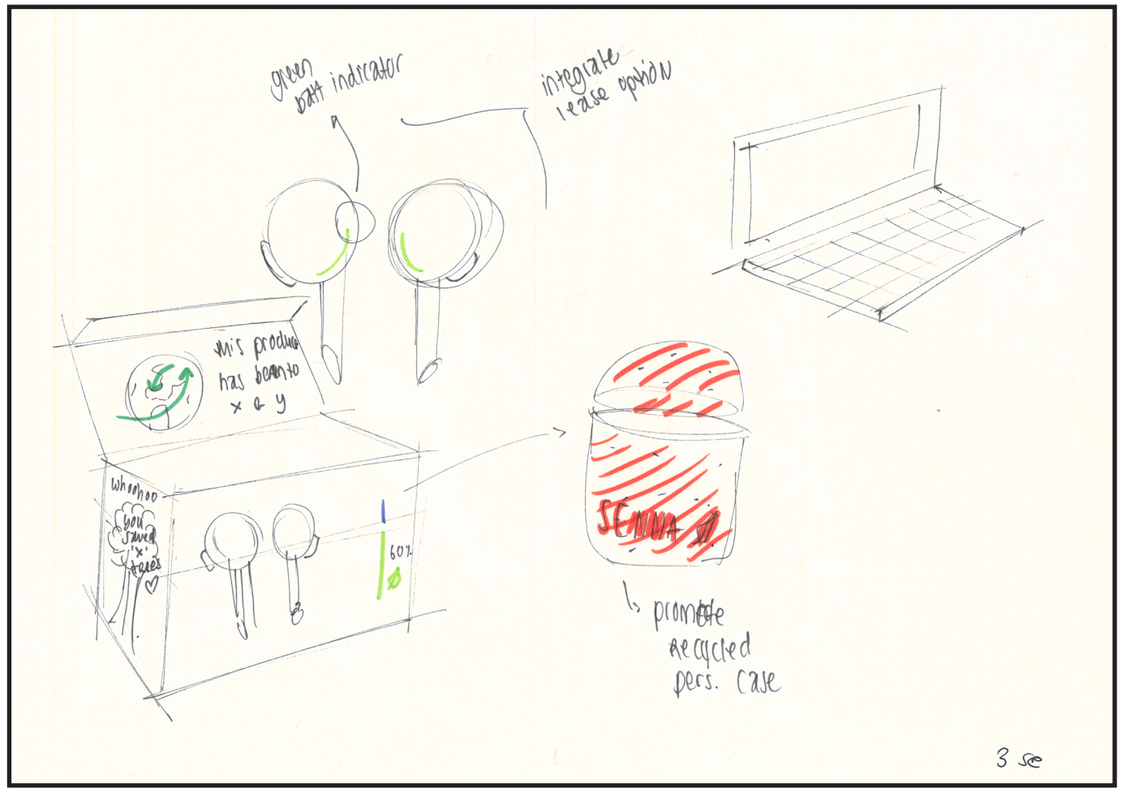
SCENARIO 3

PARTICIPANT C

What is the product going to look like if you try to combine your ideas with recycled plastic?

Here is space to write down your thoughts about the prototype while you explore it:
Eample: „This sentence confused me first because..."

some insight are a bit generic => self expression -> obe? (uniqueness & individualism)
↳ how does this work with plastics => example
Design importance -> 'many factors'
↳ what factors? -> maybe add some questions I can ask myself
it would be nice to have some actionable things to use
↳ questions ↳ canvas (↳ examples -> success vs. fail)
↳ how to's ↳ fill in box ↳ good vs. bad
↳ never mind haha
↳ how do I anticipate on bad experiences?



CONCEPT EVALUATION

What would be reasons to use the tool or to not use it?

↳ May be just as a guidence.

Do you understand the website? What is not clear?

↳ Yes :- As there are specific topics for me as example Aesthetics.

Is the website inspiring (why/why not)?

↳ Some what.
↳ As, considering visual product designer for some people it will be very basic knowledge.

What is missing on the website? How would you improve it?

↳ Rather than dividing I would add tags.
↳ Make it like a wikipedia.
↳ May be you can add point if sudden change happen during project like using the material How can people adapt without much ~~dif~~ Impact.

Was there something you liked about the website?

↳ Basic tips.
↳ Also directing it to Information about next. Stage gives good nice overview to make it more sustainab.

Evaluation results

SCENARIO 3 PARTICIPANT A

make improvements regarding the consumer perception.

Here is space to write down your thoughts about the prototype while you explore it:
Eample: „This sentence confused me first because..."

- I like the big 'Welcome designer.'
- You can not scroll anymore when you hover over the 3 design stages → or other clickable images
- I really like the GIF's!
- 3 categories: promotion, price, place are easily distinguishable because of the colours.
- It is really nice to have the 'learn more' options at the bottom of the page.
- The post-design tips are refreshing. I did not think of certain ones like platform creation. Some of them can be implemented throughout the process. (> or can be kept in mind such as service design and price transparency.

* Find participant's skech on the next page.

CONCEPT EVALUATION

What would be reasons to use the tool or to not use it?

I would use it to validate my ideas and see if I forget something that can still be added.

Do you understand the website? What is not clear?

The website is clearly structured and supported with cute icons and gif's.

Is the website inspiring (why/why not)?

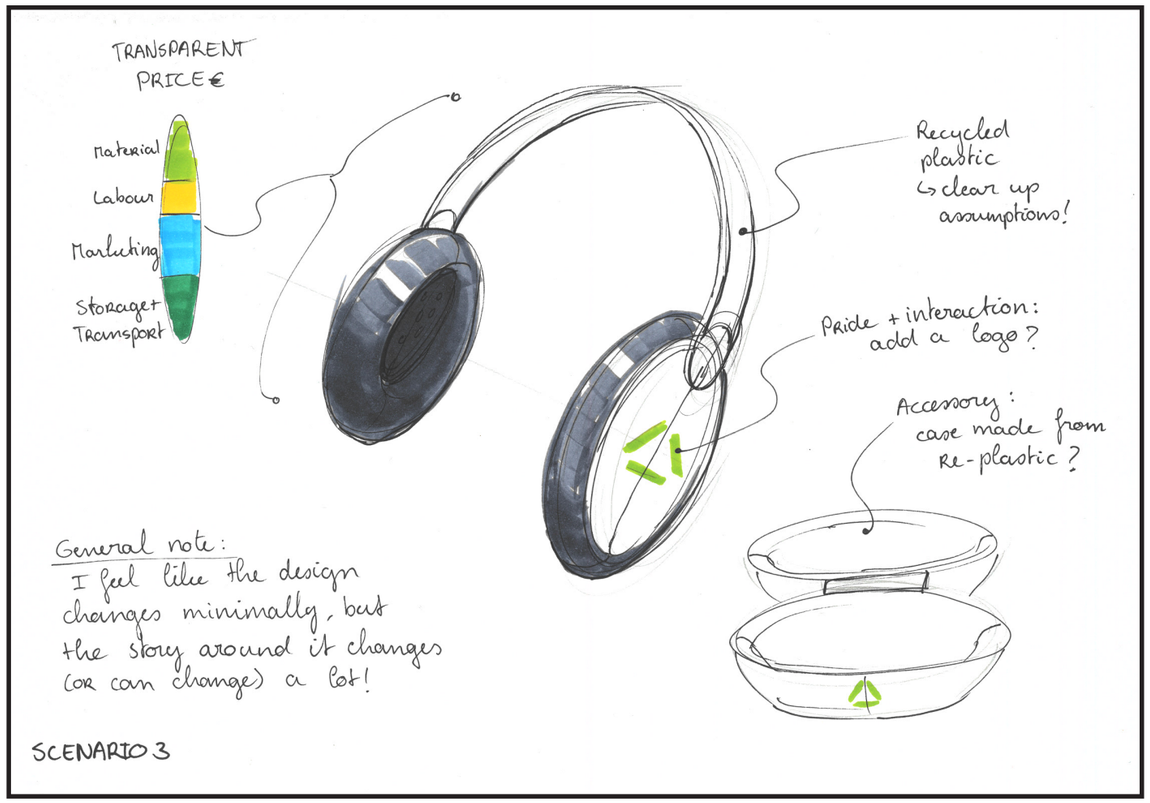
It is! The examples show how certain steps have already been successfully implemented. Makes me want to succeed as well. Might be more product related though.

What is missing on the website? How would you improve it?

The final touches: adding stories and explanations to all the additional recommendations.
Maybe the addition of a forum would be cool? To share experiences with the tool.
For the final phase, the recommendations could be more plastic-related

Was there something you liked about the website?

GIF's! And the cute drawings and use of colours.
Plus it is quite simple (still) and easy to understand.


TRANSPARENT
PRICE €
Material
Labour
Marketing
Storage+
Transport
Recycled
plastic
↳ clear up
assumptions!
Pride + interaction:
add a logo?
Accessory:
case made from
Re-plastic?
General note:
I feel like the design
changes minimally, but
the story around it changes
(or can change) a lot!
SCENARIO 3