Maximizing OneBlade use time by same product users

IPD master gaduation
Teye Ubbens

A report about OneBlade doesn't seem

complete without that sporty lime green

A research into maximizing OneBlade use time by same product owners

MSc. Graduation Thesis
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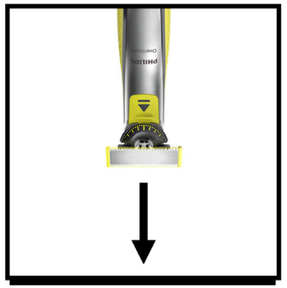

PHILIPS TUDelft

Acknowledgments

I want to say thank you to all the people who helped and supported me throughout this project as, while I learned a lot, it sure as hell wasn't easy.

To Ruth, who was the main driver for starting this project and who, despite her busy schedule, always made time for meetings and supported me through detailed feedback. Looking forward to working together from January on.

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And of course to my lovely twin, for doing absolutely nothing but rubbing in my face that your graduation day is 3 days before mine.

Executive summary

This thesis explores potential causes for reduced OneBlade use time, as this increases e-waste while reducing Philips' profit. Influenced by the upcoming energy label, impact resistance of the 360 shaving head is deemed to negatively affect use time and Philips' strategic position. Through researching breaking behavior of the head several strategies for achieving full 110 cm impact resistance are proposed, with the direction of detaching the interface legs being further explored. In the end this direction is found to not be feasible and not recommended to be researched further. However other strategies are proposed that potentially offer the OneBlade an increase in impact resistance or use-time.

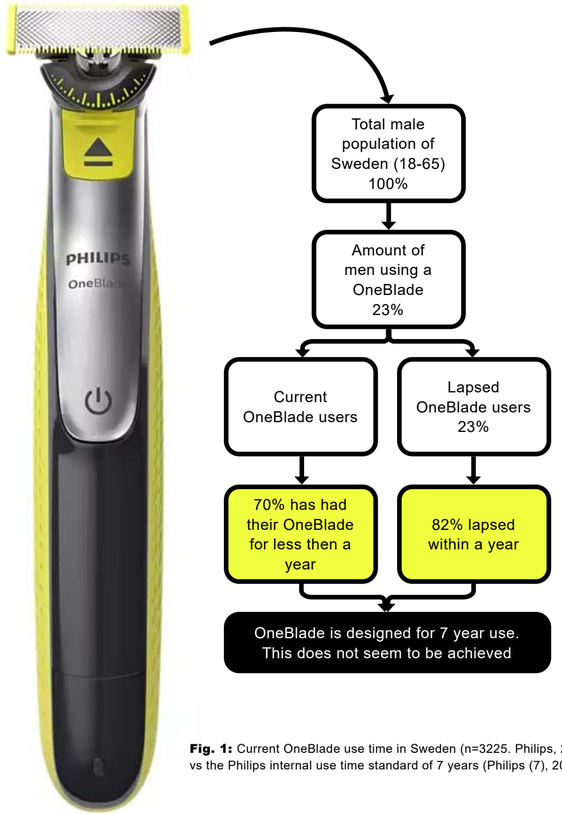


Fig. 1: Current OneBlade use time in Sweden (n=3225. Philips, 2021) vs the Philips internal use time standard of 7 years (Philips (7), 2023).

Low 360 shaving head impact resistance impacts Philips' strategic position

Looking at Philips, low impact resistance of the OneBlade shaving heads is found to negatively influence their strategic position as:

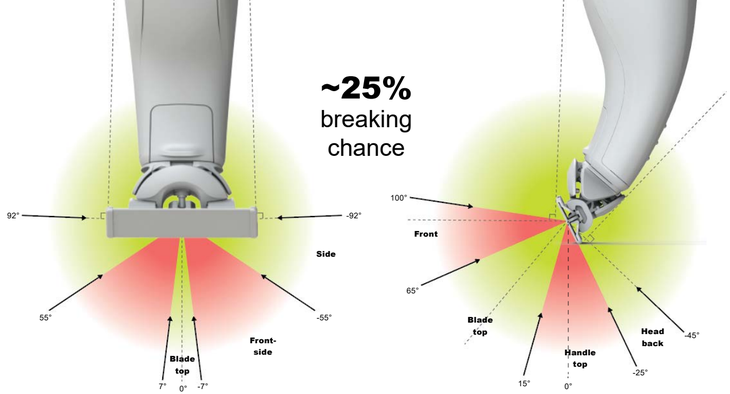
- The OneBlade shaving head has a lower impact resistance than most competitors. This while Philips prides itself for its build quality (Philips (17), 2023) and has an internal standard of 110 cm impact resistance that is currently not being met.
- The upcoming energy label is expected to come to shavers and will score repeated free fall reliability at 1 meter without external protection. If replaceables are to be included the OneBlade will score an E.

Looking at users, through literature, desk and user research (and multiple expert interviews) three main OneBlade replacement reasons have been defined:

- Unexpected shaving experience (out of scope)
- Expensive shaving head replacements (Out of scope)
- Low shaving head impact resistance

Because of this the strategy selected to reduce environmental impact and increase Philips profit is to increase the OneBlade impact resistance.

Fig. 2: High level process of selecting the focus on increasing impact resistance



8 defined breaking scenarios when falling directly on the 360 shaving head

Fig. 4: Results form droptests and analyzing highspeed camera footage

Better understanding of 360 head breaking behaviour

Through filming ~70 drop-tests with a high-speed camera at 5400fps, a better understanding of 360 shaving head breaking behavior was attained.

Four factors influencing breaking were defined, giving 8 scenarios of which four break. This research can be used as a starting point for future research. Philip Monsbourgh knows where the drop-test videos can be found.

Six potential design directions for increasing impact resistance

Using insights from drop-tests six design directions were defined. Three are deemed viable, continuing with optimizing the connection between the head and the handle. The three other directions were dropped.

- Increased hinge toughness is not deemed feasible, as then the blade assembly would need to dissipate all force, which it can't.
- No ideas were found to significantly reduce the chance of falling on the shaving head.
- External protection is not deemed viable, as free fall reliability tests conducted for the energy label do not allow external protection.

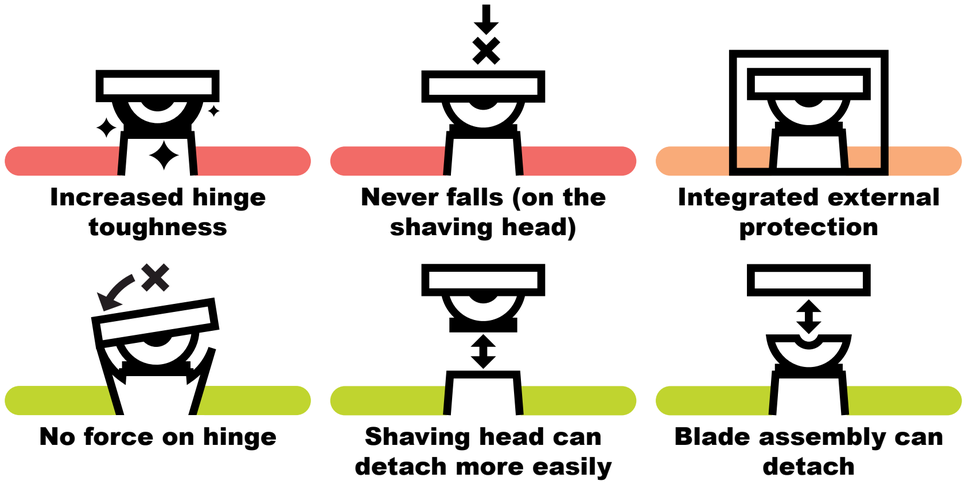


Fig. 5: Six found design directions, easier head-handle detaching being selecting as it best foit the scope of the project.

110 cm impact resistance not deemed feasible with only changing the interface legs

For researching the possibility of achieving 110 impact resistance with only changing the interface (i.e. the leg shape) four concepts were made and tested based on 3 requirements.

However it was found that these requirements inherently overlap.

1. To stop the shaving head for detaching during shaving it was found that it needs to resist 15 [N] of force parallel to the blade.
2. To allow for easy shaving head replacement the maximum force allowed for inserting/ removing the blade is 9 [N]. As this is lower than the maximum shaving force, legs are necessary for keeping the head attached.
3. However, for allowing the shaving head to detach during a fall it was found that the legs need to be all but removed, with the shaving head easily detaching. Additional ideation was conducted with concept V3 and V4 being made and tested, but to no avail. The requirements inherently overlap.

Because of this it is not advised to further explore this direction.

Fig. 6: From top to bottom: Current interface legs, V1, V2, V3

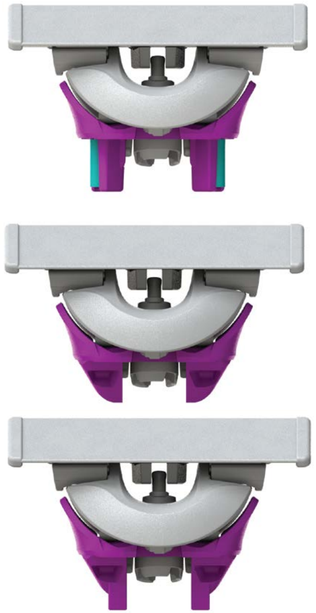


Fig. 7: Testing of concept V2

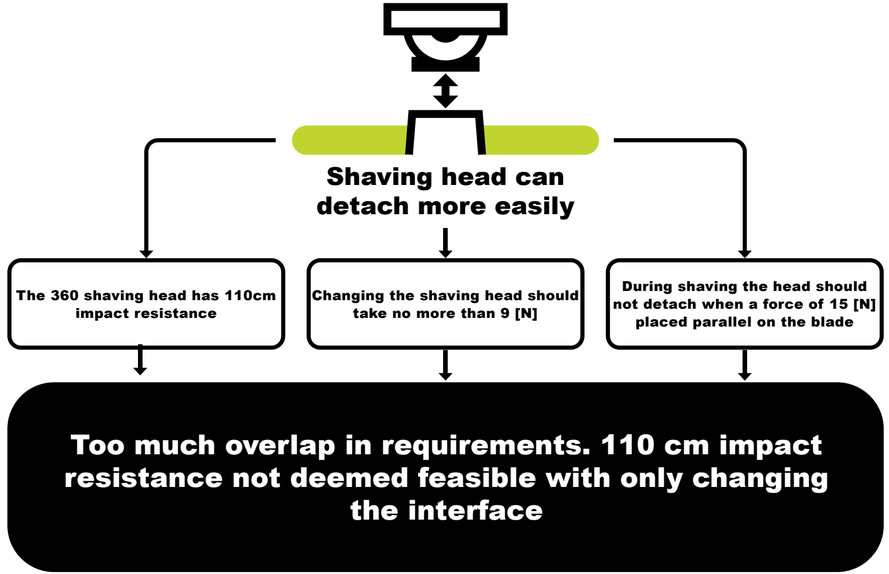
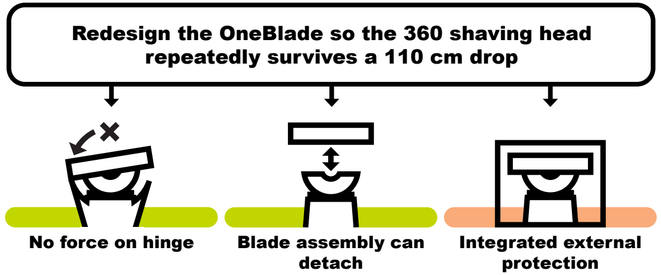


Fig. 8: Conclusion



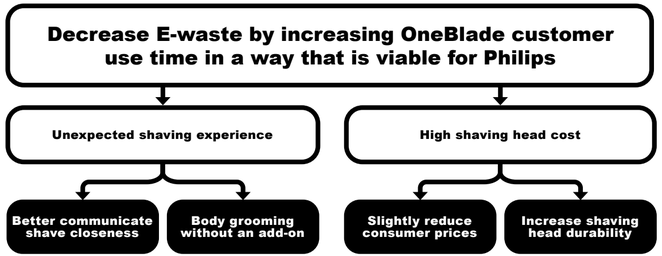


Fig. 9: Recommended topics for future research

Design directions to be further explored

Three other directions are advised to be explored to achieve 110 cm impact resistance

Four other design directions are advised to be further researched to increase OneBlade use time, decreasing e-waste and increasing Philips profit.

See ‘Recommendations’ on page 138 for more information.

Overview of all findings

To the right you will see a diagram showing all conclusions from this project. The black blocks are conclusions, with green line is the path that was mainly researched in this thesis.

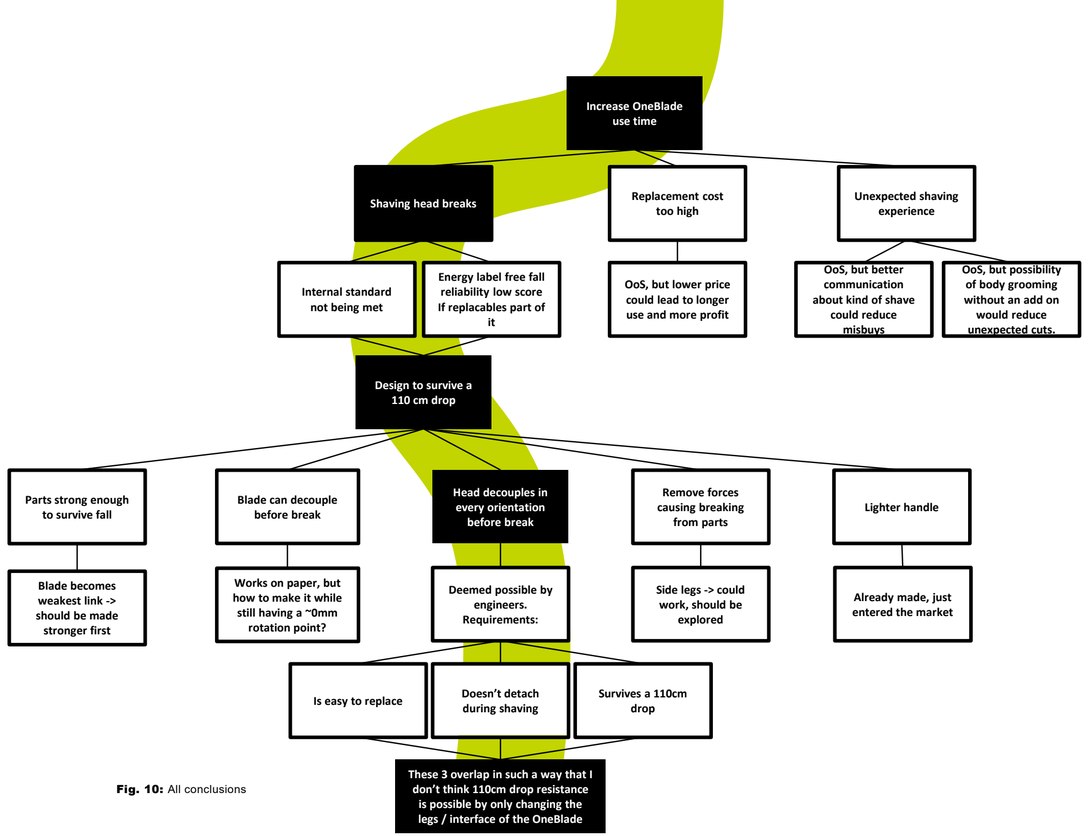


Fig. 10: All conclusions

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Chapter 1

Project introduction

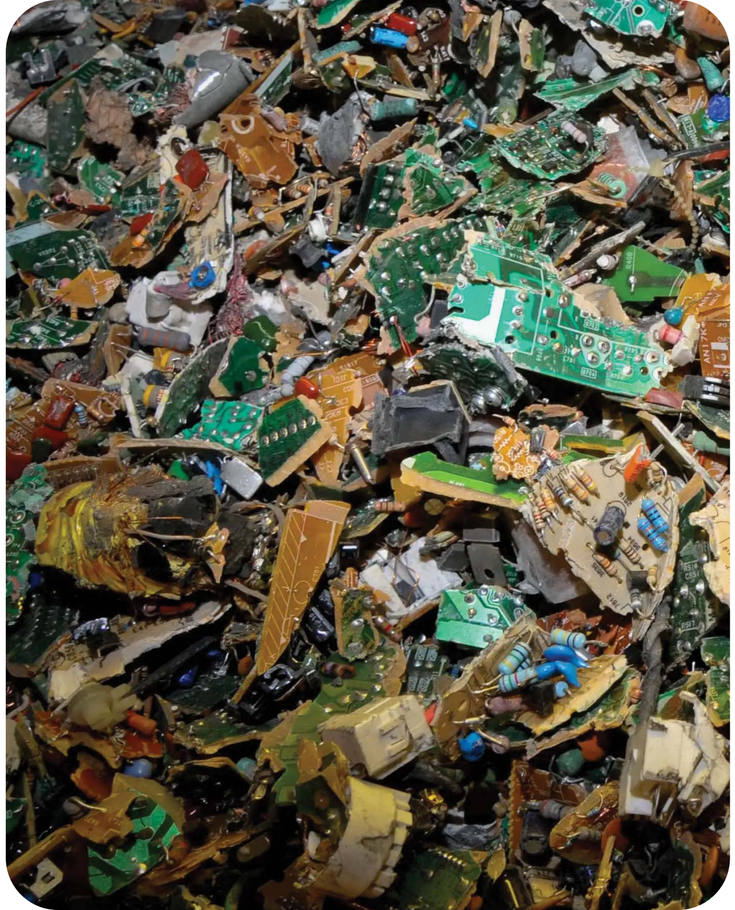
In this first chapter the design challenge this thesis researches will be introduced. Additionally an overview is given of the scope, final deliverables, research questions and method.

1.1 | Problem statement

1.1.1 Shavers adding to E-waste

The use of electric shavers for personal grooming is a widespread practice globally, with approximately 1/4th of all shavers being electric (Statista, 2022). Like any other consumer product, electric shavers are eventually replaced by their users, leading to a significant environmental impact due to the presence of components such as PCBs, motors, and batteries (Matthews, 2021). It is estimated that roughly 250,000 electric shavers are replaced each year in the Netherlands alone*, adding to the 53.6 Mt of e-waste being generated each year globally (Statista, 2019).

* Based on an estimated electric shaver lifespan of 7 years (luxuryshavingrazors, 2023), the fact that about 1/4 of used shaving devices are electric (Statista, 2023), and considering the entire 14+ male population in the Netherlands (40% of 17.6M, (Statista, 2023)),



1.1.2 Shavers and current reduction strategies

Around the world action is being undertaken to minimize e-waste by striving to create a “circular economy”. This is a model where “the value of products and materials is maintained, waste is avoided, and resources are kept within the economy when a product has reached the end of its life.” (Geisendorf & Pietrulla, 2018).

The value hill model on the right visualizes multiple strategies for maintaining this value. Higher up strategies like repair have the smallest impact, as “The greenest product is the one that already exists, because it doesn’t draw on new natural resources to produce.” (Donahoe, cited in Bocken et al., 2014)

1.1.3 Shavers and regulation

The European Union’s Green Deal initiative promotes implementation of these strategies though legislations like the “right to repair” and “battery directive”. These mandate e.g. the non-destructive disassembly of key components and easy battery replacement (i.e. repair), forcing companies to change their products, otherwise losing the right to sell them.

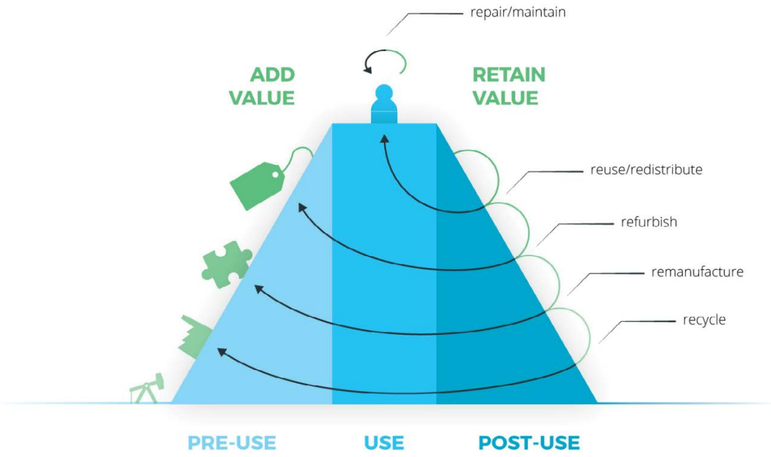


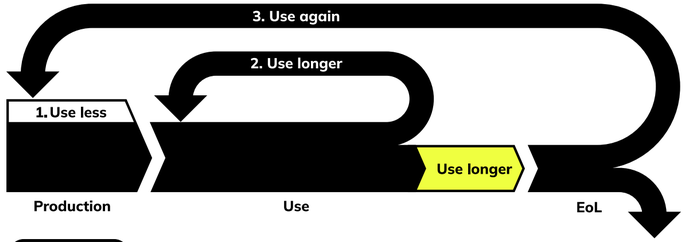
Fig. 11: Value hill model

1.1.4 **Philips and circular shavers**

Because of these regulations Philips, a global leader in men's grooming (Philips, 2019) has updated its internal design rules, making design for repair mandatory (see 2.1 in Fig. 12). Through this their shaver lineup is currently being redesigned to allow consumers to non-destructively fix their broken devices, enable most discussed circular design strategies.

1.1.5 **Focus on use time**

However, often products are replaced before breaking, instead being replaced because of less rational reasons as reduced emotional connection (van den Berge et al., 2021). For example research shows that 31% of washing machines, 66% of vacuum cleaners, 56% of TVs and 69% of smartphones are replaced for other reasons than being broken (van den Berge et al., 2020). Currently Philips does design for this, illustrated by design rule 2.2 (see the yellow highlight) both not being mandatory and only focusing on durability and reliability. As increasing use time would be the circular strategy retaining the most product value (Donahoe, 2014), it should be researched.



1. Use less

- **1.1** Design with Sustainable Materials (recycled and/or bio-based materials)
- **1.2** Design with Low Weight
- **1.3** Design for Digitalization (reducing hardware)

2. Use longer

- **2.1** Design for Disassembly & Reassembly (enabling service, repair, spare parts harvesting, refurbishment, and remanufacturing)
- **2.2** Design for Long Life (durability and reliability)
- **2.3** Design for Modularity and Standardization
- **2.4** Design for Diagnostics (monitoring and assessing performance)
- **2.5** Design for Cleaning, Disinfection/Sterilization and Restoring Aesthetic State

3. Use again

- **3.1** Design for Recycling

Mandatory within Philips — My project focus

Fig. 12: Philips' updated internal design rules regarding sustainability

1.1.6 **OneBlade and maximizing use time**

Philips' most sold shaver is the OneBlade, with over 30 million handles sold since its launch 7 years ago (Philips (9), 2023). However market research shows that the OneBlade is currently used less than expected, with users seeming to stop using it after the first year while it has been designed for 7 years of use (see Fig. 14). While this is environmentally unsustainable is economically unsustainable. This is because the OneBlade is special in that it's shaving head needs to be replaced, and part of the OneBlade business is on selling shaving head replacements (Philips, 2017).

Because of this, Philips and I have expressed interest in exploring the opportunity of reducing E-waste and increasing revenue by maximizing OneBlade use time by same product owners.

Disclaimer: This thesis has been enabled by Philips, with me working on their grounds, and receiving an internship compensation.

Fig. 13: A Philips OneBlade model

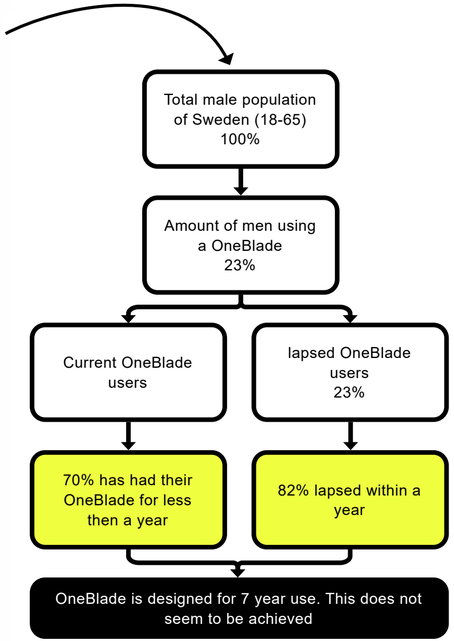


Fig. 14: Current OneBlade use time in Sweden (n=3225. Philips, 2021) vs the Philips internal use time standard of 7 years (Philips (7), 2023).

1.2 | **Scope**

The scope of this thesis will be limited to the circular strategy of increasing use, as the other strategies are already being explored by Philips.

Also viability for Philips will be a key part of this research. This is because for reducing e-waste, Philips will have to want to implement found ideas.

Additionally the focus of this thesis will be on physical product design. This is because a personal learning goal is to better understand how physical product design works in big corporations, aiming to go through a complete design process.

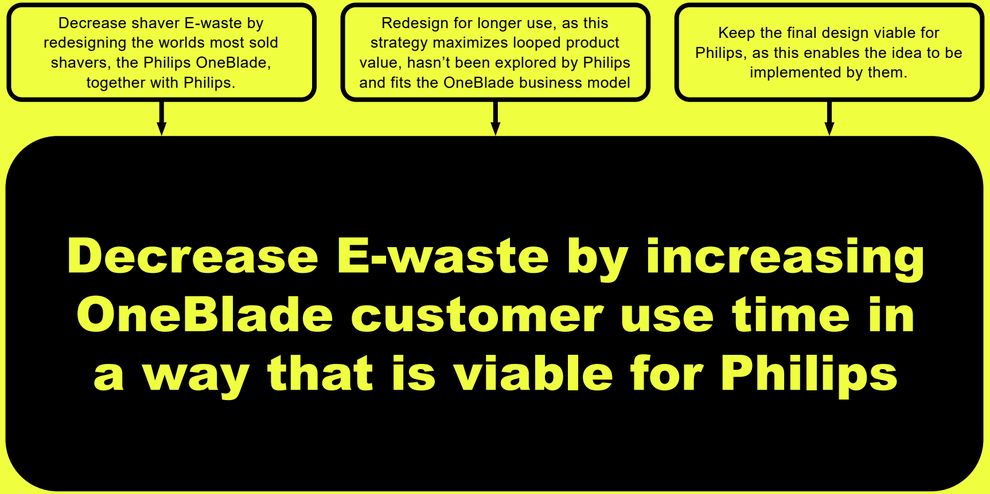
This has resulted in the first design challenge shown on the next spread.

In the end this thesis was further scoped, focusing on increasing the impact resistance of the OneBlade shaving head. This has resulted in the following deliverables:

1.2.1 **Notable final deliverables**

- Research into the main reasons for OneBlade replacement (page 48).
- An analysis of the impact of the upcoming energy label legislation on OneBlade viability, showing a potential need for 110cm drop resistance of the 360 shaving head (page 58).
- A deeper analysis on the breaking behavior of the OneBlade 360 shaving head (page 86).
- A substantiation on why only changing the OneBlade 360 shaving head interface will not result in viable 110cm drop resistance (page 134).
- A set of recommendations on how 110cm drop resistance might be achieved (page 140).
- A set of recommendations on other potential strategies for increasing use-time (page 144).

1.3 | **Design challenge #1**



Research questions

RQ1 **Which strategy should be used to increase the use time and reduce the environmental impact of OneBlade shavers?**

RQ1.1 What is the OneBlade?

RQ1.2 What is the business model of OneBlade?

RQ1.3 What specific OneBlade and shaving head should be focused on?

RQ1.4 What strategies for increasing use time according to literature fit OneBlade?

RQ1.5 What are stopping reasons for users?

RQ1.6 What are the most important stopping reasons?

RQ1.7 What components have the highest environmental impact when discarded?

RQ1.8 What upcoming regulations might impact OneBlade?

RQ2 **How can the impact resistance of the 360 shaving head be maximized?**

RQ2.1 What requirements should a redesign adhere to make it feasible, viable and desirable?

RQ2.2 When and why does the 360 shaving head currently break?

RQ2.3 What are the current solutions for increasing impact resistance and how well do they work?

RQ2.4 What strategies exist for increasing the 360 shaving head impact resistance?

RQ2.5 What strategy has the most potential within my scope?

RQ2.6 How can the impact resistance of the 360 shaving head be maximized through changing the head-handle connection?

RQ3 **How do redesigns compare to the current 360 shaving head**

RQ3.1 What is the impact resistance of redesigns?

RQ3.2 What is the (shaving) experience of redesigns?

1.4 | **Method**

For the high level structure of this project the triple double diamond by Heijne & van der Meer was used, splitting the process into three phases. Each phase concludes with the project scope being tightened. The diagram on the right gives an overview of these phases and the high level methods used.

Problem finding phase

In the first phase, problem finding, the broad first challenge had to be further scoped through understanding the solution space. For this it was split into three chapters that were researched in parallel, with a second challenge being selected based on the total impact and my personal ability and learning goals. Later the challenge was further specified (challenge 2.1) as a new legislation impacting OneBlade was introduced (energy label regulation, see page 58).

Idea finding phase

In the second phase, idea finding, the second challenge had to be further narrowed through choosing a design direction (i.e. the third challenge). Here an iterative learning by doing approach was introduced and used for the remainder of the project (see the gray blocks under challenge 2). It worked as follows: Ideas were generated, clustered and quickly made, after which they were tested and discussed with experts, highlighting knowledge gaps to be further explored. Through this a better understanding of requirements, breaking behavior and the solution space were acquired in parallel. This quick process was enabled by me working part time in Philips with the engineers and state-of-the-art prototyping facilities. As shown in the diagram the first loop was cut short due to the new legislation, with the third challenge being chosen together with engineers at the end of the second loop instead.

Solution finding phase

In the third phase, solution finding, the third challenge had to be further explored, now really diving deep into the breaking behavior. As mentioned the same structure as in the idea finding phase was used. As solutions proved difficult to find, three loops were needed to get to a result.

More specific overviews of used methods and substantiations of discrepancies are given in their respective parts and chapters, as otherwise this diagram would have become (very) messy. Of course the process wasn't as clean as this in the first place, but it does show the plan that was followed.

A full overview of the idea and solution finding phases can also be found in appendix 12.5 |.

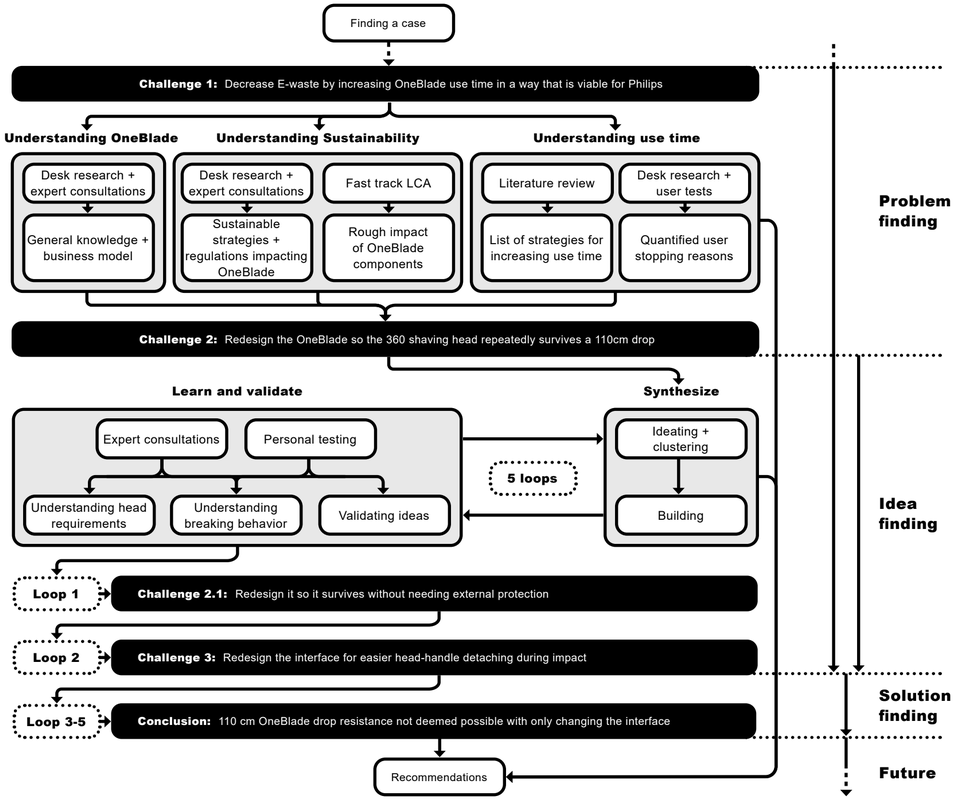


Fig. 15: High level method of this project, with conclusions being highlighted in black

Part 1

Problem

This first part goes into problem finding phase that answers RQ1. It researches the three main stakeholders of this project, being Philips (OneBlade), OneBlade users and the environment. Through analyzing their needs and wants and comparing them to my competences and learning goals, the second challenge is chosen. All is discussed in the three chapters shown below.

Method to report stucture

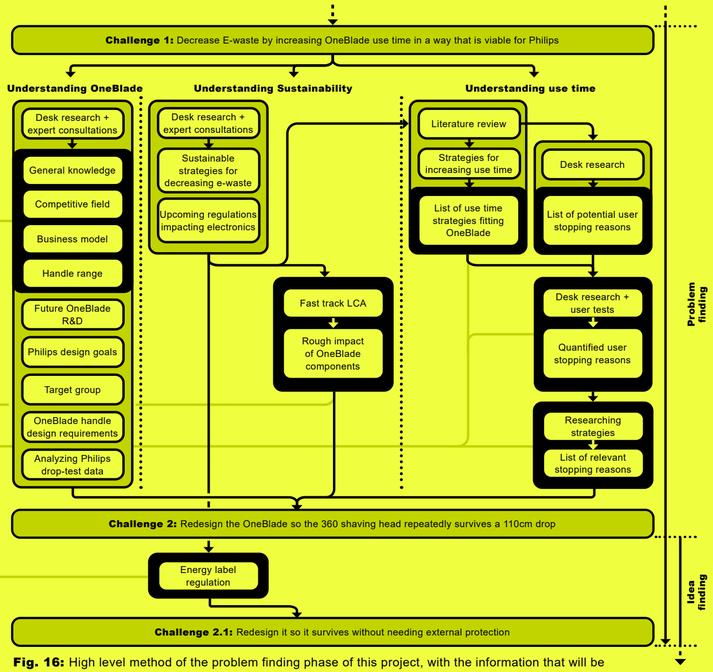


Fig. 16: High level method of the problem finding phase of this project, with the information that will be discussed in part 1 being highlighted in black.

As with most design processes a significant part of researched information turned out not to be necessary for conclusions. Only the parts adding to the story are discussed, highlighted in black. However I think at least knowing actual full process adds to the story:

First OneBlade was thoroughly researched with the help of Philips engineers and the Internet, understanding not only the current lineup, but also the past and future. However as in the end only the shaving head was redesigned, most of this was left out.

After this a significant amount of time was put into researching literature regarding increasing use time and other sustainable strategies, only to find out they were not applicable or that Philips was already researching them.

Only then it became clear that shorter use time was mainly influenced by user dislikes, after which desk and user research was conducted. The found dislikes were further researched, with three relevant ones being found.

Then later during ideation, an expert pointed out that a new regulation, the energy label, could impact OneBlade and the design challenge had to be updated.

Chapter 2

Understanding OneBlade

This opening researches what the OneBlade is, i.e. its business model, competitors and product portfolio.

2.1 | Introduction

To understand the OneBlade, firstly its general idea and product offering were researched. Secondly Philips should implement the idea, meaning it should be viable, for which the business model was researched within my scope. Thirdly as OneBlade offers a broad range of products which cannot all be individually researched, a single product combination had to be selected. Lastly through researching this, first potential reasons for decreased use time were already identified.

Additionally this part explains features and facts of the OneBlade that become relevant later in the report.

Research questions

RQ1.1 What is the OneBlade?

RQ1.2 What is the business model of OneBlade?

RQ1.3 What specific OneBlade and shaving head should be focused on?

RQ1.5 What are stopping reasons for users?

2.2 | OneBlade business model

For researching the business model nine points introduced in the business model canvas were used (Osterwalder, 2010). However as this thesis does not go into product embodiment, only three are further discussed.

1. Value proposition: what value does it offer to customers.
2. Revenue streams: How does it offer Philips quantitative value?
3. Customer segments: Though the value proposition, which customers does it serve?

2.1.1 Value proposition

Understanding the OneBlade value proposition means understanding the three traditional categories of grooming devices and their up- and downsides (see Fig. 17).

Razors, trimmers and shavers

Firstly razors can shave any length of hair down to a clean shave. However they require shaving cream and regular blade replacement. Additionally the razors can cause skin irritation or ingrown hairs because the hairs are cut so short (Healthline, 2023).

Shavers can still shave almost as clean as razors without the need for shaving cream or regular blade replacements. However they cannot shave long hair, needing a trimmer first. Additionally they are expensive (see appendix 12.2 |).

Trimmers can cut any length of hair, and with the help of adjustable add-ons they can also cut hair to any length you want. However, they cannot give a clean shave.

OneBlade value proposition

The proposition of the OneBlade is to allow full control over hair length (including shaving clean) without shaving cream and for a low price (Philips, 2019).

It is a trimmer, being able to cut hair of any length. However compared to regular trimmers the blade is thinner and contour-following, allowing for a cleaner cut. It still does not shave as close to the skin as razorblades or shavers, however this also means less skin irritation and no ingrown hairs (Philips, 2019). Additionally it comes with several add ons (see 2.4.4 on page 38) that allow shaving hair to different lengths or body grooming.

	Razor	Shaver	Trimmer	OneBlade
Shavable hair length	○ Any	✕ Only stubble	○ Any	○ Any
Possible results	~ Only very clean	~ Only clean	~ Any up to stubble	○ Any up to quite clean
Shaving cream required?	✕ Yes	○ No	○ No	○ No
Irritation/ingrown hairs?	✕ Often	~ Possible	○ No	○ No
Initial buy-in price	○ Low	✕ High	✕ High	○ Low
Blade lifetime	✕ ~10 uses	○ Years	○ Years	✕ ~4 months

Fig. 17: Pros and cons of the three categories of grooming devices compared to the OneBlade

2.2.1 **Revenue stream**

Shaving head replacement needed

A downside of the OneBlade is that, like razors, it's shaving heads need to be regularly replaced (every four months if shaving twice per week, Philips (14), 2023), costing money. For an electronic grooming device this is uncommon, as normally their blades are self-sharpening as they are spring pressed against each other (Philips (4), 2023). However because of how the OneBlade is made this is not possible, thus needing replacement (Philips (15), 2023).

Revenue stream

Profit is made on selling these shaving head replacements (and handles, albeit less (Philips (5), 2023). Because of this it is desirable for Philips that customers use the OneBlade handle as long as possible, as then more heads are sold.

2.2.2 **Customer segments**

Through offering a wide range of selling points the OneBlade caters to a broad audience. However women and older men find a clean shave important, which the OneBlade cannot to well enough for them. Because of this the OneBlade is not for everybody, with Philips targeting it at younger men (Philips, 2019).

2.3 | **Competitive field**

The Business model leads to five groups of competitors shown here (Philips (10), 2023). The next paragraph will show how the OneBlade currently covers this competitive field.

Shavers - Offline / Online electronic retail

Major players

BRAUN PHILIPS

Shavers allow clean shaving without needing shaving cream or regular blade replacement.

Trimmers - Offline / Online electronic retail

Major players

WAHL BRAUN PHILIPS

Trimmers allow for variable final hair length.

Razors - Offline wet isle

Major players

WILKINSON SWORD Gillette BIC

Portable and clean shaving when blades are regularly replaced. Sold in supermarkets for a low price.

Razors - Direct to consumer sales (D2C)

Major players

HARRY'S

Cutting out the middle man and shipping razors and replacement blades directly to your doorstep, reducing cost and effort for customers

Lookalikes - Offline / Online electronic retail

Major players

REMINGTON BRAUN

As the OneBlade formula is a success, other brands want to do it too.

2.4 | **OneBlade portfolio**

2.4.1 **Different handle categories and version history**

Firstly a range of handles exists covering the competitive field and target group discussed in the previous paragraphs.

Small + normal targets mainly razors

Normal handles mainly target the razor market, being sold next to them for a low price in supermarkets. The new V2 handle is currently the best-selling model (Philips (9), 2023). Also a new small handle was just introduced that targets teenagers by offering a safer alternative to razors (Philips (16), 2023).

Bluetooth targets D2C market

The Bluetooth handle targets the D2C market through being subscription based (Philips (10), getting blades delivered on your doorstep every x months. Additionally it can connect to you phone, showing shaving head lifetime, battery percentage and offering AR shaving guides. It is not very successful (Philips (5), 2023), however due to the focus of this graduation being on physical design, it was not further researched.

Pro targets trimmers + shavers

The pro handles mainly target the shaver and trimmer market through offering a more premium build quality and better trimming functionalities (Philips (10), 2023).

Fig. 18: OneBlade full model range

2.4.2 **Replaceable shaving heads**

Secondly OneBlade has replaceable shaving heads. They consist of a green cutting element that can shave hair on both sides and a hinge that allows the blade to follow the contours of the skin. Currently two versions exist.

Original shaving head

The original shaving head has a hinge uni-axial hinge as illustrated in Fig. 19.

360 shaving head

The new 360 shaving head was just introduced to the market as the successor of the original head. It has a bi-axial hinge, allowing it to better follow the skin contours (Philips (14), 2023), while also spotting a cleaner design. Additionally, it has increased impact resistance, as the original shaving head is prone to breaking (see appendix 12.3.1).

Future of the original head

With the introduction of the 360 head, production of the original could have been stopped. However Philips has stated this will not be the case. This is because it is fully developed, meaning low overhead thus high profit margins. However no changes to the design of the original head will be made anymore (Philips (4,5), 2023).

Fig. 19:

Original shaving head

Release date: 2016. retail price: ~€15,-

Fig. 20:

360 shaving head

Release date: 2023. retail price: ~€15,-

2.4.4 Add-ons for trimming and body grooming

Thirdly, through offering a range of add-ons, the OneBlade can deliver on it's 'one blade for everything' proposition.

Normal handle trimming add-on

The trimming add-on of the normal OneBlade allows users tho cut hair at a few length settings. The old iteration consisted of four fixed length spacers that fell off easily and were said to not shave well (see appendix 12.4 |). The new iteration is a single comb with five length settings called the 5 in 1. Though a new attachment system it solves the previous issues (Philips (7), 2023). However it still does not offer the same shaving experience as dedicated trimmers, with users mentioning it lacks stability (See appendix 12.4 |).

Pro handle trimming add-on

The pro handle trimming add-on however performs close to dedicated trimmers (Gadgetsnow, 2022), offering 12 distance settings and higher stability through a better attachment method.

Add-on needed for body grooming

The OneBlade is sold as being able to also shave the body. However add-ons with long teeth are needed for this (called a skin guard), as otherwise users can cut themselves. This is because some areas have looser skin that can otherwise get to the blade (Philips (13), 2023).

Fig. 21: Old normal beard spacers

Fig. 22: 5 in 1 comb

Fig. 23: Pro beard spacer

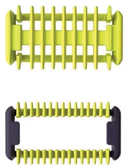


Fig. 24: Grooming add-ons

2.4.3 Protection

Fourthly soft and hard covers exist for storing and protecting the OneBlade. Options consist of a hardshell case, a soft-shell pouch and a hardshell shaving head cap.

Fig. 26: Cap

Fig. 25: Pouch

Fig. 27: Case

2.4.5 Charging

Fifthly, charging the OneBlade is done through connecting a cable on the bottom. It has a special port as USB-c chargers do not offer the necessary water resistance (Philips (5), 2023). The OneBlade cannot be used during charging due to this being unsafe in a potentially wet environment (Philips (11), 2023).

NimH version taking 8 hours of charging for 30 min of shaving. All other handles have a Li-ion battery, taking ~1 hour of charging for 60-120 min of shaving (Philips (14), 2023)

Some pro models come with a charging stand.

Fig. 28: Charging stand

2.5.1 Packaging

Lastly the Oneblade is has a fully cardboard packaging when bought. Additionally there is an infographic on a side-flap of the box explaining to new users how to best shave with the OneBlade: against the grain and with long strokes. With razors and shavers direction and stroke length is not important, so this addition to the packaging will likely reduce unnecessary consumer annoyances and thus product retention.

Fig. 29: Box with infographic explaining how to shave with the Oneblade

2.5 | Conclusions

Business model

Viable ideas should take into account that the business model revolves around selling shaving heads. This means ideas should enable selling heads with the same markup, or prove a reduction in markup is overshadowed by an increase in total sales. Additionally to keep competing with razors, price of normal handles should remain low.

Potential stopping reasons

OneBlade is a generalist shaver, being able to do a lot, but not as well as specialized devices (e.g. it cannot shave very clean, while this is a need of women and older men). However OneBlade does compete with them meaning users are expected to compare the OneBlade functionality to all of them, possibly leading to unexpected behavior and thus stopping reasons

Focus on 360 head and V2 handle

Offering a better shaving experience and impact resistance, the 360 is expected to be the new norm being sold with OneBlades. If the shaving head has to be redesigned, the 360 head should be prioritized. Also as the normal V2 handle is the most sold handle it will be used through the rest of the project for tests.

Chapter 3

Understanding use time

This chapter mainly details the needs and wants of the user by researching ways to make them want to use the OneBlade as long as possible.

3.1 | Introduction

3.1.1 Current knowledge

Research from Philips currently shows that OneBlades are used shorter than expected (see 1.1.6 on page 21). It also presents four reasons for OneBlade retention based on a questionnaire (see Fig. 30).

Knowledge gap

However these reasons did not provide enough knowledge for designing. Firstly they are too vague. Secondly as access to the data leading to these four reasons was not given, it is unknown if participants gave additional reasons. Thirdly as these four reasons came out of a single question more latent user replacement reasons might have been missed. Fourthly the reasons are not quantified, meaning it is unknown which should be focused on. Lastly literature might propose additional strategies for increasing customer use time.

Fig. 30: Q: Why did you stop using your OneBlade? (Sweden, n=146). Conclusions: four vague stopping reasons (Philips, 2021).

Because of this additional research into OneBlade replacement reasons is deemed necessary.

Research questions

RQ1.4 What strategies for increasing use time exist according to literature? Which fit OneBlade?

RQ1.5 What are stopping reasons for users? (For all, see appendix 12.4 |)

RQ1.6 What are the most important stopping reasons?

After describing the process this chapter goes through the findings from all the conducted researches.

3.1.2 Process

Expand stopping reasons

For defining more potential stopping reasons first a literature review was conducted, defining strategies to increase use time. After this desk research was conducted, gathering customer reviews from various places. This resulted in a list of potential stopping reasons, with seven categories being defined. Additionally through counting reviews stopping reasons were already roughly quantified.

Further quantify stopping reasons

Further quantification was achieved through questionnaires. A first questionnaire was made that also asked open questions about the seven defined categories, hoping to further expand the list of stopping reasons through finding more latent unmet needs and wants. Some were found, but due to its length there were too little participants for quantification. Because of this a shorter second questionnaire was made. The insights from this (paired with reviews from the desk research and comments from the first questionnaire) resulted in five potential stopping reasons being defined.

These were further explored and compared to my personal ability and ambitions, with a stopping reason best fitting this thesis being found.

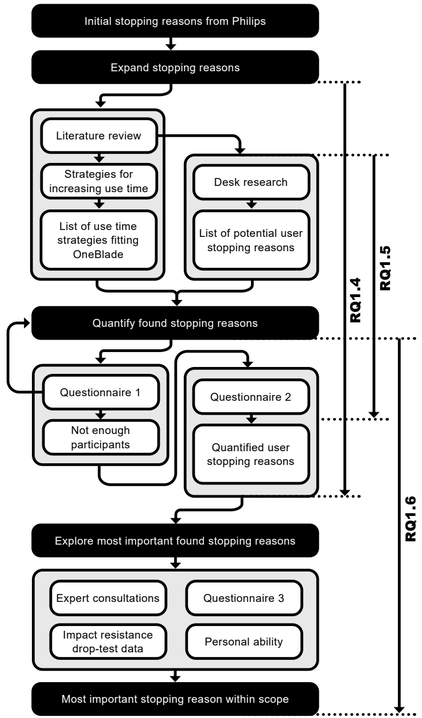


Fig. 31: Process for understanding the use-time of the OneBlade

3.2 | **Expand list of stopping reasons**

3.2.1 **Literature research**

Theory behind product replacement

First it was researched what makes people replace a product. (Sheth et al., 1991) and (Ackermann et al., 2021) state that an owned product has value that is compared to other new products. This value consists of five sub-values, of which four are deemed important (see Fig. 32. Social value is dropped as shaving is done in a private context).

1. Functional values: Level of product performance.
2. Emotional values: Amount of feelings and affective states it arouses.
3. Epistemic values: Amount of curiosity, novelty or change of pace it provides.
4. Conditional values: how specific situations or circumstances influence consumer decisions

Strategies to increase these values are researched, with Table 1 showing the strategies that fit OneBlade. The most important value(s) for OneBlade are discussed in the conclusion.

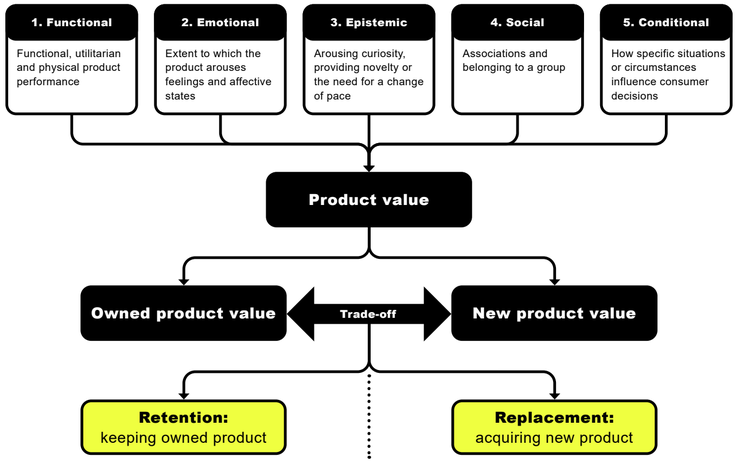


Fig. 32: Theory behind product replacement by Ackermann et al., 2021

Strategies for increasing use time

Table 1 defines four strategies for retaining product value. Their applicability to OneBlade is discussed, with take-aways being added to the list of potential stopping reasons (see Table 2).

As most strategies were not applicable this paragraph focused on conclusions only.

Strategy	Theory	Main take-aways
Design for product care	Prevent loss of functional value through product design that enables users to take care of the product. For this they need to be motivated, have the ability to take care and are triggered in doing so (Ackermann et al., 2021).	• Already designed for
Design for aesthetic pleasure	Design products to be resilient to emerging trends (timeless aesthetic design: Design that is visually simplistic, ordered, and harmonious) and wear (use materials that age gracefully over time) (vand den Berge et al., 2021).	• Degrading aesthetics might be a stopping reason OneBlade deemed to already have a timeless design.
Design for upgradability	Allow products to adjust to developing needs and/or technologies. This allows sustained product functional value (van den Berge et al., 2021) and epistemic value (Chapman, 2009).	• OneBlade is upgradeable through offering a range of add-ons, handles and shaving heads. However if aesthetics are deemed important further personalization like changing color might increase emotional value and thus use time.
Design for product attachment	Pleasure: the product provides the owner with pleasure. Self-expression: the product expresses the owner's identity. Group affiliation: the product expresses the owner's belonging to a group. Memories: the product reminds the owner of the past (Mugge, 2017).	• If aesthetics are deemed important, instead of the current bold aesthetic, a aesthetic reminding of the past might increase emotional value.

Table 1: Strategies for increasing product use time that are potentially applicable to OneBlade.

3.2.2 **Desk and user research**

Multiple sources were used to make a final list of potential user stopping reasons (see Table 2).

Desk research

Already posted comments were gathered from review websites (Amazon.com, Amazon.de, Tweakers, moo.review), reddit and youtube comment sections. ~100 were found and analyzed (see appendix 12.3.3, also for the sources). Through this was found that users mainly complain about the cost of head replacements, heads breaking, unexpected roughness of the final shave or it missing hairs resulting in a slow shave.

A post was also placed on the reddit shaving forum (r/shaving), asking users why they stopped using their OneBlade, and how it could be improved (see appendix 12.3.4). The seven respondents again complained about the hinges breaking, not expecting a rough shave or shaving taking too long. As for ideas (other than fixing the above) it was mentioned that the head should be able to shave sensitive areas without an add-on.

User research - questionnaire 1

During the first questionnaire several extra stopping reasons were mentioned. These were added to the list. The research and findings described in the next paragraph.

Found potential stopping reasons
1 Shaving experience
• Doesn't allow for a clean enough shave • Doesn't allow for enough control over my beard length • Doesn't allow for an even shave • Doesn't allow for making clean (enough) trim lines • Doesn't allow for enough control • Shaving takes too long • Have to run over the same part too many times • Hairs get stuck into the blades • Doesn't feel nice on my skin
2 Build quality
• Diminishing battery life • Too short battery life on a single charge to begin with • Doesn't charge fast enough • Blade is too small • (the hinges of the) blades break easily
3 Cleaning
• Hairs get stuck between the blade and the body • Hard to clean • Hairs shoot everywhere while shaving
4 Aesthetics (added from literature research)
• Doesn't look nice anymore (damaged) • Don't like how it looks in general • Rubber on the handle is degrading
5 Shaving head (replacement)
• Blades become dull too fast • Blade is too small • Blade pops out of the handle easily • Blades are too expensive • Don't like the waste blades generate
6 Storage
• Falling and breaking due to storage on high place
7 Add-ons
• The add-ons don't work like I want them to • The add-ons pop off easily

Table 2: All found potential reasons for users to stop using their OneBlade.

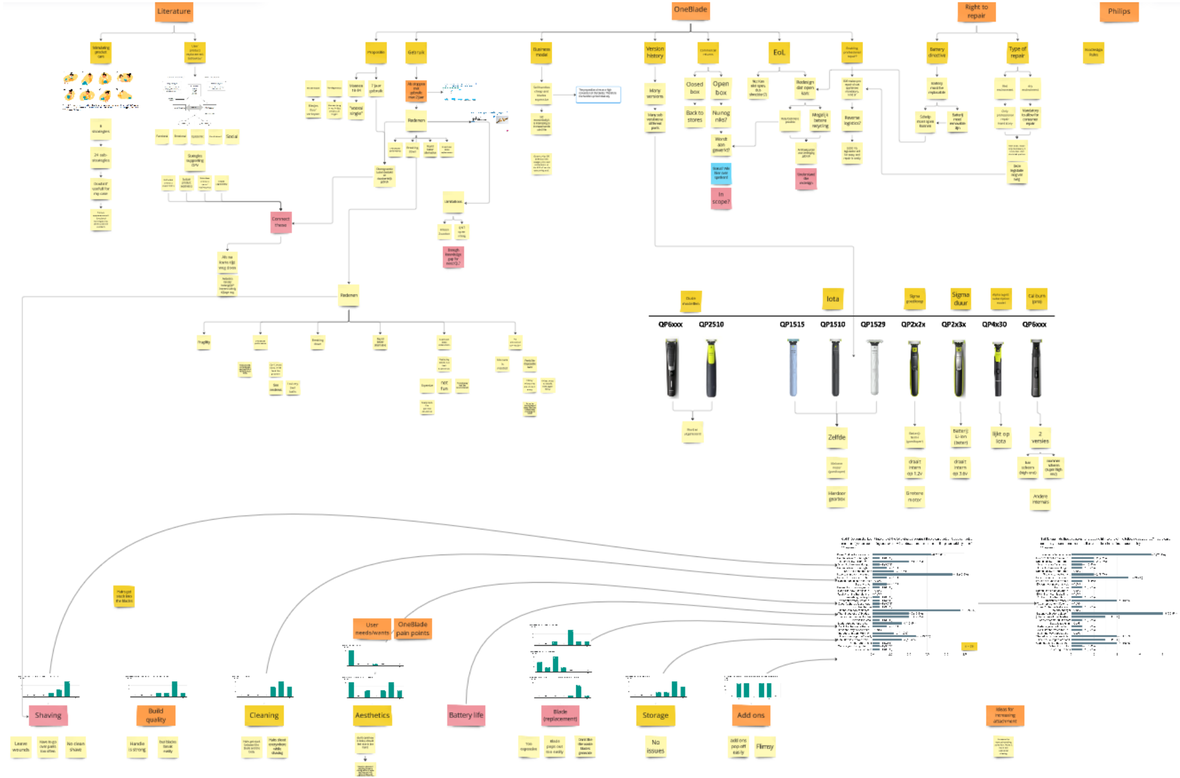


Fig. 33: As this page would otherwise be empty: This was the overview of the findings regarding sustainable strategies, regulations, user behavior and how they impacted each other. Making these kinds of overviews helped me in formulating conclusions and was done a lot throughout the project.

3.3 | **Further quantify stopping reasons**

To further quantify the found stopping reasons user research was conducted with two questionnaires.

3.3.1 **Method**

The first questionnaire asked both in depth questions about the seven categories defined in the previous paragraph, at the end asking participants to select dislikes and stopping reasons from a list. Only 9 people responded, offering qualitative insights, but not enough for quantification (see appendix 12.6.1).

Because of this the second questionnaire only asked participants to select from the list. However to avoid bias, they were still first asked to list their main likes and dislikes. The quantification can be seen in Fig. 34, the questionnaire in appendix 12.6.2, and the comments in 12.3.5.

In both researches a split was made between participants. Lapsed users were asked why they stopped using their OneBlade, while current users were asked what their current annoyances are, and which could lead to them stopping to use the product.

3.3.2 **Demographics**

Questionnaire 1

- n = 9, 7 current users and 2 lapsed users.
- 6 dutch, 1 American, Mexican and German.
- 100% male, 92% being between 23-29 y.o.
- 78% uses a normal handle V2. 22% a pro.

Questionnaire 2

- n = 30, 28 current users and 2 lapsed users
- 26 Dutch, 1 Spanish, British, Canadian and American
- 100% male, 87% being between 18-24 y.o.
- 90% uses a normal OneBlade V2, 20% (also) uses a pro. This sample size is too small to make a distinction in results.
- Average OneBlade use time of 2.0 years.

3.3.3 **Results - 5 potential stopping reasons**

The result are 5 potential stopping reasons ranked most to least mentioned. They are further worked out in the next paragraph by using insights from aforementioned literature and desk research. Also additional research was conducted.

Quantification only based on current users

Over both tests only four lapsed users participated. As this is too little for quantification they were left out of the statistics. However it should be mentioned that their stopping reasons were unexpected shaving experience, replacement head cost or blades breaking too easily.

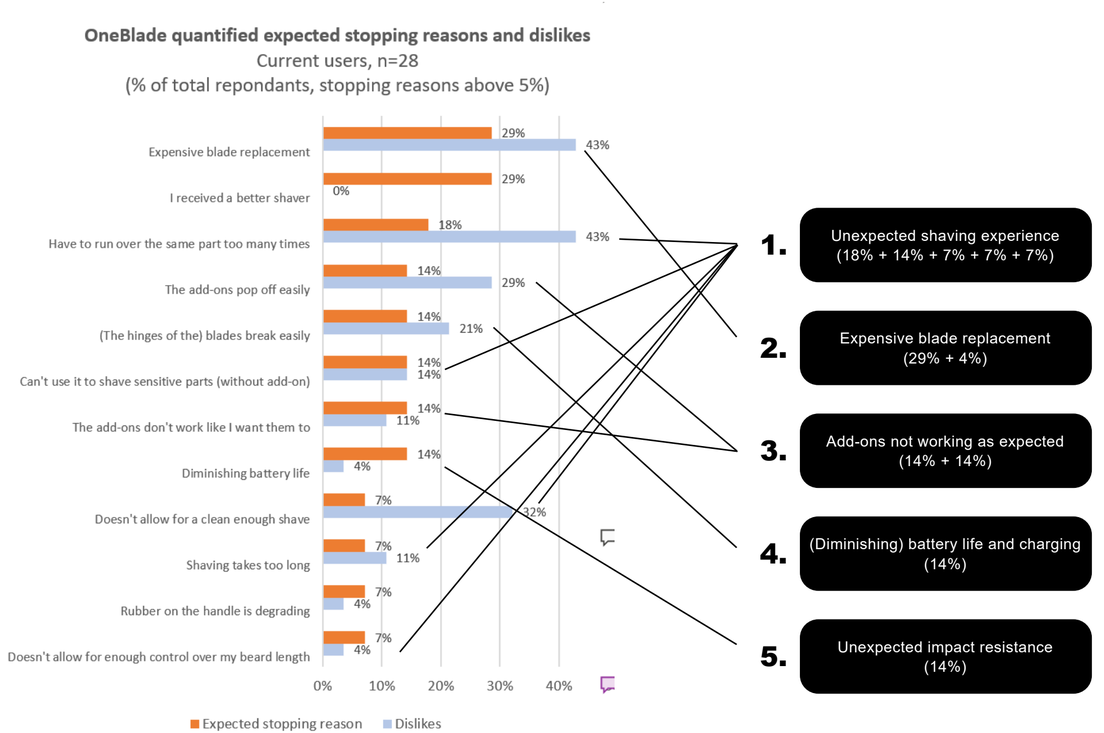


Fig. 34: The results of quantification and how they led to the five found shaving expected stopping reaons

1. Unexpected shaving experience

The biggest found expected stopping reason is various forms of unexpected shaving performance. Two main causes are seen. The first is mechanical ability, like the blade not allowing for an easy shave. The second is unexpected performance, like customers expecting a clean shave, not knowing that you have the shave against the hair direction or believing shaving sensitive parts can be shaved without an add-on (see appendix 12.3.5).

Competitor comparison

As the OneBlade can do anything, it is expected that users compare it to trimmers, manual razors and shavers, explaining user confusion as: Firstly trimmers have a stronger motor and rougher blade, allowing for faster and easier shaving. Secondly manual razors and shavers shave cleaner than the OneBlade, but this isn't clearly communicated to users (Philips (14), 2023). Lastly trimmers exist that can shave the body without add-ons (Manscaped, 2023), which the OneBlade can't but doesn't clearly state (I made the mistake myself...).

The fact that you have to shave against the hair direction is however already being clearly communicated (see 2.5.1 on page 39).

2. Cost of replacing shaving heads

The second most important found expected stopping reason is the cost of shaving heads compared to their lifetime.

"... and very f*****g expensive blades. It's like the printer of shaving machines, super affordable to buy but expensive to use." (12.3.4)

Competitor comparison

Comparing competitor prices (see appendix 12.2 |) shows that together with premium Gilette systems the OneBlade is the most expensive shaving system, costing ~€70,- annually. Additionally OneBlade shaving heads are the most expensive shaving blade consumable by far at ~€15,- with Gillette being second and costing ~€3,50. This could explain the heavy reaction to the price, but could also mean that a small price reduction would not change the blades 'feeling expensive'.

The third most important found expected

3. Add-ons not working as expected

stopping reason is add-ons not working as expected. They detach during shaving and do not give the desired results.

Deeper analysis of the problem

This data is however outdated. The problem was only mentioned to occur with the old beard combs of the normal OneBlade. However Philips has already solved this issue by introducing the new 5 in 1 comb which has a stronger connection to the body and better shaving experience. No comments were made about the add-on of the pro model. This is likely because of its more premium design. For an in-depth explanation of the add-ons, see 2.4.4 on page 38. Because of this it is longer seen as a problem and not further researched.

The fourth most important given expected

4. (diminishing) battery life + charging

stopping reason is diminishing battery life and other battery related annoyances.

Deeper analysis of the problem

No comment were found about the battery life actually degrading, with participants probably meaning that if the battery would diminish, they would stop.

Comments were found about the battery of the normal V2 handle dying after a low fall. However after speaking with experts, it was mentioned that this was due to a solder issue that has already been solved (Philips (7), 2023).

Comments were also found about the annoyance of not being able to charge and shave at the same time, as sometimes the battery dies mid shave. This is however due to charging in a potentially wet environment being unsafe (Philips (11), 2023).

Because of this it is not seen as a (solvable) problem and not further researched.

5. Unexpected shaving head impact resistance

The fifth most important found expected stopping reason is lower shaving head impact resistance than expected. The original shaving head is mentioned breaking during transport, by tapping it on the side of the sink too hard or even mid-shave (see 12.4 |). After this users mention that buying a new head is too expensive.

"I give up on oneblade once a year once the plastic hinge breaks 1 month in or similar. I'm not that rough with it but it's flimsy sorry" (12.3.4)

However all this data is on the original shaving head.

Deeper analysis of the problem

The new 360 shaving head has increased impact resistance compared to the original head (see appendix 12.3.1). It shouldn't break anymore during transport, cleaning or shaving due to it's stronger bi-axial hinge. However it can still break when dropped from 110 cm, which is the internal Philips standard for impact resistance (Philips (18), 2023) and about the height of a sink. Through research it is expected that the 360 head will break ~3 times less than the original shaving head (see Fig. 35), meaning the problem is reduced but not solved.

Competitor comparison

Most competitor products outside of lookalikes survive a 110 cm drop. This includes other products with replaceable heads i.e. manual razors, as their handles are significantly lightly due to not needing electronics.

Because of this users will likely expect the OneBlade to have a similar impact resistance. Competitors are visualized on the next page.

Fig. 35: The 360 shaving head is expected to only break ~1/3 of the times compared to the original.

1. Appendix 12.3.1 (GTS 08.04.08) on page 164
2. (Gilette fusion power drop test, Philips (12), 2023)
3. Philips internal standard, also expected from competitors.
4. Philips (5), 2023

Special mention: (Degrading) aesthetics

In paragraph 3.2.1 literature mentioned (degrading) aesthetics as a stopping reason.

However aesthetics were said not to degrade even after using the handle for years. Some participants did mention that degrading rubber on the handle would be stopping reason. However there is no record of this ever happening.

Participants also judged general aesthetics to only be important during product acquisition.

“Aesthetics matter when initially buying a shaver, but after that it is purely about functionality” (participant #7) and “Aesthetics are important in everything. However in a shaving machine it’s the least important in my opinion. Its needs to be small and easy to grip, that’s it. (participant #2)”.

Because of (degrading) aesthetics are not seen as a stopping reason and will not be further researched in this thesis.

3.4 | Conclusion

All found stopping reasons are about the functionality of the OneBlade, concluding that then OneBlade product value is mainly comprised of functional value.

Within this three main drivers for expected reduction in value have been found: Unexpected shaving experience, cost of replacing shaving heads and unexpected shaving head impact resistance. These overlap with the initial stopping reasons presented by Philips, adding to their believability. It will now be discussed why unexpected impact resistance is the found to be the biggest opportunity to increase value within the scope of this project.

Choice

Unexpected shaving experience is comprised of two groups of issues, with both being seen as out of scope. Firstly mechanical issues have to do with shaving mechanics, which I am not allowed to work on and is outside of my area of expertise. Secondly unexpected performance can be solved with better communication, making it a marketing problem and out of scope. However insights and ideas are discussed in the recommendations (chapter 9.2 |)

High shaving head cost has two issues, again with both being seen as out of scope. Firstly shaving head cost is finance, not design. Secondly quick blunting of the blades again has to do with shaving mechanics. Again insights and ideas are discussed in the recommendations.

Unexpected impact resistance has been improved with the introduction of the 360 shaving head. It has been developed by a team of mechanical engineers over years, chances of me improve it when working within their scope are low. However I have the ability to offer a new creative view on possibilities when working within a different scope then the original team a.k.a. break some requirements. Also it is within my learning goals.

Chapter 4

Understanding Sustainability

This chapter goes into questions around sustainability that have not been answered yet in the previous chapters, i.e. CO2 impact and additional regulation.

4.1 | Introduction

4.4.1 Knowledge gap

The focus on the strategy of increasing use time has been discussed in 1.1.5 on page 20, and strategies for achieving this have been explored in 3.2.1 on page 44. However this still leaves two questions regarding sustainability.

Firstly should the focus be on maximizing handle or head use time? When OneBlade is replaced this has a high environmental impact. However if shaving heads last 4 months and a handle is used many years, more that 10 heads can be thrown away before a handle is replaced.

Secondly are there additional upcoming legislations that will shaver design criteria, and do they affect viability for Philips?

Research questions

RQ1.7 What components have the highest environmental impact when discarded?

RQ1.8 What upcoming regulations might impact OneBlade?

4.4.2 Method

Here a big step will be taken back. Actually this thesis did not start being focused on use time. Instead the starting point was to in general reduce e-waste, with Philips and after that the OneBlade being found as a good case study for this. Because of this research into sustainability and the rough calculation of CO2 impact were conducted very early on (see Fig. 36).

The energy label regulation was found as my coach was researching it and pointed out that it might impact OneBlade.

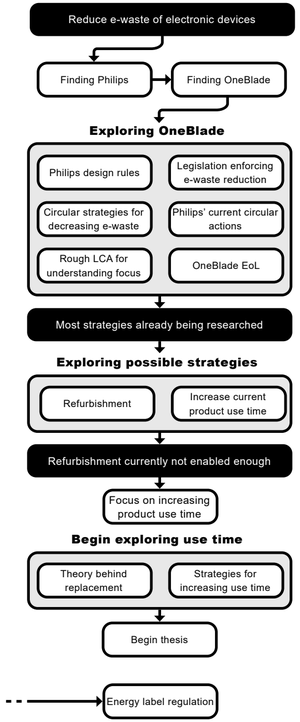


Fig. 36: Process regarding sustainability

4.2 | OneBlade carbon footprint

4.1.1 CO2 footprint comparison

For comparing the impact of the OneBlade head to the handle only the CO2 footprint from the sourcing of materials were compared. This is because data regarding the CO2 footprint of the handle was already available and showed that material sourcing accounted for the majority of the impact.

Findings

Handle carbon footprint is found to be ~300 times higher than the shaving head due to the big difference in size and addition of electric components. For the comparison see Table 3 and Table 4.

4.1.2 End of life

Handles of course only have impact if they are not reused. During first questionnaire participants were asked what they would do with their OneBlade when it when they wanted to replace it while it still worked. None of the respondents mentioned they would try to give it a second life, instead expecting to dispose of it or even worse, store it (see Fig. 37).

(1) IDEMAT, 2021
(2) Fonteijne, 2023

360 shaving head		
Part	**Weight (grams)**	**Footprint of raw materials (Kg CO2)**
Plastic parts	1.5	0.005 (1)
Metal parts	2.5	0.005 (1)
Total	**4**	**~0.01 Kg CO2**

Table 3: Estimated CO2 footprint of the raw materials of the 360 shaving head.

New V2 handle		
Part	**Weight (grams)**	**Footprint of raw materials (Kg CO2)**
Motor	32.6	0.14
PCB	6	1.8
Battery	19.4	0.35
Other	265	~0.9
Total	**323**	**~3.1 Kg CO2**

Table 4: Estimated CO2 footprint of the raw materials of the new V2 handle.

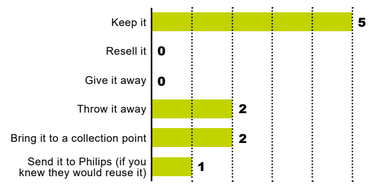


Fig. 37: Q: If you stopped using your OneBlade but it still works, what would you do with it? Multiple choices are possible (n=9)

4.3 | Upcoming energy label

4.3.1 Found additional regulations that shape the future of shavers

Through further researching upcoming regulations it was found that the energy label could negatively affect sales.

As part of EU Ecodesign, the EU has proposed a regulation for labeling electronic devices, promoting sustainable behavior for both companies and consumers (EU, 2023). Currently the label is only for smartphones and tablets. However the EU has pledged that EU Ecodesign regulations will be placed on all categories of physical goods placed on the EU market (EU, 2023) meaning also the OneBlade.

4.3.2 Energy label impact on OneBlade

If the labeling remains the same for shavers it will be scored on the information shown in Table 5.

Experts told that the OneBlade has good energy usage and battery endurance (Philips (11), 2023). Additionally it has an IPX7 water resistance rating, which is the shaver industry standard. Also due to the battery directive legislation it should be redesigned for repair, meaning it should score as well as the competition.

4.3.3 Low score on repeated free fall reliability expected

However the OneBlade will also be scored on its impact resistance. This test is conducted at 1 meter multiple times (see Table 5). The 360 shaving head starts breaking at 70 cm, meaning multiple drops will not be survived, scoring an E.

Additionally with phone testing no cases or screen protectors are allowed. Because of this use of external protection is expected to be prohibited during testing with shavers.

Now experts at Philips did mention that the shaving head is a consumable, which might exempt it from testing. Currently no energy label has been placed on products containing consumables making this unknown. However as most competitor shavers with consumables survive 1 meter drops, and consumables form an integral part of shavers, inclusion is not unlikely.

	Falls without defect
Repeated Free Fall Reliability Class	**Non-foldable smartphone**
A (most robust)	n ≥ 270
B	180 ≤ n < 270
C	90 ≤ n < 180
D	45 ≤ n < 90
E (least robust)	-

Table 5: Repeated free fall reliability score calculator for smartphones (EU, 2023).

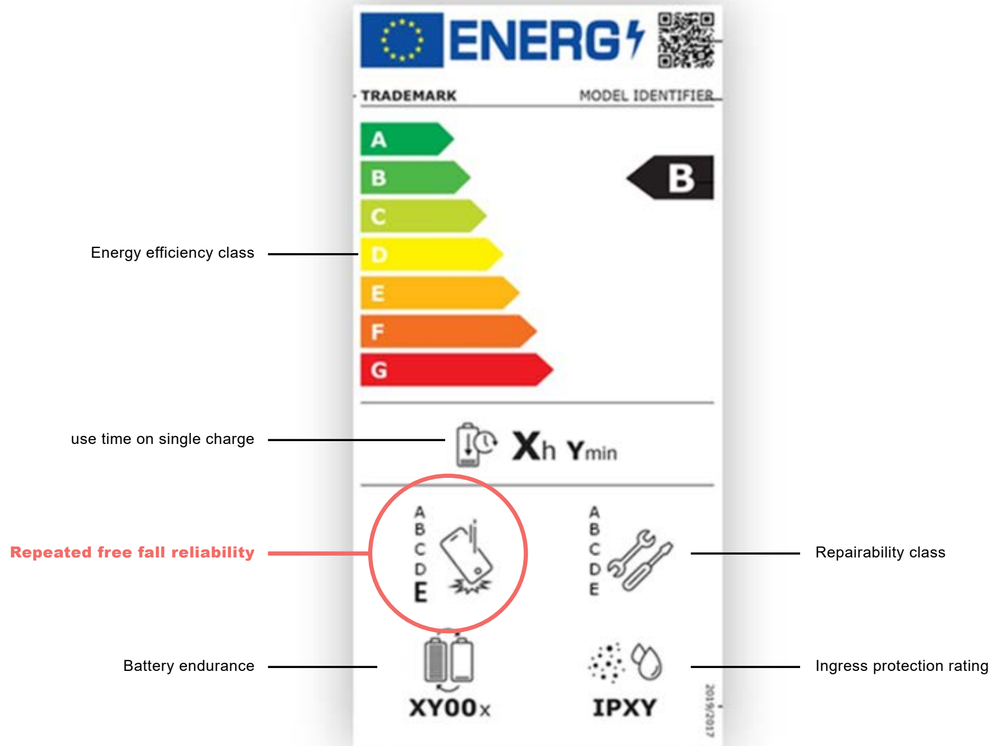


Fig. 38: Upcoming energy label for smartphones and tablets (EU, 2023)

4.3.4 **Label visibility research**

If the label comes to shavers, it will be displayed as illustrated in Fig. 39 and Fig. 40. The mock-ups are based on current regulation for smartphones and tablets (EU, 2023), assuming that the same rules will apply to other electronic product categories.

Physical retail label mock-up

In physical stores the label would have to be placed in close proximity to the sold box. The label would be 68x136 mm big. Fig. 39 shows the size compared to a OneBlade.

Online retail label mock-up

Online the label would have to be displayed as a colored marker that by hovering or clicking on it would show the full energy label. This would mean that the impact resistance would only be visible after hovering/clicking.

Fig. 39: Mock-up of the expected size and placement of the energy label in physical retail settings.

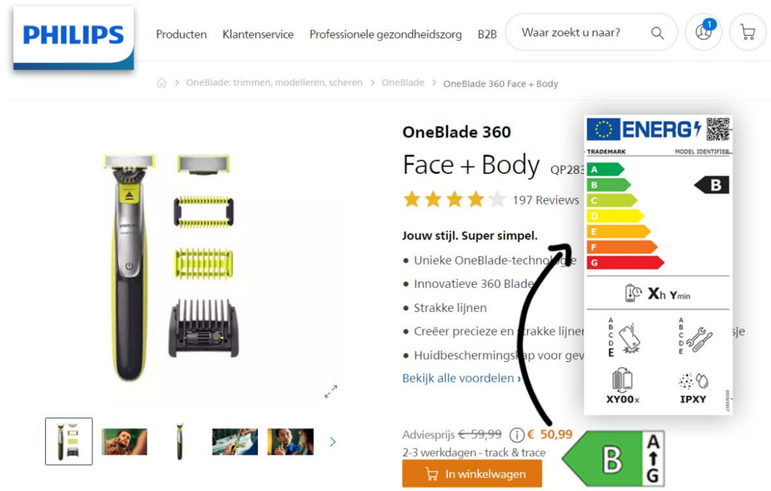


Fig. 40: Mockoup of the expected size and placeament of the energy label in online retail settings.

4.4 | **Conclusions**

For reducing environmental impact the focus should be on increasing the use time of the OneBlade handle compared to reducing waste from the replaceable shaving heads. This is because the CO2 footprint is ~300 time higher.

Additionally the Energy label regulation could negatively affect OneBlade. This is because, If consumables have to be part of repeated free fall reliability tests, the OneBlade will score lower than some competition. As shown in Fig. 39 and Fig. 40 this score is expected be highly visible during both physical and Online sales.

Part 1 Summary and conclusions

With the three previous chapters enough information has been gathered to answer RQ1

RQ1 Which strategy should be used to increase the use time and reduce the environmental impact of OneBlade shavers?

Looking at users, through literature, desk and user research (and multiple expert interviews) three main OneBlade replacement reasons have been defined:

1. Unexpected shaving experience (out of scope)
2. expensive shaving head replacements (Out of scope)
3. Low shaving head impact resistance

Looking at Philips, low impact resistance of the OneBlade shaving heads is found to negatively influence their strategic position.

1. The OneBlade shaving head has a lower impact resistance than most competitors. This while Philips prides itself for its build quality (Philips (17), 2023) and has an internal standard of 110 cm impact resistance that is currently not being met.
2. The upcoming energy label is expected to come to shavers and will score repeated free fall reliability at 1 meter without external protection. If replaceables are to be included the OneBlade will score an E.

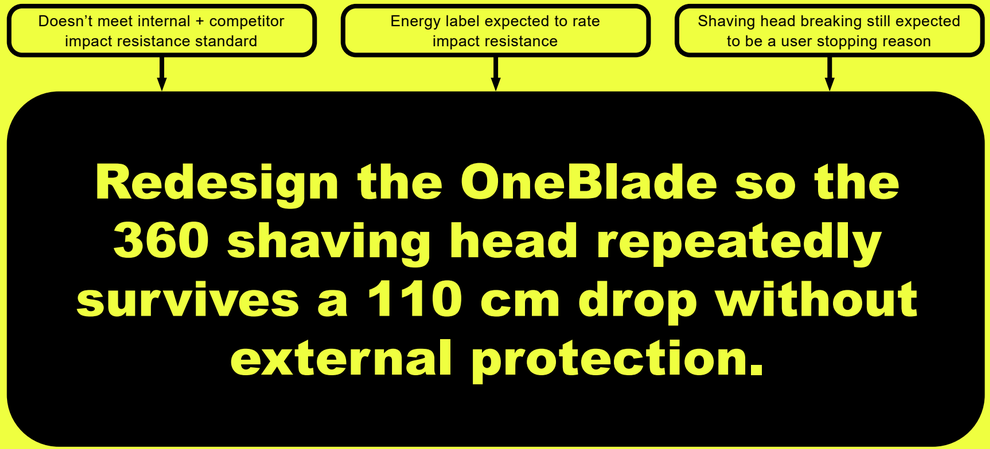
Looking at the environment a question was if handle or head use time should be increased. However the focus will be on handles as they have a ~300 times higher CO2 footprint.

Also a redesign will focus on the 360 shaving head, while breaking is mainly a problem of the original head. This has two reasons.

1. While offering the benefit of having an uni-directional hinge (some like this), it is otherwise outperformed by its successor. The revenue model of the original head is in offering high margins due to being fully developed, meaning changing it is not viable
2. The 360 will be the new norm, with new handles being sold with it, meaning it will be used for repeated free fall reliability testing.

Because of this the strategy selected to reduce environmental impact of the OneBlade is to increase its impact resistance to ensure longer handle use time.

4.5 | **Design challenge #2**



Part 2

In depth

Before jumping into solving the second design challenge, first a more in depth understanding of the OneBlade is needed. Firstly to understand the requirements of a redesign mainly the shaving head has to be better understood. Secondly to redesign it for 110 cm impact resistance, its current breaking behavior has to be analyzed. This results in requirements and potential design directions that are discussed in the following two chapters:

Method to report stucture

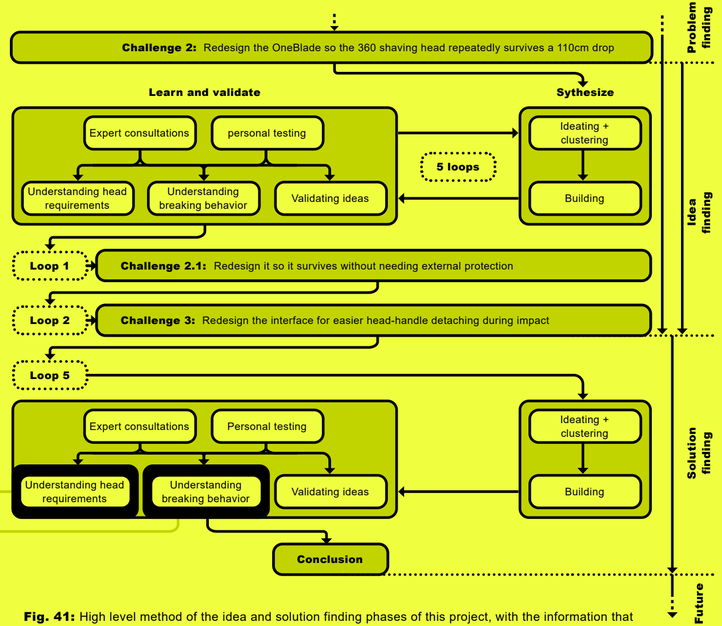


Fig. 41: High level method of the idea and solution finding phases of this project, with the information that will be discussed in part 2 being highlighted in black.

As explained in ‘Method’ on page 26 ideation, requirements and breaking behavior were researched in parallel, iteratively gaining a better understanding of it all through 5 loops.

However telling the story chronologically would result in a very chaotic reading experience. Instead this part presents the final understanding of requirements and breaking behavior that I had at the end of the solution finding stage in loop 5 (highlighted in black in Fig. 41). In the next part concepts are discussed, but they were designed based on a rougher understanding than presented in this part.

Additionally it should be noted that in Chapter 5 “Requirements” the handle was also extensively researched. However ultimately these requirements were not used and left out of this story.

Chapter 5

Shaving head deep dive

This chapter will go into how the upper part of the OneBlade (so mainly the shaving head) works up to a component level. This results in requirements, but also guided ideation. It also provides a better understanding of how the shaving head works to readers, which is necessary to better understand future ideas and concepts.

5.1 | Introduction

To understand the 360 shaving head is to understand the four assemblies it consists of (and their parts, functions and limitations).

Research question

RQ2.1 What requirements should a redesign adhere to to make it feasible, viable and desirable?

The four 360 shaving head assemblies:

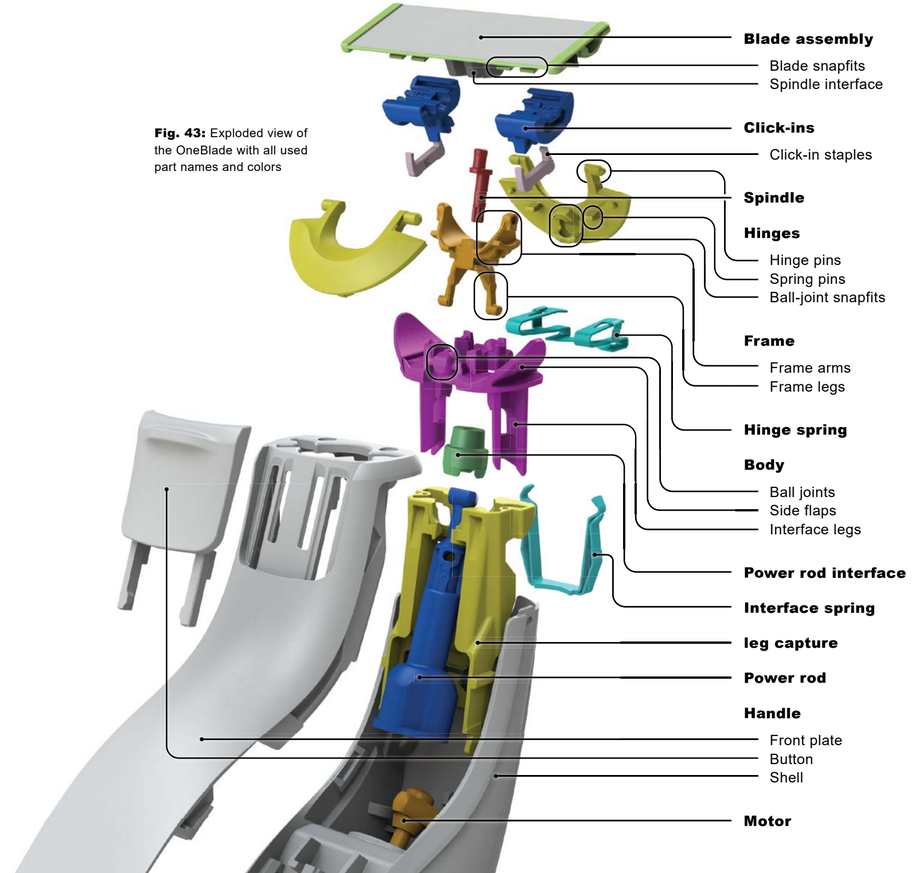
- **Blade assembly** - for cutting that hair.
- **Hinge assembly** - for allowing the blade to easily stay perpendicular to the face for a closer shave.
- **Interface assembly** - for keeping the shaving head in place during shaving while still allowing for easy replacement.
- **Powertrain assembly** - for connecting the motor and the blade.

The next paragraphs will go more in depth on each assembly. For readability headings are labeled requirement (**req.**) or nice to have (**n2h**).

Additionally an overview of all parts and names mentioned in this report can be seen in Fig. 43.

Fig. 42: The OneBlade

Fig. 43: Exploded view of the OneBlade with all used part names and colors



5.2 | **Blade assembly**

The blade assembly cuts the hair. It consists of 3 main parts. There is a blade that can move sideways (called, well, the **blade**). This blade is surrounded by a stationary green shell called the **guard**. Both have sharp teeth, and as only the blade moves hair is cut just like with a hedge trimmer. To connect the blade assembly to the rest of the head four sets of snapfits are embedded into the guard, called the **blade snapfits**, attaching to the click-ins. To power the blade, the **red spindle** connects to the **black spindle capture**, which in turn connects to the blade. This turns rotary motion into linear (cutting) motion and is called the **blade-spindle connection**.

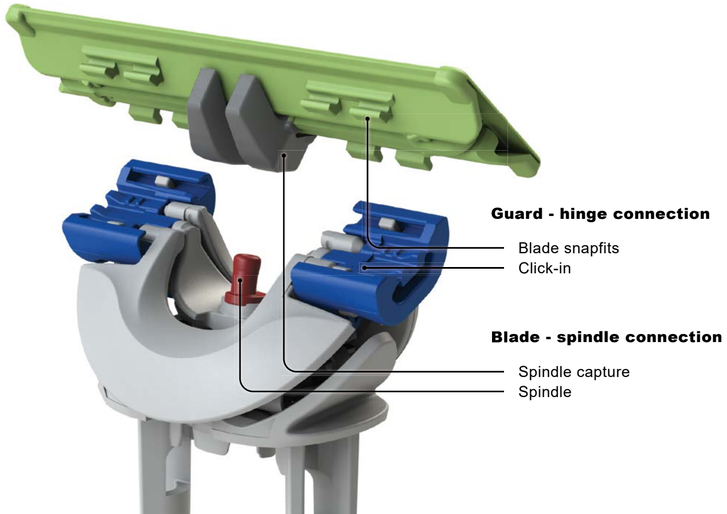
Req - No changes to the blade

As mentioned in chapter fixme anything regarding the blade is out of scope as it is a trade secret and outside my expertise.

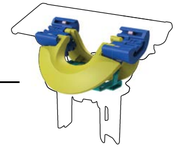
N2h - No changes to the guard

The blade assembly should not be changed unless absolutely necessary. This is because the tooling is expensive enough to significantly reducing Philips profit (Philips (6), 2021). This means the guard shape and blade snapfits should preferably stay as is.

Fig. 44: Components of the blade assembly



5.3 | **Hinge assembly**



The bi-axial hinge allows the blade to move up and down (primary rotation) and sideways (secondary rotation). Where the primary rotation point lies and how much force moving takes greatly impacts shaving experience (Philips (12), 2023). This introduces various requirements and nice to haves.

N2h- Secondary rotation point should be ~10mm from the skin

Sideways (secondary) rotation is enabled through a ball hinge construction (see Fig. 45). The **yellow hinge** attaches with a snap-fit to a ball on the **purple body**. Engineers told that the exact rotation point is not important but should remain ~10mm from the skin. (Philips (4), 2023).

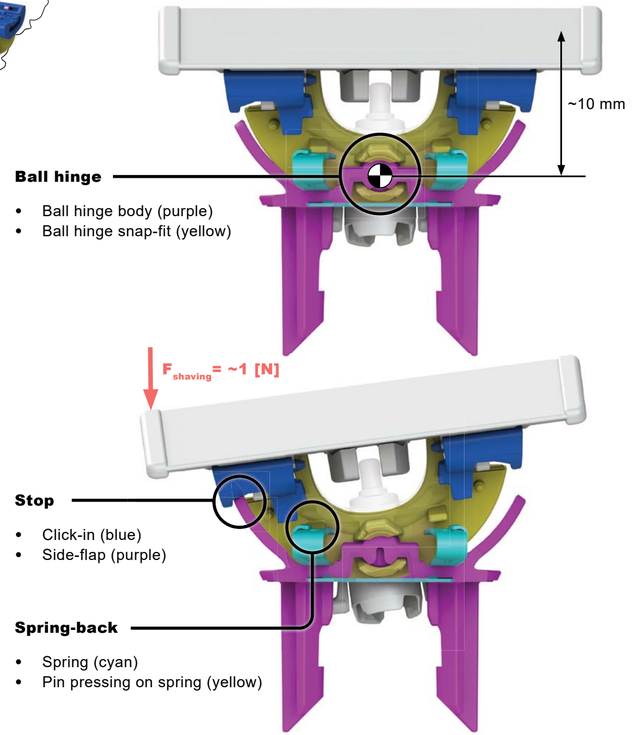
Req - Secondary rotation range is ~14°

Sideways rotation must be stopped after turning ~7° in one direction. This is done through the **yellow side-flap** coming into contact with the **blue click-in**. This also increases impact resistance as it stops motion. A stopping system should be in the new design.

Req - Moving the blade should take ~1 [N]

It should take force to move the blade. This should be kept in a redesign. Currently a yellow pin pushes on the cyan spring (see spring-back). Force for primary and secondary rotation is roughly same.

Fig. 45: Secondary rotation of the hinge



Req - Primary rotation point must be within 1 mm of the skin

For the best shaving experience, the blade should follow the contours of the users face without biting into the skin. This is achieved by having the primary rotation point of the hinge be close to the skin of the user, between -1 and 1 mm (see Fig. 46) (Philips (6), 2021) which should be kept in a redesign. A negative rotation point (i.e. it is in the skin) is preferred, as with force this means the blade will pull away from the skin in the direction that you are shaving, resulting in a smooth shaving experience (Philips (12), 2023).

Currently a 4 axis hinge mechanism is used by having the **yellow hinge** connect to the **blue click-in** with **pins**, and the **purple body** with a **Ball hinge**.

Req - Primary rotation range is ~50°

As with secondary rotation, primary rotation also has to be stopped, here after turning ~50°. Additionally the neutral position of the blade should be angled forward as in Fig. 46. This is to allow for easy edging (Philips (14), 2023).

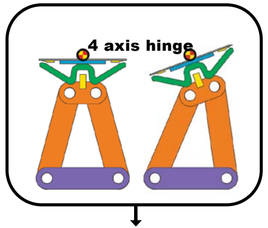
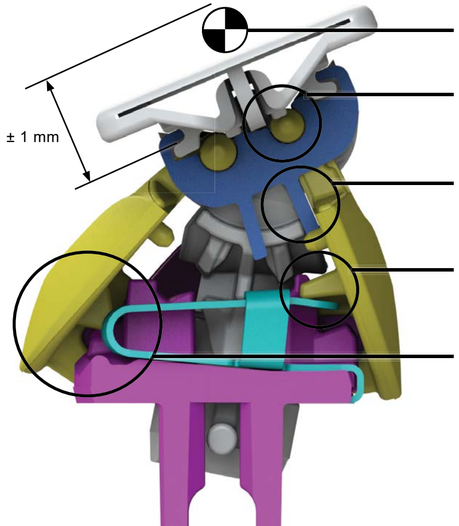


Fig. 46: Primary rotation of the hinge



Rotation point

Upper hinge

- Click-in (blue)
- Hinge pins (yellow)

Stop

- Hinge (yellow)
- Click-in block (Blue)

Spring-back

- Spring (cyan)
- Pin pressing on spring (yellow)

Lower hinge

- Ball hinge body (purple)
- Ball hinge snap-fit (yellow)

5.4 | Powertrain assembly

The powertrain connects the motor and the blade to each other, introducing four sub assemblies. Beginning at the top, this starts with the aforementioned **blade-spindle connection** (see ‘Blade assembly’ on page 70).

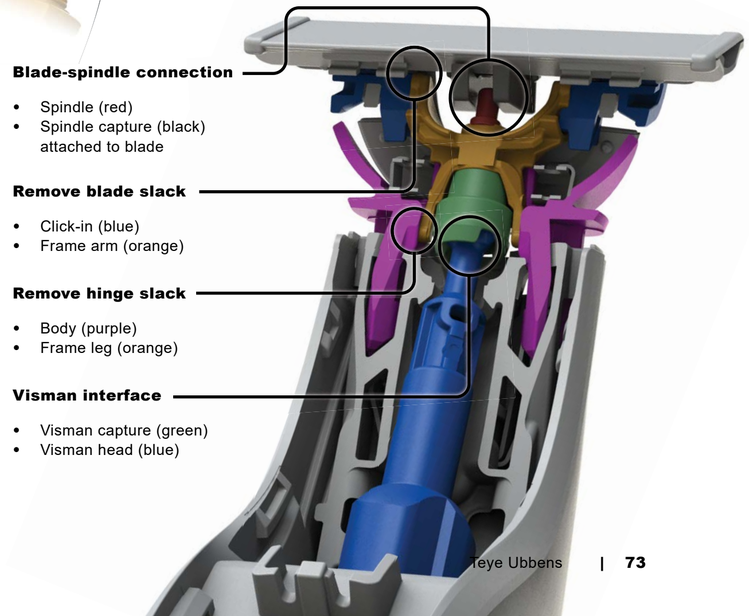
Then to allow for head replacement the powertrain should be able to be broken up. This is facilitated through the **visman interface**. This consists of the **green visman capture** that connects to the **blue visman head**.

And last the connection between the blade and the motor should be free of slack, which is cleverly facilitated by the **orange frame**. The **orange frame arms** are tensioned between the **blue click-ins**, removing slack. The **orange frame legs** slide into the **purple body**, removing slack from the hinge by stopping torsion.

N2h - Powertrain should not be changed

This paragraph only scratches the surface of the powertrain optimizations. As it is also already designed to be as small as possible, it should not be changed unless absolutely necessary.

Fig. 47: Components of the powertrain assembly



Blade-spindle connection

- Spindle (red)
- Spindle capture (black) attached to blade

Remove blade slack

- Click-in (blue)
- Frame arm (orange)

Remove hinge slack

- Body (purple)
- Frame leg (orange)

Visman interface

- Visman capture (green)
- Visman head (blue)

5.5 | **Interface assembly**

The shaving head should stay in place during shaving while still allowing for easy replacement. This is achieved through the interface. The **purple interface legs** (that are part of the purple body) can slide into the **yellow capture** and are held in place by the **cyan double spring**.

N2h - Interface remains backwards compatible

The interface legs have a v-shape. While this is for stability, the shape is also patented. This makes any off-brand OneBlade shaving heads illegal to produce or sell without Philips' approval (Philips,(19), 2023). Because of this a change is not ideal. However if a change to the legs is patentable and viable enough to offset the cost of making a new patent, it is possible.

However additionally the shaving head should remain backwards compatible. If not a split between old and new OneBlades would come, leading to old OneBlades being thrown away, increasing e-waste. However if this change leads to better impact resistance it could be input for future redesigns.

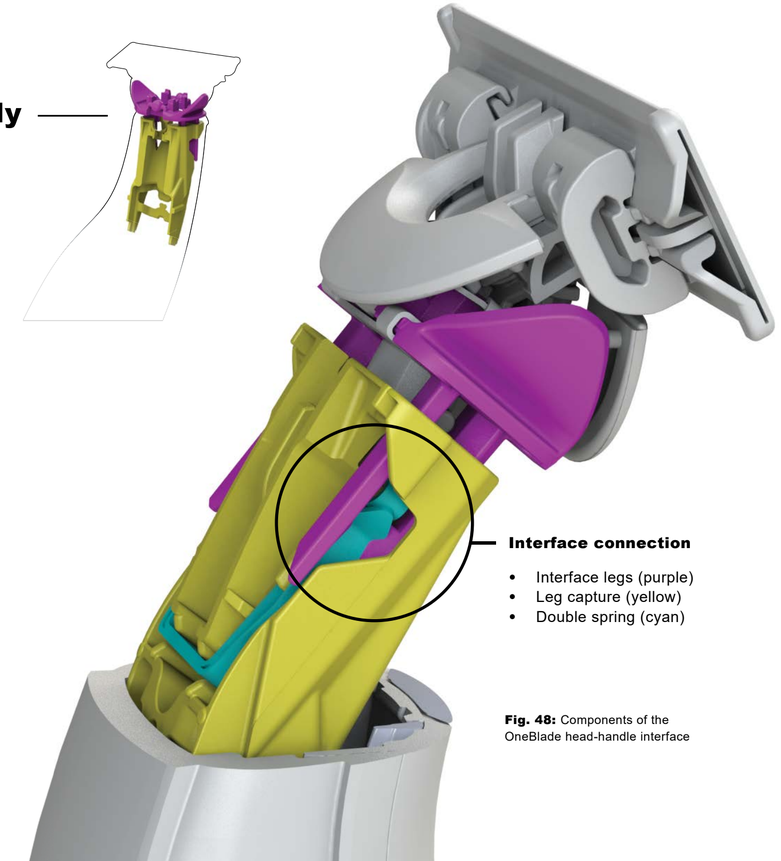


Fig. 48: Components of the OneBlade head-handle interface

Fig. 49: The asymmetrical head-handle interface shape

Req - Shaving head can only be placed on the handle in the correct orientation

If the leg shape were to be changed, their shape should only allow the shaving head to be placed in the handle in the correct orientation. Currently the asymmetrical v-shape of the legs facilitates this (as can be seen in Fig. 49).

Req - During shaving the head should not detach when a force of 15 [N] placed parallel on the blade

A redesign should not make the shaving head detach during shaving. For this the minimum needed clamping force of the interface needed to be defined.

Method

A force meter was used with two 3D printed add-ons for measuring force normal and perpendicular to the blade. With this the size and orientation of shaving force could be found. 5 participants were asked to shave their face and body in various orientations. They were asked to do this with normal shaving force and with the force 'an idiot would use to carve hairs our of their body'. Through this two results were found. For the full test see appendix 12.1 |.

- **Max force scenario**
  Forces on the interface were the highest in the orientation shown in Fig. 53. Additionally a higher force is applied on the interface when shaving with add-ons, especially the 5 in 1 comb, as it increases the moment arm.
- **Max force**
  Within this scenario force tests were conducted (see Fig. 51 and Fig. 52). The highest measured resulting force was 12.1 [N], which was rounded up to 15 [N].

Fig. 50: The apparatus used: an MRC DFG500 digital push gauge with two 3D printed shaving heads for measuring the x and y components of shaving force.

Fig. 51: Measuring the highest F_x on the face

Fig. 52: Measuring the highest F_x on the body

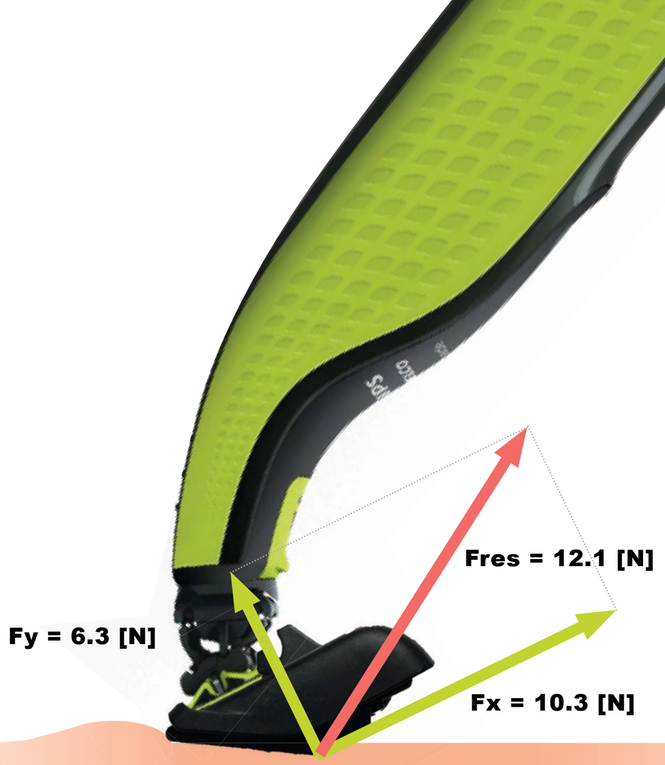


Fig. 53: Highest found resulting shaving force (red) based on the highest found x and y components (green).

Req - Changing the shaving head should take no more than 9 [N]

If the interface is changed the force needed to attach or detach the interface should not be significantly higher in the current design (1.5x).

Using the setup below it was found that ~6 [N] of force is currently required to insert/detach the interface.

Req - How to change the shaving head is easy to understand

In general all users should be able to understand how to change a shaving head without an explanation (Philips (fixme), 2023).

Fig. 54: Illustration of the requirement

Fig. 55: Apparatus for finding the max force for changing heads

5.6 | Other

Req - Handle neck shape cannot be changed

The OneBlade should maximize shaving experience, as this is it's primary function. The c-shaped neck add to this as it allows shaving harder to reach places like the jawline and is not allowed to change.

Req - Handle is and remains IPx7 waterproof

Users expect the handle to be usable in wet conditions. Changing this will undoubtedly lead to breaks and thus e-waste and should be kept over the handle lifetime of 7 years.

5.7 | Conclusion

All collected requirements and nice to haves are added to the list of requirements on page 92.

Fig. 56: Illustration of the need of the neck shape

Chapter 6

Breaking behavior deep dive

This chapter researches when and why currently the 360 shaving head breaks. Many poor shaving heads (and a few handles) were harmed in this process.

6.1 | **Introduction**

6.1.1 **Knowledge gap**

To design the OneBlade for 110 cm drop resistance it is essential to understand how and why the 360 shaving head currently breaks.

Current drop-tests from Philips do not offer enough information for this, as they only list from what distance a break starts occurring (Philips (2) and appendix 12.3.1). Their results also vary greatly, making it hard to design with.

Because of this it was deemed that information was needed on what parts break the most, and with what specific forces this happens.

Research questions

RQ2.2 When and why does the 360 shaving head currently break?

RQ2.3 What are the current solutions for increasing impact resistance and how well do they work?

6.1.2 **method**

Apparatus

To answer the research questions drops were recorded with a high-speed camera at 5400-8000fps using the setup shown in Fig. 59.

Procedure

Understanding the breaking behavior has been an iterative process.

Initially the OneBlade was dropped in only six angles (conform the usual Philips drop-test guidelines) with a high-speed camera. This showed that that due to the way OneBlades are dropped the starting and impact angles vary (see Fig. 57). Additionally it was found that small differences the impact angles resulted in big differences in breaking behavior. This explained the inconsistency in current drop test results.

Because of this inconsistency the procedure was changed to a more iterative approach (see Fig. 58). Drops were done, videos were analyzed and breaking behavior was sketched out. From this missing angles were identified, new drops were conducted and the breaking behavior was further understood. This was done 5 times to get the current results, with over 300 drops being done. ~50 highspeed recordings were saved (appendix 12.2.1). Philip Monsbourgh knows where they can be found.

Data analysis

High-speed videos were saved and analyzed by eye and discussed with Philips engineers.

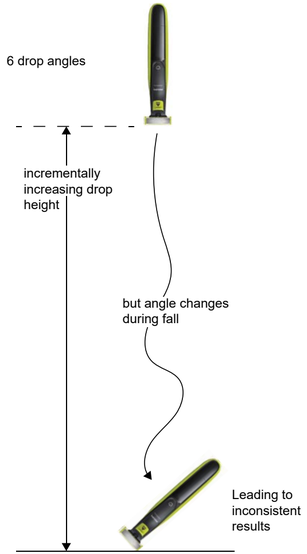


Fig. 57: Current method

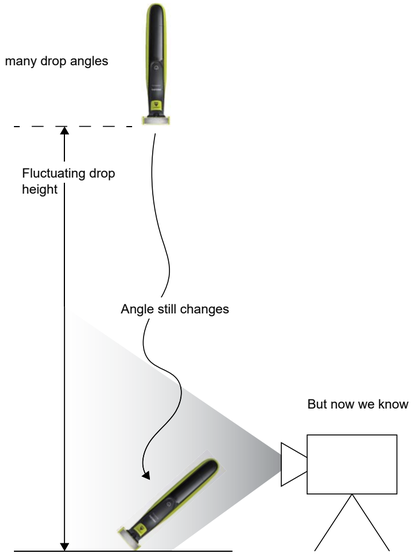


Fig. 58: My method

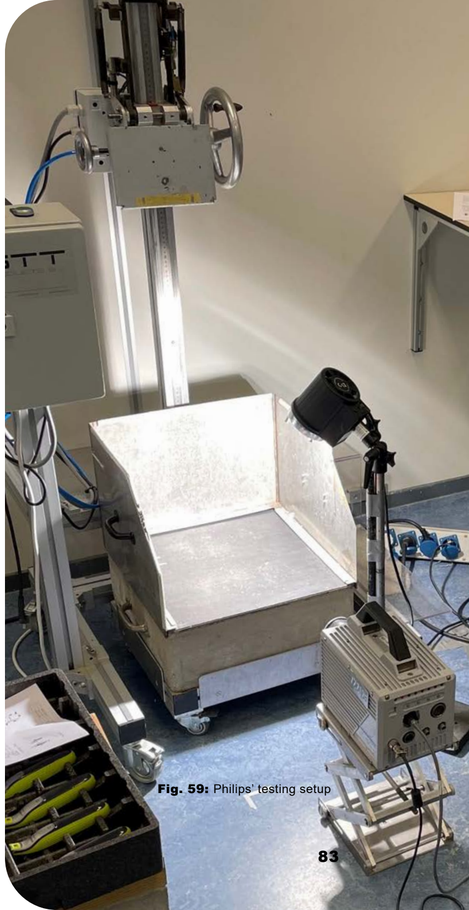


Fig. 59: Philips' testing setup

6.2 | **Current solutions**

Currently the 360 shaving head spots two main solutions to increase impact resistance. This paragraph will go over them, discuss how well they work and what a redesign could improve.

Side flap for preventing over-rotation

When a force is applied on the side of the blade, over-rotation is stopped by the purple side flap and the blue click in hitting each other.

Testing shows this does not work well. In some scenarios the force is too big and the flap breaks, making the hinge over-rotate and break as well. In other scenarios a break is stopped (see fig. 60). However instead the force bends the blade assembly, making it unsafe to shave with. This means that increasing the side flap strength will not solve the problem.

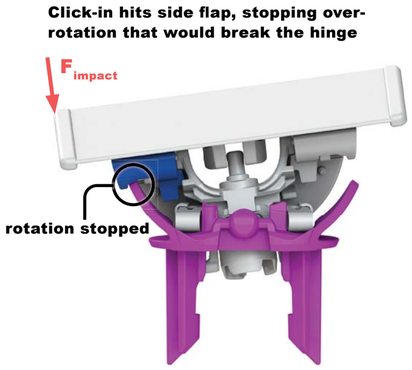


Fig. 62: How the side flap prevents over-rotation

Fig. 60: 90cm hinge opens as intended

Fig. 61: Blade bends, becoming unsafe to use

Hinge can open to dissipate energy

When a force is applied on the front or back of the blade, the blue click-in stop pushes against the yellow hinge. If enough force is applied the hinge opens, dissipating energy. After this users can non-destructively click the hinge back in.

Testing showed that the system does work to an extend, opening when a moderate straight force is put on it. However when the straight force is too great the snap-fit breaks (see Fig. 65). Additionally if it doesn't fall straight the opening of the hinge seems to reduce drop resistance. This is because with the hinge opens the stiffness of the rest of the head is reduced, making it more susceptible for torsional forces.

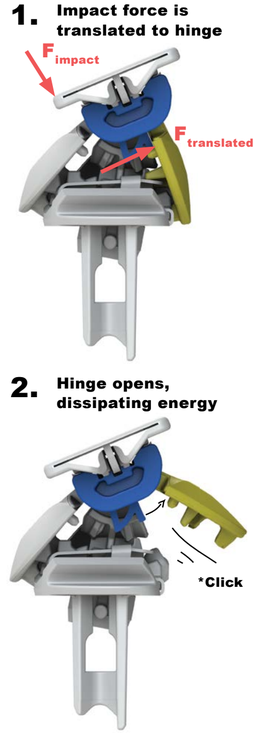


Fig. 63: How the opening hinge works

Fig. 64: 110cm hinge snap-fit breaks

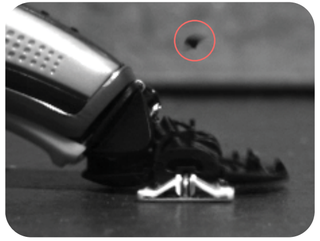


Fig. 65: 110cm reduced torsion resistance

Fig. 66: 90cm hinge opens as intended

6.3 | **360 head breaking behaviour**

Through analyzing the drop test results it was found that when it falls on the handle the head doesn't break. However when it falls on the head four factors are found to define the heads' fate

1. It falls on the top or bottom half of the blade.
2. It falls on the point or on the edge of the blade.
3. The force vector lies inside or outside the handle.
4. It falls within or outside of the rotation range of the hinge.

Combining these results in 8 scenarios (only 8 as some are not possible due to the angle of the blade in relation to the handle). 4 survive and 4 break. This behavior is further discussed in the next paragraphs, finishing with a rough current breaking percentage.

6.3.1 **360 head survives**

The four factors lead to four scenarios in which the 360 heads can make it if falling from 110cm. These scenarios are split in two reasons why it survives.

1. A moment arm is created that can pull the head loose from the body before forces inside the head become too big.

    - **It falls on the bottom half of the blade.**
      This produces a moment that pulls the head loose, dissipating energy.

    - **It falls on the top half of the blade, but on the side, with the force vector being outside of the handle**
      This allows hinge to rotate around it's secondary axis, making the blade slide away, creating a moment arm that pulls the head out, again dissipating energy.

2. No moment arms are created anywhere.

    - **It falls inside the rotation range of the hinge**
      If the head falls inside it always survived tests. It is expected this is because no pulling force is applied to any components

In all other scenarios forces build up and break the head in various unpleasant ways.

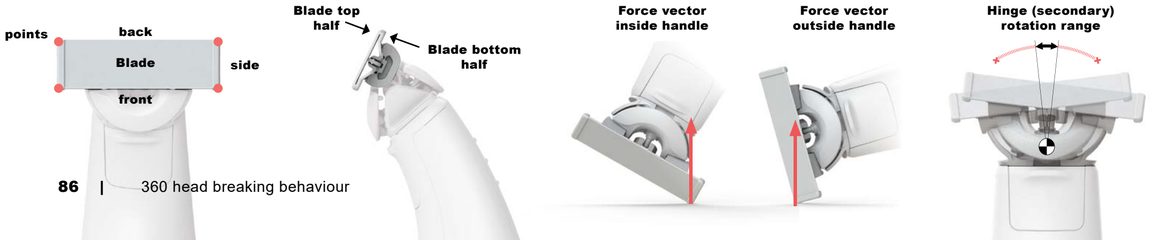


Fig. 67: Explanation of terms of the factors

- Blade bottom half
- Blade back edge
- Vector outside body
- Outside hinge rotation range

- Blade bottom half
- Blade back point
- Vector outside body
- Outside hinge rotation range

- Blade top half
- Blade side
- Vector outside body
- Outside hinge rotation range

- Blade top half
- Blade front edge
- Vector inside body
- Inside hinge rotation range

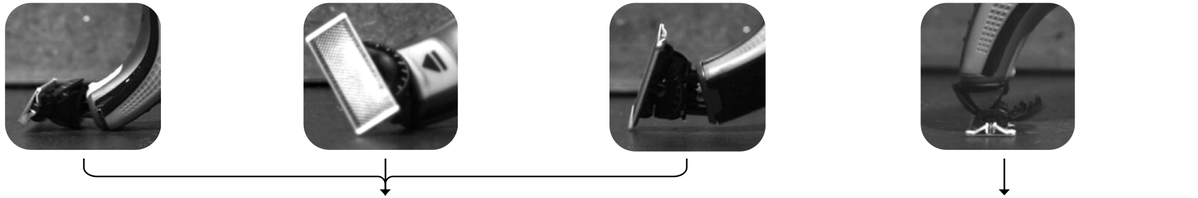


Fig. 68: four scenarios where the 360 head survives when it falls on the head from 110 cm.

- Blade top half
- Blade front point
- Vector in- and outside body
- Outside hinge rotation range

- Blade top half
- Blade back point or side edge
- Vector in- and outside body
- Outside hinge rotation range

- Blade top half
- Blade back edge
- Vector in- and outside body
- Outside hinge rotation range

- Blade top half
- Blade front edge
- Vector in- and outside body
- Outside hinge rotation range

Moment around side of the blade that cannot be dissipated

Force on the top/front of the blade cannot be dissipated due to small moment arm between the interface and the blade

Break from 70 cm on

Guard snapfits shear off due to moment, destructively disconnecting the blade assembly.

Break from 70 cm on

The front ball hinge snap-fit detaches, putting all the force on the side flap. If the side flap breaks, the hinge over-rotates, breaking off the frame legs and destructively detaching the top half of the head. If the side flap stays intact the moment created around it shears of the guard snap-fits or hinge pins, or detaches the frame arms.

Break from 70 cm on

The front ball hinge detaches, over-rotating the primary hinge. This puts a pulling force on components. Result: guard snap-fits shear off, hinge pin(s) shear off, the frame arms detach, frame leg(s) break/detach or an interface leg breaks. This at least detaches the blade assembly from the head.

Break from 70 cm on

Ball hinge snap-fit breaks off due to pulling force.

Fig. 69: four scenarios where the 360 head breaks when it falls on the head form 110 cm.

6.3.2 **360 head breaks**

The four factors also lead to four scenarios in which the 360 head breaks when falling from 110. Again these scenarios are split in two reasons for breaking.

1. A moment is created within the hinge around the side flap or frame that cannot be dissipated, breaking components instead.
   - It falls within the blade top half on the blade side or points outside of the hinges' secondary rotation range.
2. A moment arm is created within the hinge around the hinge pins that cannot be dissipated, breaking components instead.
   - It falls within the blade top half on the blade side or points outside of the hinges' secondary rotation range.

The forces forces leading to failure are more clearly displayed in Fig. 71 and Fig. 70.

Fig. 71: Moment around side of the blade cannot be dissipated

Fig. 70: Force on the top/front of the blade cannot be dissipated due no small moment arm between the interface and the blade

6.4 | **Conclusion**

6.4.1 **Breaking chance**

Using the insights from the drop-tests 2D diagrams with breaking angles can be made (see Fig. 72 and Fig. 73). These show that, if each drop angle has the same chance, the 360 shaving head has a ~25% chance of breaking when dropped from 110 cm. However for a more precise number a 3D diagram should be made.

Additionally through understanding the breaking behavior strategies for increasing impact resistance could be defined. These are discussed on the next spread.

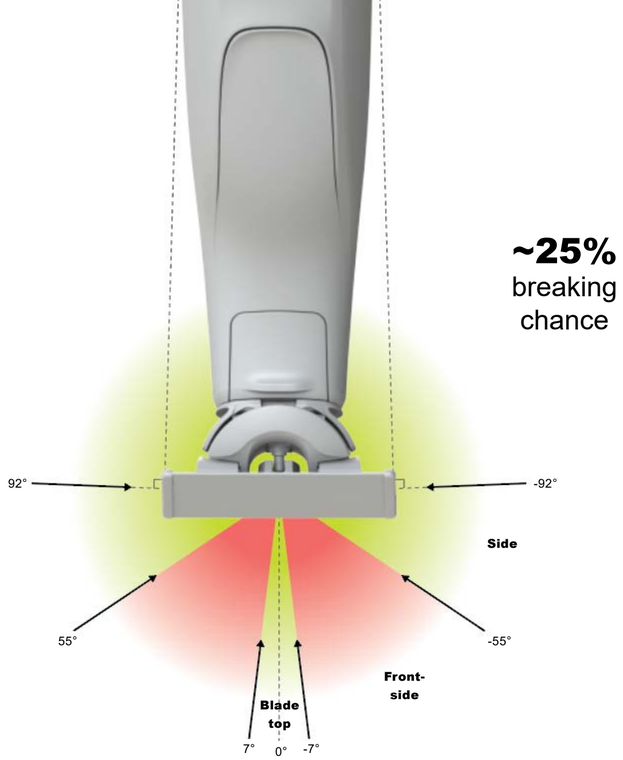


Fig. 72: 2D breaking chance graph from the front.

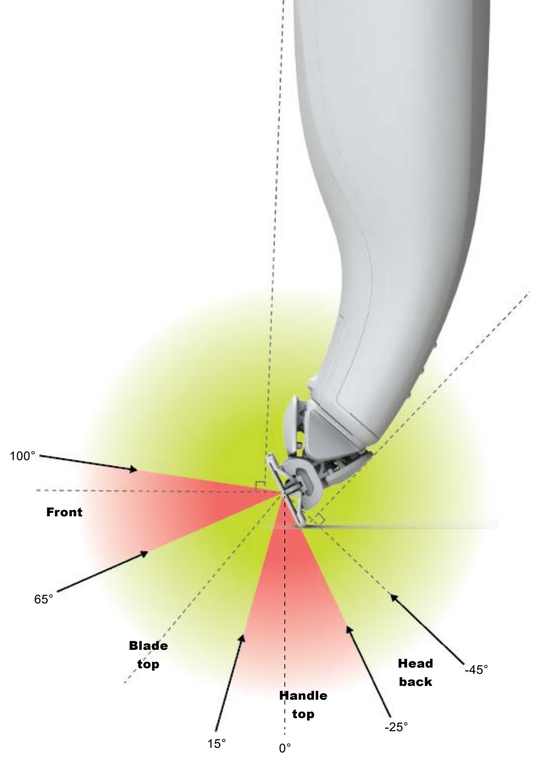


Fig. 73: 2D breaking chance graph from the side.

6.4.2 **Limitations**

Some drop angles only have results for 110cm drop. This is because of the limited time available, the difficulty of achieving some drop angles, and the iterative nature of the research.

For this project however this is not especially important. The goals were to understand breaking and to quantify breaking chance at 110cm, which was achieved.

Part 2

Summary & conclusions

Through the previous five chapters enough information has been gathered to answer RQ2.1. This is captured in the list of requirements on the next page.

RQ2.1 What requirements should a redesign adhere to make it feasible, viable and desirable?

Additionally through researching the shaving head and its breaking behavior RQ2.2 was answered, which shows ideas for RQ2.4.

RQ2.4 What strategies exist for increasing the 360 shaving head impact resistance?

Potential impact resistance strategies

Remove moment arm in hinge

A break happens because the forces from an impact have to travel from the handle, through the fragile hinge, to the blade. If the force can directly travel between the blade and the handle, the hinge will survive. This is explored in the recommendations.

Allow the head to always detach before forces become critical

Instead of negating the forces they could also be dissipated before they lead to breaking components.

Increase shaving head component strength

You would think a solution would be to increase the strength of hinge components or the connections between them. However this will not work, because if the hinge wouldn't break, the blade would. It would take the brunt of the force and deform, stopping it from moving or making it a hazard to shave with.

This means that the impact resistance of the blade assembly should be increased before the hinge, which is out of scope.

Reduce force through minimizing handle weight

If the handle weights less potential energy and thus the impact force is reduced. A new lighter handle called the 1st shave just entered the market (see chapter 2.4.2) completing this direction.

Protection

Protection like the shaving head cap (see 2.4.4 on page 38) dissipates force when the OneBlade is dropped outside of shaving. This will significantly reduce breaks, as a small user test (see page 52) shows that the majority of breaks happened outside of shaving. The only thing is that users should not forget to apply this protection, which could be designed for. However due to the energy label not allowing protection this is out of scope (see 4.3.3 on page 58).

Requirements

Feasibility

RF1 The 360 shaving head has 110cm impact resistance
RF2 The new V2 handle has 110cm impact resistance
RF3 Primary rotation range is ~50° and secondary rotation range is ~14°
RF4 The neutral position of the blade is angled forward
RF5 Moving the blade should take ~1 [N]
RF6 Primary rotation point must be within 1mm of the skin
RF7 During shaving the head should not detach when a force of 15 [N] placed parallel on the blade
RF8 Handle neck shape cannot be changed
RF9 Handle is and remains IPx7 waterproof
RF10 When an idea requires the blade to be reattached by a user, the spindle should always fall correctly within the spindle capture.

Viability

RV1 Shaving head and handle markup cannot be reduced unless it offers Philips value that is at least equivalent
RV2 No changes to the blade
RV3 A potential new interface shape should be patentable
RV4 The 360 shaving head and new V2 handle have 110 cm impact resistance without using external protection.

Desirability

RD1 Changing the shaving head should take no more than 9 [N]
RD2 How to change the shaving head is easy to understand
RD3 Shaving head can only be placed on the handle in the correct orientation
RD4 Shaving head retail price cannot change
RD5 Handle will survive 7 years of use

Nice to haves

Feasibility

NF1 Secondary rotation point should be ~10mm from the skin
NF2 Powertrain should not be changed

Viability

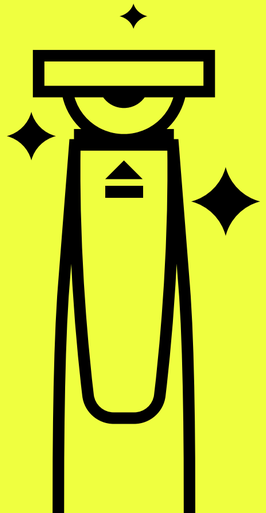
NV1 No changes to the guard

Desirability

ND1 Shaving heads remain backwards compatible
ND2 If a part of the head or handle detaches or opens, users understand that this is not a break and how it can be reattached or closed.
ND3 Maximize ease of (dis)assembly
ND4 Minimize waste generation
ND5 Maximize ease of cleaning

Part 3

Design



This part will go into both the idea finding and solution finding phases. For this five ideation loops were gone through. As each has hit own take-aways, all will be discussed quite linearly, ending with conclusions leading to recommendations. Findings are discussed in the following chapters.

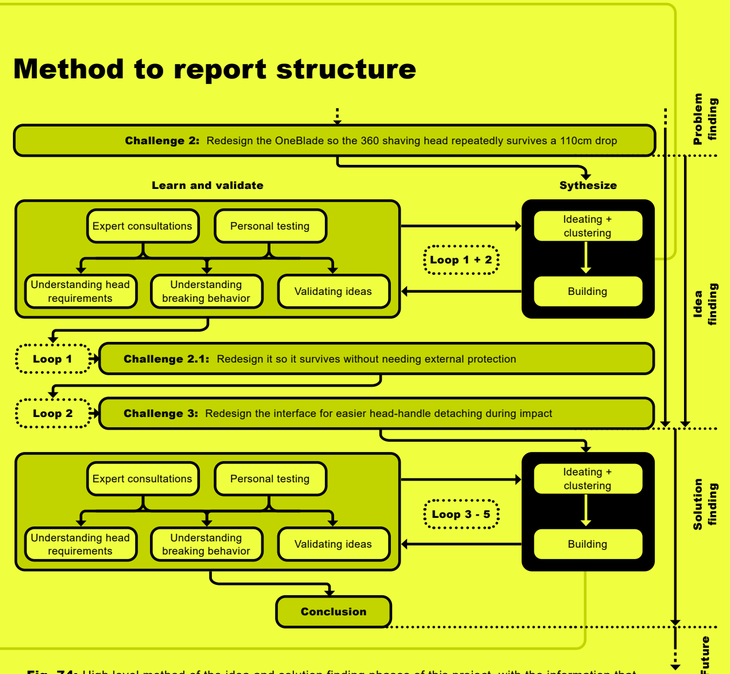


Fig. 74: High level method of the idea and solution finding phases of this project, with the information that will be discussed in part 3 being highlighted in black.

Two non chronological mentions:

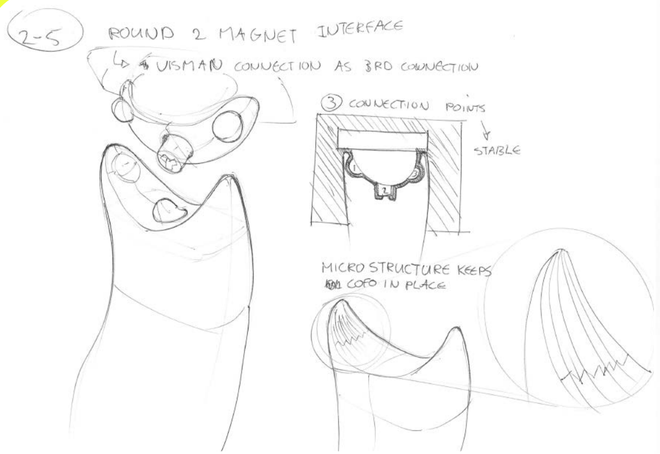
As previously discussed the ideation was conducted parallel to researching the OneBlade breaking behavior and requirements. Important to not here is that during the entire idea finding phase the High-speed camera was not available yet, meaning that some insights discussed on the previous spread were not yet known when a direction was chosen.

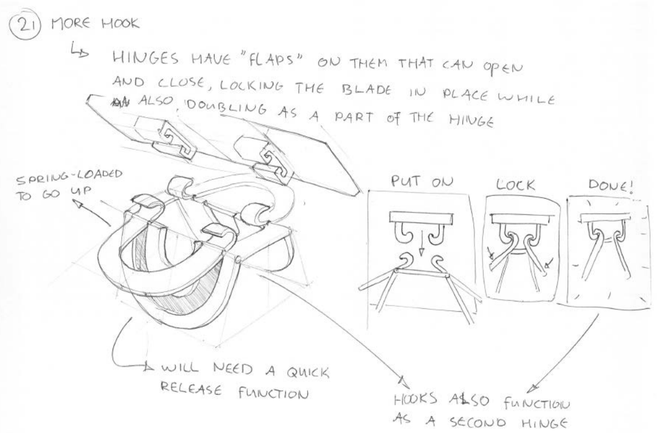
Additionally the energy label regulation was published at the end of the idea finding phase. As external protection is not expected to be possible, all ideas regarding this were scrapped, while the idea at that point was to choose on of them.

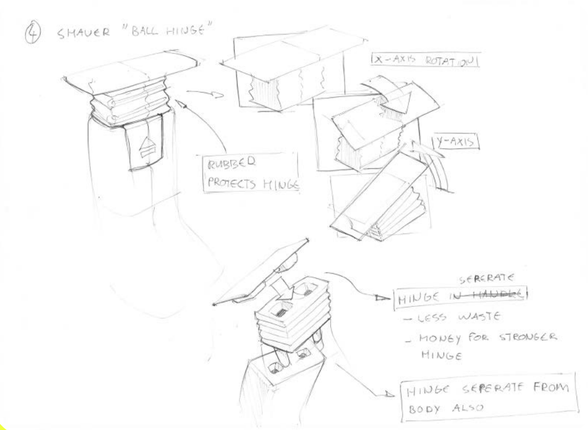
Chapter 7

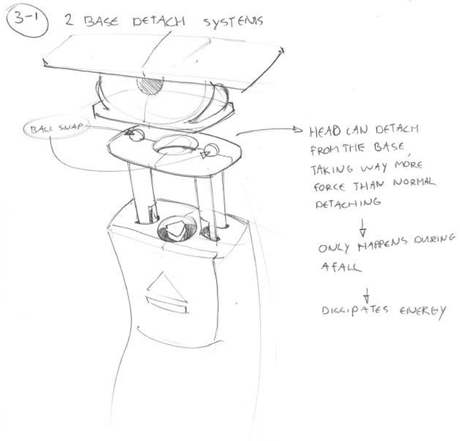
Idea finding

This chapter will go into the ideation part of the idea finding phase, going through the creative process that was used to get to the final design challenge, while also introducing ideas that are further explored in the recommendations.









7.1 | **Idea finding process**

The design challenge, shown on the top right, was too broad and needed to be scoped further. This was achieved through the process shown in Fig. 75. As engineers already worked on this problem for years, the goal of this ideation was to find unexplored angles through 1. Starting the ideation without knowing the requirements and 2. After knowing the requirements deliberately breaking them. The more specific phases of this ideation and the used methods are described on the next page.

Important to note again is that this process takes place before breaking behavior was understood, as the high-speed camera was unavailable.

Research questions

RQ2.4 What strategies exist for increasing the 360 shaving head impact resistance?

RQ2.5 What strategy has the most potential within my scope?

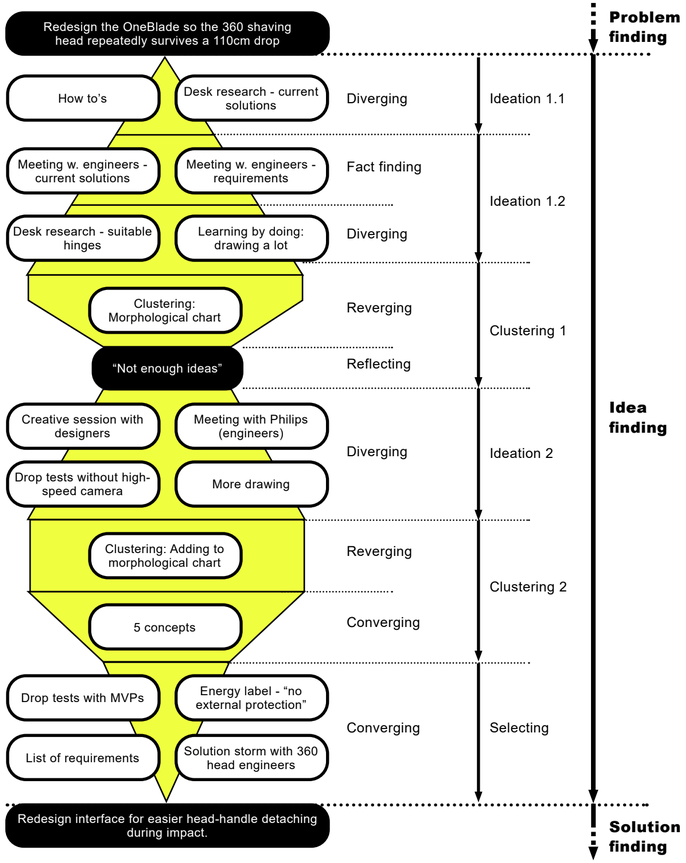


Fig. 75: Overview of the process of the idea finding phase

7.2 | **Generating ideas**

Ideation 1.1 - not understanding reqs.

First information was gathered to facilitate out-of-the-box ideas:

Desk research (appendix 12.5.2)

- Products with hinges
- Current impact resistance solutions if shavers and other products

How tos for broad inspiration (appendix 12.5.1)

- H2 connect two things?
- H2 connect two things in a way that they can move?
- H2 make something impact resistant?

With this list ideas were generated through individual drawing and reflecting on them with other designers.

Ideation 1.2 - understanding reqs.

After this the main 360 shaving head requirements, like close primary rotation point, were learned from engineers. Through this input additional desk research was conducted into hinges, and more ideas were drawn out.

Clustering 1 and reflecting

All ideas were clustered using a morphological chart. However it showed that no clear solutions had been found yet, with more ideation being deemed necessary.

Ideation 2 - external input and drop-tests

As creativity had run dry external input was gathered through conducting a creative session with designers and discussing with Philips employees. Additionally conducting drop-tests provided a better understanding of breaking behavior. All resulted in new insights. For all ideas see appendix 12.5.3.

7.3 | **Clusters**

Clustering 2

New ideas were added to the morphological chart and 5 final clusters were defined. For the morphological chart see appendix 12.5.6. All final ideas break at least one requirement (req) or nice to have (n2h), as Philips engineers had already explored the rest.

Combining ideas while looking at the requirements led to 5 concepts discussed on the next spread. The **bold codes** in the challenges are requirements (**R**) and nice to haves (**N**) about feasibility (**F**), viability (**V**) and desirability (**D**) specified on page 93.

Blade assembly can detach

The blade assembly (or just 'blade') detaches non-destructively from the rest of the shaving head, dissipating energy before parts start breaking.

Additional advantages

- If the blade is designed to also be easily removable by users, this would mean that the lower part of the body would not have to be thrown away during replacement, reducing waste.

Challenges

- **RF6:** An attach/detach system should still have a <1mm primary rotation point, in practice meaning it has to be very small.
- **RF10:** When reattaching the blade, the spindle has to fall into the spindle capture. With the current design of the hinge this is not possible.
- **NV1:** Would likely require changes to the guard, which is expensive.
- **ND2:** Users will not understand that the blade can be put back, seeing it as a break (Philips, 2023).

Shaving head can detach more easily

The shaving head can detach in every angle, not just when falling on the side/back, dissipating energy before parts start breaking (see 6.3.2 on page 89).

Additional advantages

- /

Challenges

- **RF7:** The head has still be attached strong enough to not decouple during shaving
- **RD1+RD2:** The head should still be easily replaceable by users.

Unless shorter legs work, the v-shape of the legs has to be changed, with backwards compatibility is lost, introducing additional challenges.

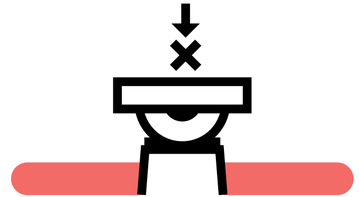
- **RV3:** New patents for the leg shape have to be (able to be) filed, costing money.
- **ND1:** Current handles will need a way to fit the new head (e.g. add a coupling piece) otherwise becoming obsolete.
- **RF8+NF2:** The new legs should still fit the handle

Increased hinge toughness

The shaving head is redesigned in such a way that the hinge always survives a 110cm drop. In the end none of the ideas in this cluster were deemed feasible.

Reason for dropping this cluster

- If the hinge is made stronger, the blade will bend/break instead, not solving the problem (see page 84).
- Even if the blade survives, all feasible ideas would increase the production price. As Philips will not want to cut in their profits, retail prices would rise, and with high shaving head cost being the second most important found stopping reason for users (see page 50), this would increase e-waste.



Never falls (on the shaving head)

Through intelligent design the shaver is redesigned in such a way that it never falls on the head in the first place. However again no ideas in this cluster were deem feasible

Reason for dropping this cluster

Ideas consisted of two sub clusters, but no feasible ideas were found.

- The first cluster consists of ideas assuring the OneBlade will not fall (on the head) outside of shaving. These will however not help with the repeated free fall reliability score on the energy label (see page 58), which makes them unfit.
- The second cluster consists of ideas assuring that the OneBlade will not fall on the head during shaving: The only potentially feasible idea found was moving the OneBlades' center of mass away from the shaving head, reducing the change it is hit. However, as heavy components are already in the bottom the only way to move it would be increasing the weight of the handle bottom, which would mean that if it falls on the head, it breaks faster.

Integrated external protection

The majority of breaks happen outside of shaving (see page 52), while the current options for OneBlade external protection allow users to forget to apply them. These ideas aim to make applying external protection a no-brainer.

Cluster discussed in recommendations

- This cluster was thoroughly explored with two interesting concept directions being defined. However the upcoming energy label regulation made them out of scope for this project. They are discussed in the recommendations in 9.1.4 on page 143.

7.4 | **Concept directions**

Through combining ideas and comparing and judging them based on requirements three concept directions were formulated.

No parts that can break:

1. Skid bearing hinge + rotating body

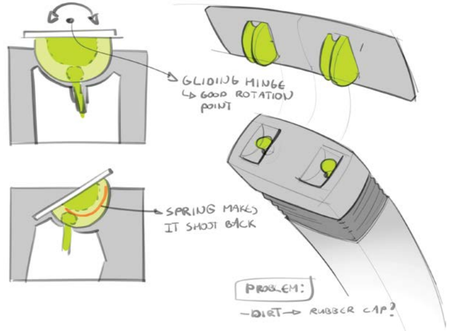


Fig. 76: Concept direction 1

The interface is changed into two balls on which a skid bearing snaps. Sideways rotation is moved inside the body. The idea is that all intricate parts are removed. If it falls on the side there is nothing to break (assuming that the skid bearing can withstand the applied shear force) If it falls on a blade edge the blade will detach, and if it falls on the front the blade is supported by the body.

Blade detaches before parts break:

2. Pinch-release hinge

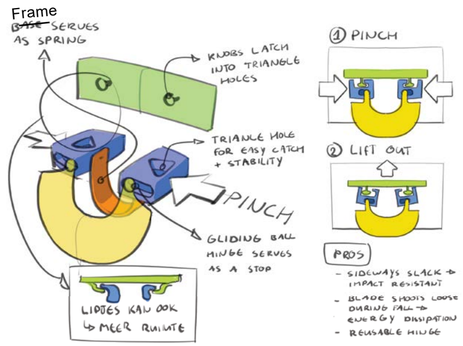


Fig. 77: Concept direction 2

The blade is made to be able to detach during a fall, while also allowing easy attaching/ detaching by users. The idea is that the hinge can be ‘pinched’, unlocking the green blade from the blue click-ins. Pinching is enabled because the yellow hinge flaps can glide sideways in the blue click-ins, and because the orange frame acts as a spring.

Head detaches before parts break:

3. Magnetic interface

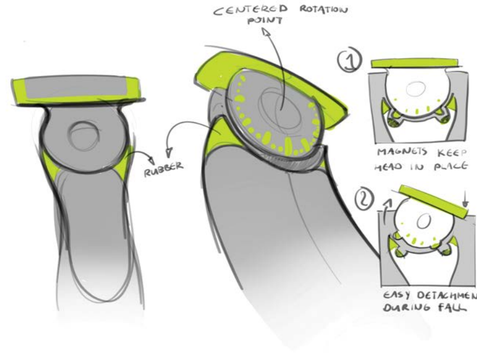


Fig. 78: Concept direction 3

The complete shaving head is made to always detach during a fall before parts break. The idea is that the legs are shortened to allow for easier detaching, and turned into magnets that can give way a little when put under force, dissipating energy (they also feel very premium, potentially increasing attachment). Furthermore the interface is rounded, the idea being that this both facilitates easier detaching and accentuates the current round hinge design.

7.5 | **Choosing concept direction**

For choosing a concept direction three things were done. Firstly their feasibility was tested by making and testing minimum viable products (MVPs). Secondly with this knowledge the concept directions were judged based on the then latest requirements and nice to haves (see Table 6). Lastly the concept directions were discussed with 360 shaving head engineers during an hour long solution storm, resulting in a final list of pros and cons (and the generation of extra ideas for the next phase).

7.5.1 **Feasibility testing with MVPs**

- Skid bearing hinge - not tested as MVP was too difficult to make for a concept that was scoring low.
- Pinch release hinge - fail, but no parts broke
- Magnetic interface - survived 110cm drops in all 6 directions, but was too loose to shave with.

Fig. 79: MVP of the pinch-release hinge concept: Click-in snap fits are filed of, with the blade being kept in place by metal fins instead. This mimics the concept

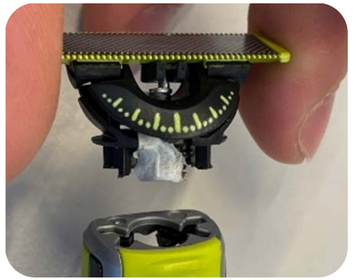


Fig. 80: MVP of the magnetic interface concept: Legs are shortened and the head-power connection is replaced by a magnet, mimicking the concept idea.

Fig. 81: Making and testing this MVP how fragile and thus difficult this concept direction is. Unfortunately during these drop-tests the high-speed camera was not yet available, having to film with a phone instead.

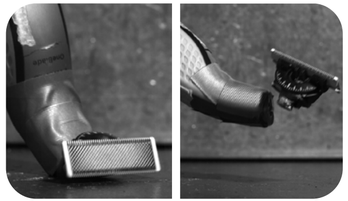
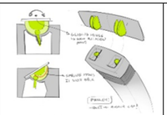
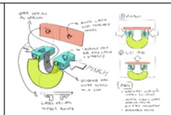
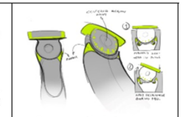


Fig. 82: Making and testing the MVP showed to potential of this direction, with the head surviving all drops. This was the very first video I shot using the high-speed camera.

7.5.2 **Judging concept directions based requirements and nice to haves**

Concepts -> Requirements \/	 **1 skid bearing hinge**	 **2 Pinch release hinge**	 **3 magnetic interface**
Survive a 110 cm fall	+1	+1	+2
Survive fall without external protection	+2	+2	+2
Moving the blade takes 1N	+1	+2	+2
Primary rotating point within 0.5mm	+2	+2	+2
Secondary rotation possible	-1	+2	+2
Watertight	+2	+2	+2
Allows for blade replacement	+2	+2	+2
Minimized blade-spindle slack	-1	+2	+2
Head doesn't detach during shaving	+2	+1	0
Feasible within project timeframe	-1	-2	+1
Nice to have			
Survives a fall during shaving	+1	+1	+1
Minimized effort of use	+2	+2	+2
Backwards compatible interface	-2	+2	-2
No changes to the guard	-2	-2	+2
Minimized shaving head cost	+2	+2	0
Maximized ease of blade replacement	0	-1	+2
Minimized waste generation	+2	+1	0
Maximized ease of cleaning	+2	0	0
Score			
# of penalties*	5	2	1
score	14	19	21

*In requirements -1 is a penalty, in nice to haves -2 is a penalty

Table 6: Choosing a concept direction based on the requirements and nice to haves (LOR) as it was back then.

7.5.3 **Final pros and cons**

The following list of pros and cons was the result of a creative session with (Philips (4,20), 2023).

Skid bearing hinge

- Skid bearings are not feasible for the OneBlade. It has been tried in the past, but hairs get into the hinge, stopping rotation.
- Adding a rubber cover to solve this is not possible. When integrated in the handle, it would degrade too quickly, causing handle failure before its designed 7 year lifetime. When added to the shaving head, it would make the heads too expensive.
- Compared to other concepts it is the least viable. Changes to both the interface and guard are needed, meaning very high development cost.
- Not feasible within the time-frame of the project. The shaving head and handle interface would have to be redesigned from scratch, something engineers expect would many months.
- Unknown if this direction will actually improve impact resistance.

Pinch release hinge

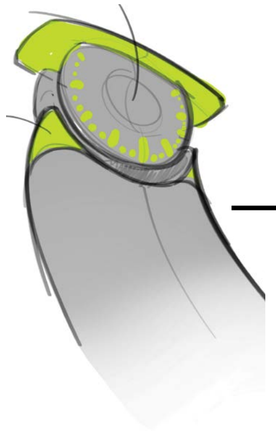
- Backwards compatible, so best solution
- However this idea probably won't work. The system holding the blade in place has to be so small that it will still break during a drop.
- And even if it were possible, development would not be possible within the project time-frame.
- Philips tried something similar, but was not able to make it work.

Magnetic interface

- This direction has not yet been explored, and is expected to work. This is further substantiated by the initial drop test results.
- However backwards compatibility is lost, making it unfit to be implemented in the near future. It should be tried to solve this, however even if this is not achieved, the input is definitely valuable for potential future generations.
- Possible within the time-frame of the project.
- However other clamping methods than magnets should be explored, as they are expensive and are expected to not have enough clamping force for a stable connection.

7.5.4 **Conclusion**

The magnetic interface concept shows the most potential. However, as engineers doubt if magnets will work, a step is taken back and the whole 'shaving head can detach more easily' cluster will be explored in more depth, giving rise to the final design challenge:



7.6 | **Design challenge #3**

Redesign the interface for easier head-handle detaching during impact

Chapter 8

Solution finding

In this chapter the ideation part of the solution finding phase will be linearly discussed, explaining the four concepts and their validation process.

8.1 | **Solution finding process structure**

For getting to the final conclusion three more iteration loops were conducted, leading concept V1-V4 (see Fig. 84). This paragraph describes the process structure, with the process findings being discussed in the coming sub-chapters.

Research questions

RQ2.6 How can the impact resistance of the 360 shaving head be maximized through changing the head-handle connection?

RQ3.1 What is the impact resistance of redesigns?

RQ3.2 What is the (shaving) experience of redesigns?

Six requirements

Before ideation was started additional requirements were gathered through meetings with engineers, adding to the list in Chapter 5. Here it was also found that I needed to know how strong the interface connection should be, but that currently Philips had no requirement for this. After meetings with four specialists the setup discussed on page 76 was decided on.

Loop 3 - Concept V1

Before over-analyzing it was decided to make a quick first prototype to learn by doing, resulting in concept V1. It led to learnings like: how does prototyping work at Philips and what is possible? What kind of tolerances should I Use? how much time does making a single prototype take? Also a process for validation was found, with three requirements being tested (see the coming chapters).

Loop 4 - Concept V2

During this loop the bulk of ideation was conducted. Ideas from the solution storm were worked out and ideas were sparked by doing more drop-tests with the current 360 shaving head. Also many coffees were had with engineers, interns and designers that led to new insights leading the idea for V2 being conceived. Through building multiple prototypes the final V2 was made and tested.

Loop 5 - Concept V3 and V4

Testing showed that V2 detached too easily. Because of this the third loop was conducted, resulting in V3 and V4. With these insights the final conclusion could be made.

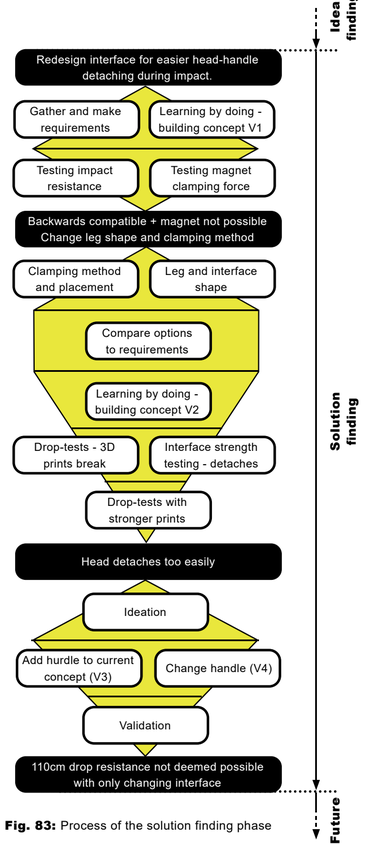


Fig. 83: Process of the solution finding phase

Fig. 84: The physical prototypes of three concepts that were developed (and their names). V4 looks like a normal handle and was left out.

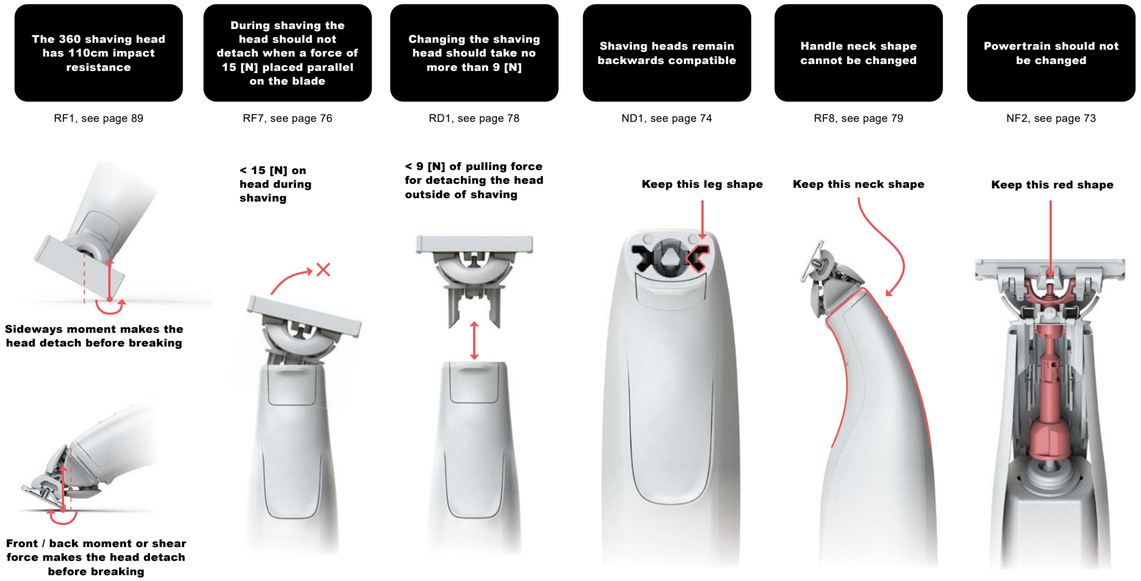


Fig. 85: Main requirements for redesigning the interface

8.2 | **Solution space**

8.2.1 **Six requirements**

Building on the list on page 100, six main requirements were found to be important (see Fig. 85). Further information on them can be found in the specified chapters. The requirement 'only one placement method' (RD3, see page 75) is left out due to retrofitting always being possible.

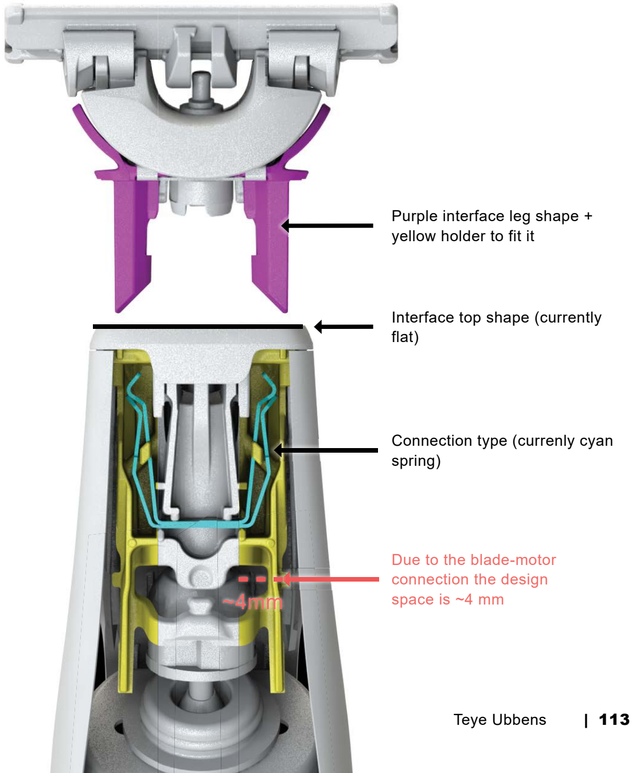
8.2.2 **Components to redesign**

The requirements mean that three things can be redesigned

- **The interface legs (and holder)**
  The shape of the purple interface legs can be changed to allow for easier decoupling. This also means the yellow holder has to be redesigned to fit the new legs. However, as the blade-motor connection and neck shape cannot be changed, the new legs can only fit into the yellow area.

- **The interface top shape**
  Currently flat. Changing it might allow for easier decoupling.

- **The clamping method (the spring)**
  The current clamping method (spring) can be changed to allow for better decoupling.



8.3 | **Concept V1 “Magnetic interface”**

8.3.1 **How it works**

Concept V1 was made for three reasons:

- Test if backwards compatibility is possible.
- Test if engineers are right about magnets not being a feasible clamping method.
- Encounter potential unforeseen problems through physical making (learning by doing)

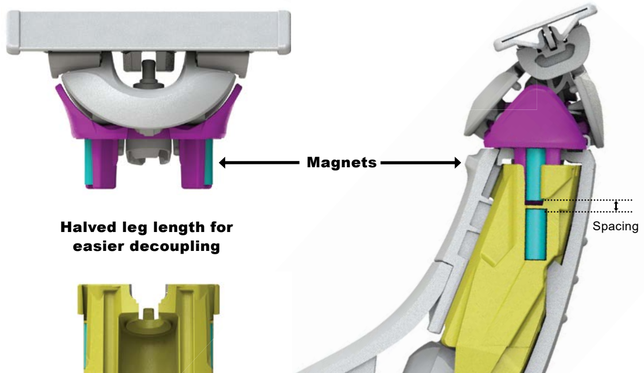
Clamping method - magnets

As mentioned in ‘Magnetic interface’ on page 103, magnets are used instead of a metal snap-fit.

Leg shape - same but shorter

The original leg shape is kept, but the legs are shortened to allow for easier detaching. The idea is that the legs can be made out of metal, allowing magnetic clamping while keeping backwards compatibility. However as this was difficult to make magnets were put in the legs instead, achieving the same effect.

Fig. 86: Concept V1



8.3.2 **Process**

Researching clamping method

Through using the CAD model of the 360 head different configurations of magnets were tried to find the best way to use them. This led to three findings. Firstly due to the powertrain assembly two magnets have to be used. Secondly the biggest size of magnets fitting the handle is 2x2x5 mm with an estimated clamping force of ~0.8 [N] each, which is not a lot. Thirdly to keep the magnets in place a bit of material needs to be added above them, spacing them from each-other (see Fig. 86), reducing clamping force.

Researching leg shape

To keep backwards compatibility only the leg length should be changed. The legs should be short enough to easily detach, but long enough to allow for stable shaving. The leg was cut shorter in increments, with a length of 6 mm still offering enough stability and being chosen.

Interface top shape

Interface top shape isn’t changed as backwards compatibility would be lost.

8.3.3 **Validation**

For validation only three requirements needed to be tested. This is because keeping backwards compatibility and not changing the neck or powertrain shape are already incorporated in the design.

Doesn’t detach during shaving

To test if the connection between the shaving head and the handle was strong enough a shaving test was conducted on myself. Though this it was found that while shaving down, the head would half-detach from the body. This happens because the clamping force of the magnets isn’t big enough, resulting in an unpleasant shaving experience and the requirement not being met.

Changing the head takes less than 9 [N]

To test if the connection is not too strong the head was attached to a force meter. This showed that the clamping force of the magnets is only ~1 [N], meeting the requirement, but also explaining why the head detached during shaving.

Fig. 87: V1 sligtly detaches when shaving down, resulting in a bad shaving experience

Fig. 88: Measuring force needed for detaching V1

110 cm impact resistance

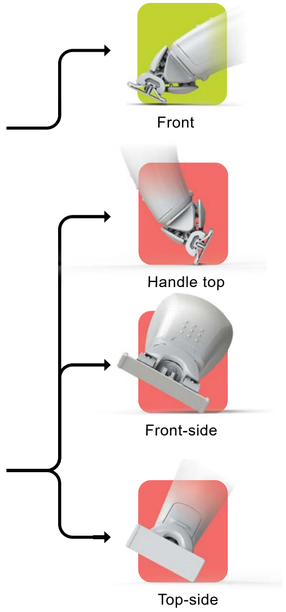
Normally impact resistance is tested with a drop test. However pushing pushing the OneBlade on a table based on the 8 directions defined in chapter 6 showed enough results.

The head does detach when pushed on the front, as the shorter legs + magnets combination allows for the head to lift out more easily (see Fig. 89)

However the legs do not allow detaching when pushing on the sides, as their straight shape doesn't turn sideways force into a detaching motion. The same the applies when pushing on the top. This means the requirements is not met.

Fig. 89: Detaches when pushed on the front

Fig. 90: But not when pushed on the top or sides



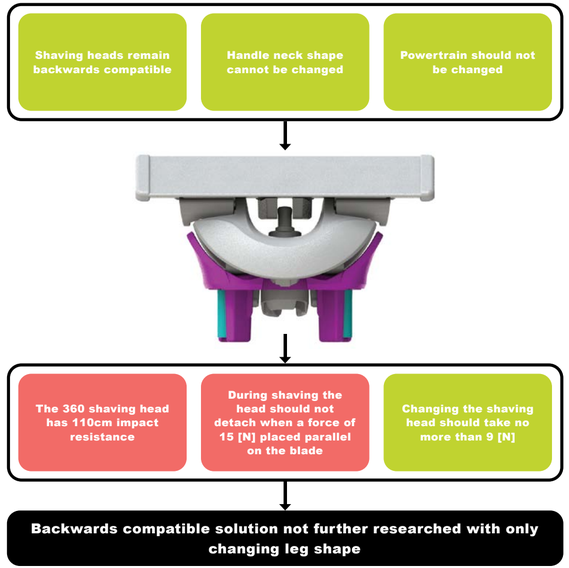


Fig. 91: Results of the validation of concept V1 and next steps

8.3.4 Conclusion

Backwards compatible legs not expected to work within scope

Straight legs are found to not detach when a top/sideways force is put on them. This is because they stop a moment. Other leg shapes have to be designed, accepting that backwards compatibility is lost and the project is a study for potential future OneBlade redesigns.

Magnets not expected to work

Due to the limited space big enough magnets don't fit. Additionally as magnet allow for a bit of play, the shaving experience is reduced. And even if they did their cost would be too high to be viable (Philips (5), 2023). Because of this other clamping mechanisms should be explored.

Other

3D printing small prototypes is found to be possible with Philips' specialized printers, meaning that I have a lot of design freedom.

8.4 | **Concept V2 “slanted legs”**

8.4.1 **How it works**

Based on the findings a second ideation was conducted and concept V2 was made.

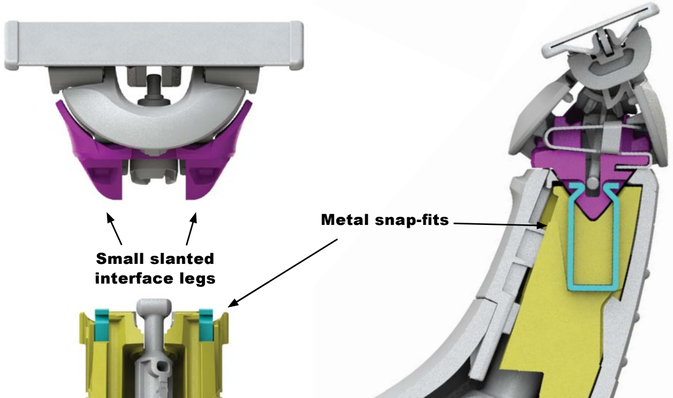
Slanted legs

Smaller, slanted interface legs allow for easy detachment at every drop angle (see Fig. 92). When a force is applied from the front or side, the head decouples as the legs can rotate out due to the angle (see Fig. 93 and Fig. 94. When torsion is applied the angle of the legs makes the head rotate themselves out (see Fig. 95).

Metal snap-fits

The used clamping method was changed back to metal snap-fits.

Fig. 92: Concept V2



Top-side

Fig. 93: Detaches with a sideways moment

Handle top Front

Fig. 94: Detaches with a small frontal moment

Front-side

Fig. 95: Detaches with sideways torsion

8.4.2 **Process**

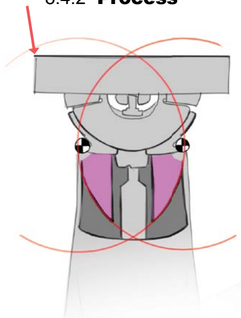


Fig. 96: Round leg shape maximizing ease of detaching with sideways moment.

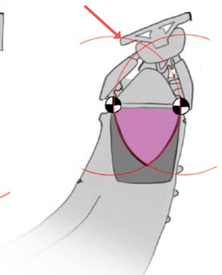


Fig. 97: Round leg shape maximizing ease of detaching with front/back moment.

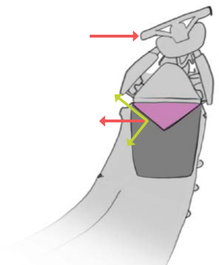


Fig. 98: Leg angle should be minimized for maximizing ease of detaching with torsion .

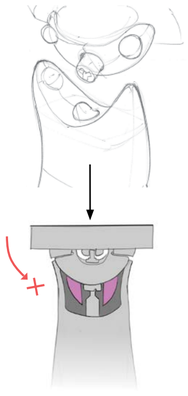


Fig. 99: Rounded interfaces and why they won't increase impact resistance

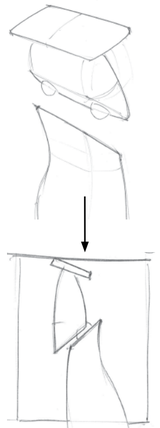


Fig. 100: Slanted interfaces and why they won't increase impact resistance

Researching interface legs shape

Firstly the idea of this concept was that the legs should allow the head to decouple as easily as possible. For this two leg factors were researched: the shape and the configuration.

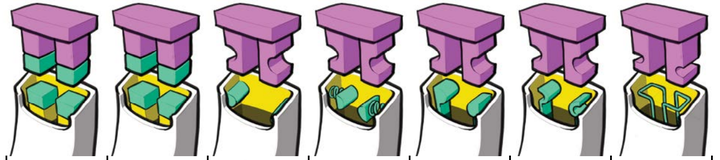
The leg shape was optimized through analyzing drop-tests (see chapter 6), with three types of forces being identified. Fig. 96 to Fig. 98 show how the these lead to the shape of V2

The leg configuration was researched, with 7 possibilities being found (see the ideas in appendix 12.5.7 on page 226). However due to the neck shape and powertrain limiting the design space, only a two legged design would fit and was thus kept.

This lead to the final leg design shown on the previous spread.

Researching interface top shape

Additionally multiple new interface shapes were thought up, with two categories being defined: rounded and slanted (see Fig. 99). However in the end they were not further explored. This is because anything that is rounded will remove the moment arm that makes the head detach. Anything that is slanted translates the pushing force of shaving into detaching force.



	Magnets	Electro magnets	Solid snap-fits	Ball detents	Plastic snap-fits	Metal snap-fits	Metal wire spring
Price	-2	-2	+2	-2	+2	0	0
Durability	+2	+2	-2	+2	-2	+2	+2
Size	0	0	+2	-2	+2	+2	+2
Max strength	-2	+2	+2	+2	+2	+2	+2
Personal ability	+2	-2	+2	-2	+2	+2	0
Score							
# of penalties	2	2	1	3	1	0	0
Score	**0**	**0**	**6**	**-2**	**6**	**8**	**6**

Table 7: All found clamping methods, requirements and choice

Researching connection methods

Lastly, as magnets were not found to work other connection methods were explored. Through desk research, conversations with engineers and analyzing existing shavers six other clamping methods were found. Together with engineers they were judged based on price (is it viable for Philips?), durability (will it let a handle survive for 7 years?), size (can it fit in the handle?), max strength (can it be made to provide enough clamping strength?) and personal ability (can I make this within the scope of the project?). Through this it was decided to switch back to using a metal snap-fit (see Table 7).

After this possible orientations of the snap-fits were researched. However it was soon realized this does not matter. This is because the snap-fits will always have to be center aligned, which means that no matter how you orient it, the sum of the moment arms of the individual snap-fits will always be the same.

Nonetheless the snap-fits of V2 are rotated compared to the original design. However this was only done because it was easier to design the yellow holder this way.

8.4.3 **validation**

110 cm impact resistance

Through conducting drop it was concluded that V2 offers increased but not complete 110 cm impact resistance.

8 V2 prototypes were made and dropped in the previously defined 8 directions. Usally drops are started at 70 cm with drop height being increased by 20 cm after three successful drops. However the 3D prints were found to not be able to resist the tests, with the first two prints immediately breaking at 70 cm. Drops could have been conducted at a lower height, but this would not prove impact resistance. Instead 8 extra V2 prototypes were made using a stronger printing technique and drop a single time at 70, 90 and 110 cm (if the prints managed to survive that is).

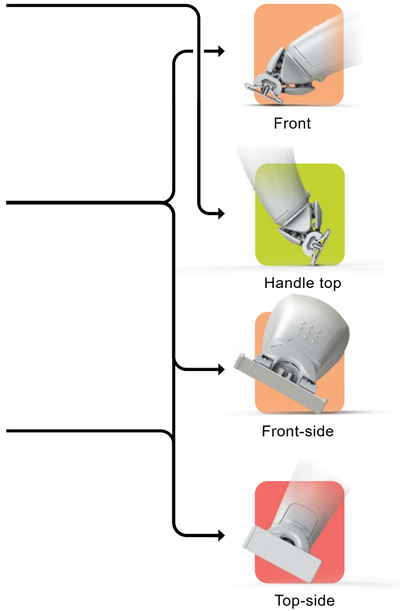
In the end a single print survived 110cm (see Fig. 101). Additionally a single hinge broke in a peculiar way. The head detached, but the handle still kept pressing on it, over-rotating the hinge and still breaking it (see Fig. 102). Unfortunately all other prints failed, causing results to be inconclusive. because of this some drop angles were tesed by pushing the prototype on a table (see Fig. 104).

Fig. 101: 110 cm drop on handle top -> survives

Fig. 104: Tabletop testing of the other scenarios. Left to right: front-side and top-side

Fig. 102: 70 cm drop on top-side -> Breaks, as after the head detached the handle pushed on the font of the legs, over-rotating the hinge and breaking the front left blade snap-fits.

Fig. 103: 90 cm drop on the front -> 3D print breaks, giving inconclusive answers



Head is replaceable

The metal snap-fit of this concept needed to be made and tweaked to offer ~6 [N] of clamping force. For this three iterations of springs were plasma-cut out of various thicknesses of spring steel, bend by hand and tested using a force meter.

This resulted in a 0,45 mm spring steel metal snap-fit being chosen that offered 6 [N] of clamping force, meeting the requirement.

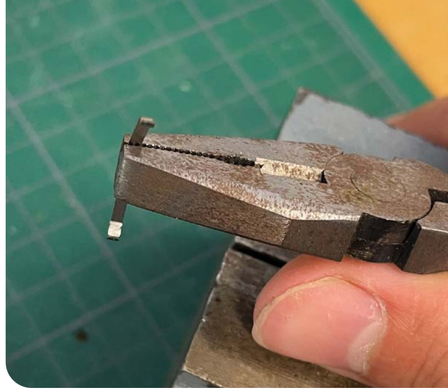


Fig. 105: Bending plasma-cut springs by hand...

Fig. 106: ...and testing their clamping force using a force meter

Doesn't detach during shaving

It was found that concept V2 easily detaches during shaving.

This was first determined through a personal shaving test. Without an add-on the head fell of when applying moderate pressure (see Fig. 107). With the 5 in 1 comb attached the head fell of when just touching the skin due to the extra moment it creates (see Fig. 108).

To know more specifically by what degree the requirement was not met, a force meter was used (see Fig. 109), showing that:

- Without add on: Detaches at 3,6 [N]
- With 5 in 1 comb: Detaches at 1,5 [N]

As it should resist 15 [N] this means the requirement is not met by a factor of 10.

Fig. 107: Applying moderate pressure (no add-on) -> detaches

Fig. 108: Applying minimal pressure (5 in 1 comb) -> detaches

Fig. 109: Test precisely measuring force needed to detach concept V2

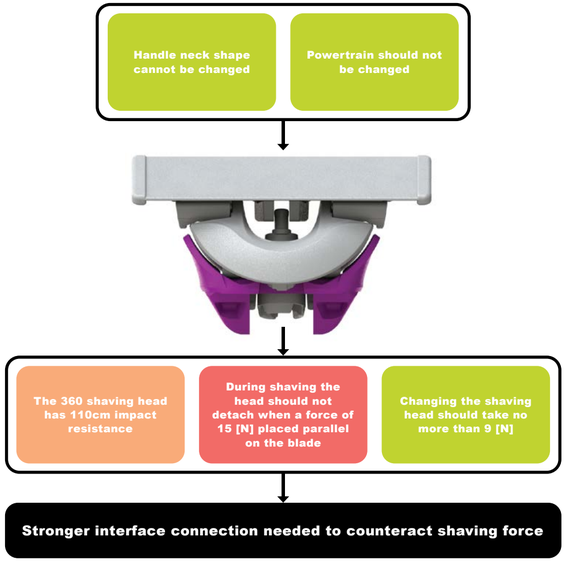


Fig. 110: Results of the validation of concept V2 and next steps

8.4.4 **Conclusion**

V2 seems to greatly increase impact resistance. However now the head detaches during shaving. Additional ideation is needed to see if this can be solved.

8.5 | Concept V3 “Slanted legs with hurdle”

8.5.1 How it works

To increase the clamping force of concept V2 additional ideation was done, with concept V3 being made.

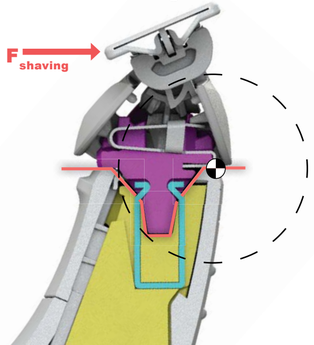
Leg shape: adding a hurdle

The idea is that small extra legs are added, serving as a hurdle. During a drop the sudden impact will make the hurdle be overcome, with the head detaching at every drop angle. A short and long legged version were made to test the difference.

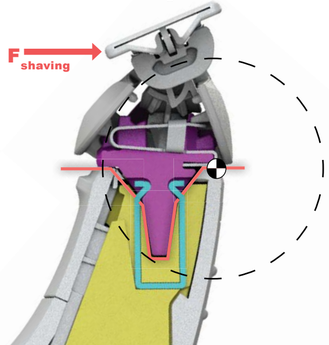
Fig. 111: 3 mm extra legs

Fig. 112: 5 mm extra legs

Stops moment during shaving a little



Stops moment during shaving more



8.5.2 Process

Through drawing and additional drop-tests 3 potential design directions were found.

Make something else detach that is allowed to have a stronger connection

The train of though was “is there some way to make detaching the head require more force that does not require the hinge to split apart and still allows for easy replacement?” One answer came out, being that the legs detach from the rest of the shaving head (see Fig. 113). This idea might work. However it is expected that development time will be too long, and testing will be too difficult due to 3D prints breaking. Hence it is a recommendation for future research.

Only make the interface detach when subjected to a shock

Here the train of thought was “what does happen during a drop, but doesn’t during shaving?”, with one answer being that during a drop force is short and intense. This led to the idea of the hurdle.

Make the handle be able to dissipate force

This idea is discussed in ‘Concept V4 “Ejecting handle”’ on page 130.

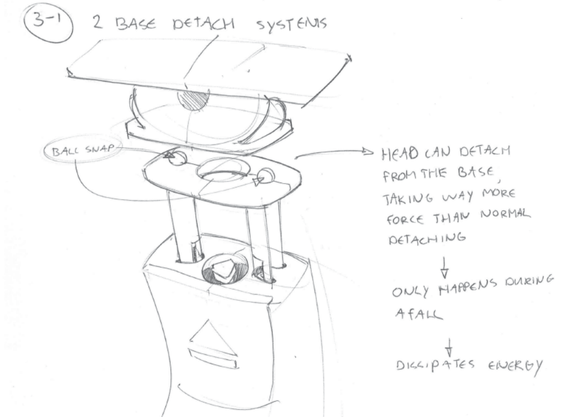


Fig. 113: Idea: allow the legs to be able to detach from the rest of the base, being able to require more that 9 [N] of force while not requiring the hinge to split up (as this makes for really difficult concepts).

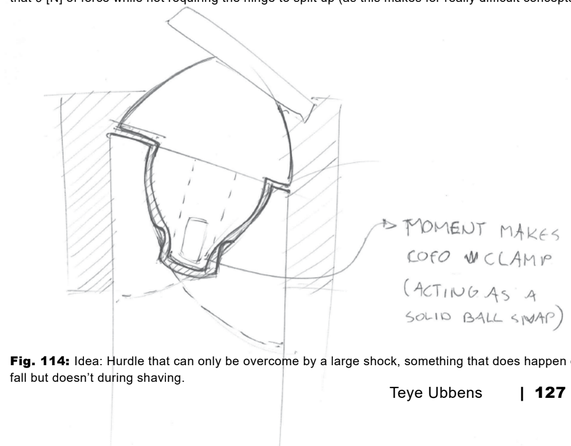


Fig. 114: Idea: Hurdle that can only be overcome by a large shock, something that does happen during a fall but doesn’t during shaving.

8.5.3 **Validation**

Doesn’t detach during shaving

Testing showed that the idea does not work as intended. The slanted legs turn sideways force into upwards decoupling force, still making the interface detach (see Fig. 115).

110 cm impact resistance

Additionally the head does not detach anymore in the four described breaking scenarios as moments are stopped. This was only tested on a table, but it would not budge (as can be seen by the blade slightly bending in Fig. 116).

Fig. 115: Just like V2, V3 still detaches with minimal force during shaving.

Fig. 116: However does not decouple during a fall anymore.

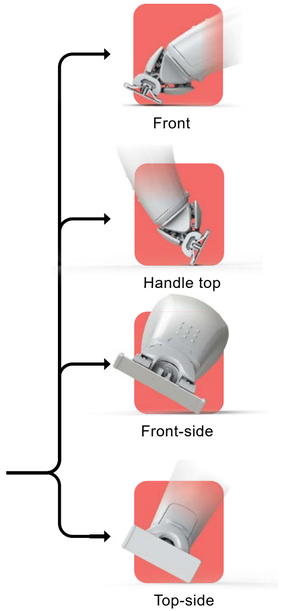


Fig. 117: Results of the validation of concept V3 and next steps

8.5.4 **Conclusion**

Through this it is expected that 110cm impact resistance will not be achieved with only changing the leg shape. This is further discussed in the conclusion on page 134.

8.6 | **Concept V4 “Ejecting handle”**

8.6.1 **How it works**

As changing the legs was not found to work, the focus was moved to the handle instead, giving rise to concept V4 (which is more of a concept direction really).

Opening front

The silver front plate of the handle is cut open. This allows the head to open the handle when falling on the back or top (see figure Fig. 119). This causes the head to be pushed out enough that the metal snap-fit comes loose, hopefully making it detach before parts break during impact.

Holder acting as a ramp

The holder has been given a slanted flap that acts as a sort of ramp when falling on the front or side (see Fig. 118). This hopefully again causes that head to be pushed out just enough to detach during impact.

Fig. 119: The front plate of the handle can open, allowing the head to detach more easily.

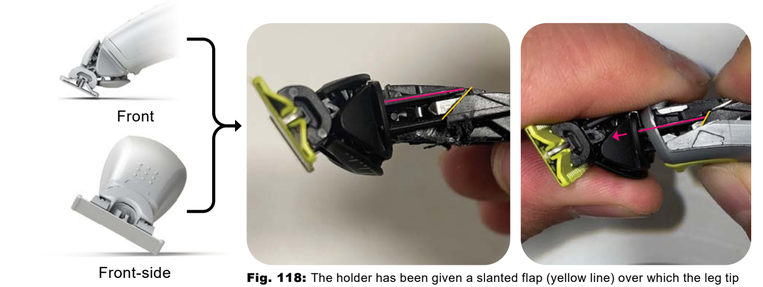


Fig. 118: The holder has been given a slanted flap (yellow line) over which the leg tip (purple) is pushed out of the body when frontal force is applied.

8.6.2 **Process**

During one test a handle opened. This caused a 360 head to survive a 150 cm drop on the handle top, something that would normally lead to a break from 70 cm on (see Fig. 120).

This rekindled the idea that 110cm drop resistance might be possible while keeping backwards compatibility. However the ‘opening handle’ idea only worked when falling on the top or back. Through a creative session with a 360 shaving head engineer and some personal sketching additional ideas were found to also allow detaching in other scenarios, shown in Fig. 121).

Using a learning by doing approach handles and holders were cut open in various ways (as I still had 39 of them). Through this the backwards compatible idea of giving the holder slanted flaps was conceived.

Fig. 120: 150 cm drop on the handle top -> handle breaks open, making the head rotate out where normally it would break

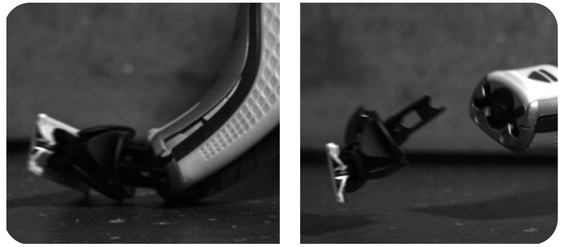
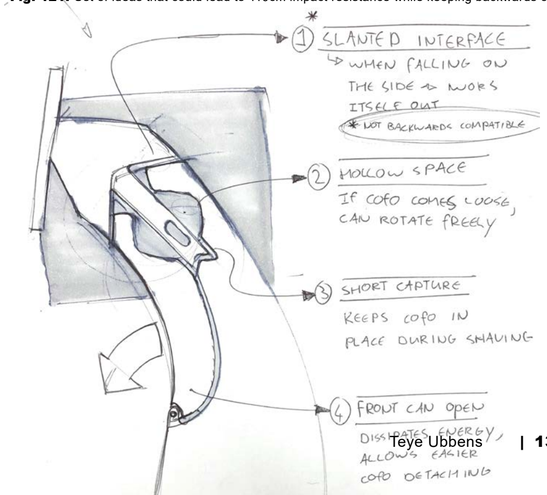


Fig. 121: Set of ideas that could lead to 110cm impact resistance while keeping backwards compatibility



8.6.3 **Validation**

However through testing it was found that the ideas do not work as apart from the shaving head, the handle now started breaking as well. 5 handles were made, and all five broke the first time they were dropped at 110 cm.

When falling on the handle top, the thinnest part of the handle plate has to dissipate the force, which it can't (see Fig. 122). Interestingly all three times it fell on the handle top the shaving head did survive, as enough force was dissipated in destroying the handle.

When falling on the front-side or top-side, the shaving head would not detach, and it broke (unfortunately there is no footage due to recording issues).

When falling on the front the head came loose a bit, but not enough enough to detach, still breaking (see Fig. 123).

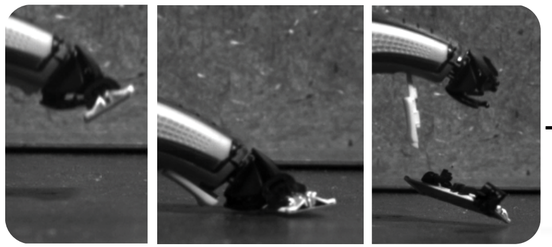


Fig. 123: 110 cm drop on front -> The head was seen coming loose a bit, but still broke

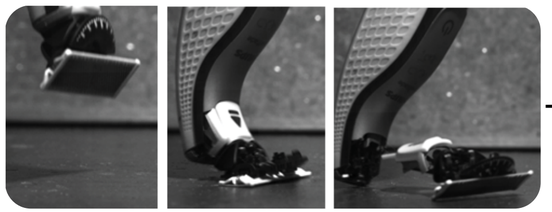


Fig. 122: 110 cm drop handle top -> As the handle plate can open, extra strain is placed on it, breaking it

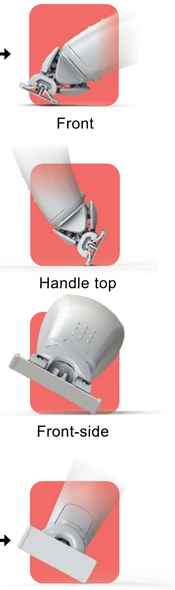


Fig. 124: Results of the validation of concept V4 and conclusion

8.6.4 **Conclusion**

Looking at the drop-tests, having the handle be able to open might increase drop resistance. However it would decrease the impact resistance of the handle, which if it breaks leads to unwanted e-waste. Additionally the effectiveness of the handle opening decreases as it falls more on the top, as it opens due to a sideways force. This makes makes me highly double if this design direction could work in the first place. Because of this the direction is not further explored.

Part 3

Summary and conclusions

Due to the requirements is is not deemed feasible to achieve full 110 cm impact resistance with only changing the interface. This is because three requirements were found not to be compatible.

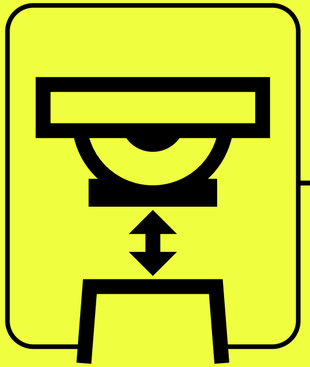
Firstly the highest allowed force needed to insert or remove the shaving head is 9 [N]. This is because otherwise it would be too difficult for users to replace the head. This caps the clamping force the interface (i.e. the connection between the handle and the shaving head) can provide.

Secondly the interface should be able to withstand a force of 15 [N], as otherwise the shaving head will detach during shaving (which is not pleasant for users). As this force is higher than the maximum clamping force, the shaving head would normally detach. In the7 current design this problem is solved through adding long interface legs that stop the moment generated by the more sideways oriented shaving force.

However thirdly it was found that for the shaving head to detach in every angle during a 110 cm drop, the interface legs should not stop moments anymore (see concept V2).

Unfortunately this means that the requirements inherently overlap, making me think a solution not feasible. Because of this I advise Philips to not explore this direction any further.

However during this thesis other potential design directions for increasing OneBlade impact resistance and use time have been found that will be discussed in the recommendations.



The 360 shaving head has 110cm impact resistance

Changing the shaving head should take no more than 9 [N]

During shaving the head should not detach when a force of 15 [N] placed parallel on the blade

Too much overlap in requirements. 110 cm impact resistance not deemed feasible with only changing the interface

Part 4

Future

This part will go into the future of both OneBlade Philips and me. First recommendations will be given regarding what follow-up research should be done to increase OneBlade use time (see Fig. 125 for all findings). After this I will reflect one both my own process and on the collaboration between Philips and me.

After this you will find the list of references and appendices, giving the following chapters

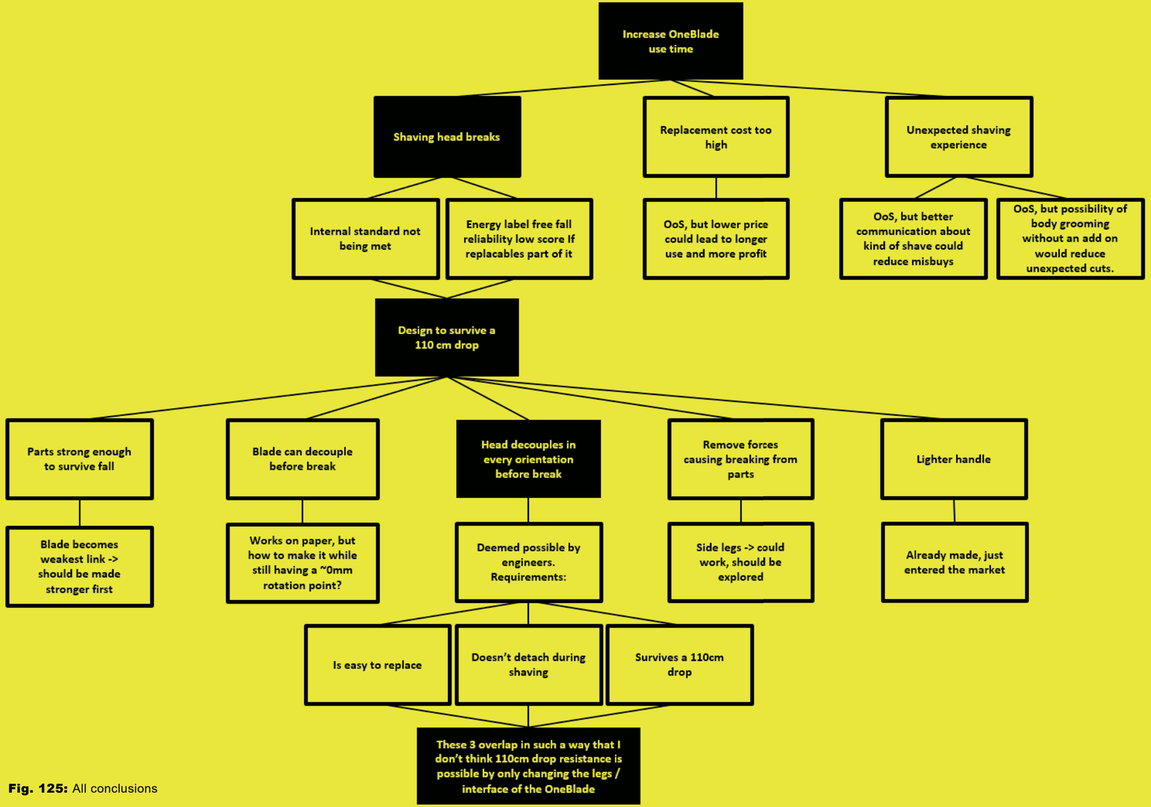


Fig. 125: All conclusions

Chapter 9

Recommendations

This chapter will go through into the recommendations for future research for philips, both regarding increasing impact resistance and increasing OneBlade use time.

9.1 | Increasing OneBlade resistance

Increasing the impact resistance of the OneBlade shaving head will strengthen the market position of the OneBlade.

This research has shown that only changing the interface will not yield both increased impact resistance and acceptable shaving experience. However through the research I think there are four other possible design directions.

9.1.1 Stop selling original shaving heads

However first a suggestion: The impact resistance (and the rest of the design) of the 360 shaving head is superior to that of the original. As shown in this thesis, low impact resistance reduces use time, in turn reducing revenue and increase e-waste. Because of this I think the original head should be phased out as quickly as possible.

9.1.2 Decoupling blades

In this thesis this idea was not further explored. This is because it was deemed to difficult to achieve within the project time frame because of the following challenges:

- Guard-hinge interface should be strong enough to not detach during shaving
- Guard-hinge interface should be small enough to facilitate a primary rotation point close to the skin
- Guard-hinge interface should be slack-free
- The spindle should correctly connect to the blade during replacement, which is currently impossible due to limited space.
- Replacing the blade should be easy
- Should still be profitable for Philips. costumers will likely want to pay less for only a blade, instead of a full shaving head.

However it should not be impossible, and I would say the possible merits outweigh the development cost:

- If done well, full impact resistance should be achievable, the merits of which have been broadly discussed.
- It is backwards compatible
- It would not detach due to add-ons generating a big moment, as all add-ons lean against the hinge (see chapter 2.4.4)
- Apart from the blade, the shaving head can be reused, reducing waste. Additionally it means the hinge could cost more, meaning more design freedom.

Because of this I really advise this topic to be further researched. Fig. 126-Fig. 129 show potential ideas that were found.

Additionally the idea of having only the legs detach (see Fig. 128) that was found on page 127 would circumvent most of the challenges. This is because the hinge would not have to be able to split up.

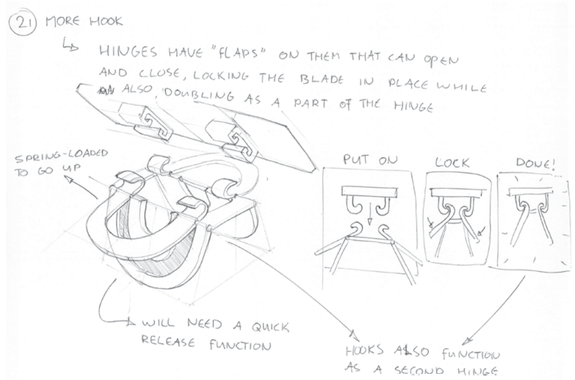


Fig. 126: Hinge doubling as attachment method that can more easily detach

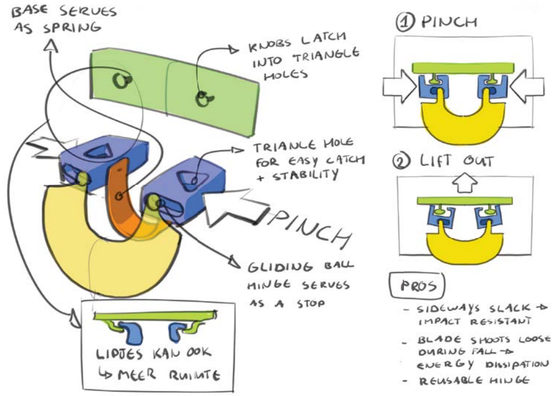


Fig. 127: Pinch-to-release hinge concept direction. See 7.4 |

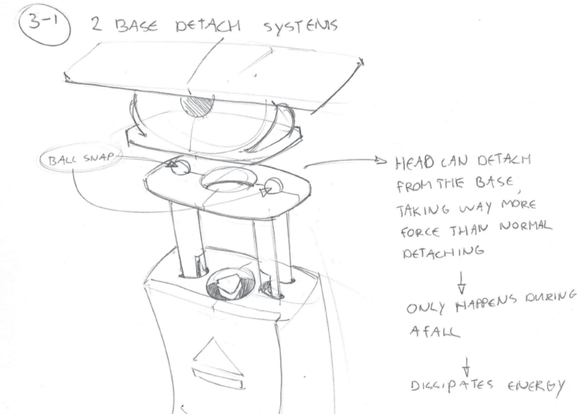


Fig. 128: Allow the legs to be able to detach from the rest of the base, being able to require more th 9 [N] of force while not requiring the hinge to split up (as this makes for really difficult concepts).

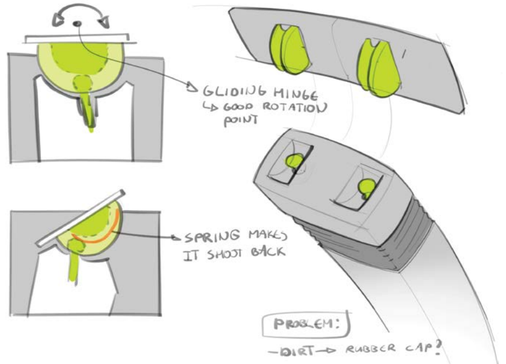


Fig. 129: Skid bearing hinge concept direction. See 7.4 |

9.1.3 **Remove force from the hinge**

As mentioned on page 92 “A break happens because the forces from an impact have to travel from the handle, through the fragile hinge, to the blade. If the force can directly travel between the blade and the handle, the hinge will survive. “ i.e. place two arms on the side of the body (see Fig. 130).

This direction was not explored because initially I thought the shaving head also broke when falling on the top within the hinge rotation range.

However as this was found to not be the case, this solution has a lot of potential. Only changes to the handle are needed, making it backwards compatible.

The old pro model incorporated this idea. However engineers explained that it sold poorly, with the reason being that customers did not like its aesthetics (Philips (7), 2023). Still I think with effort a beautiful design could be made, maybe one that accentuates the round resign from the 360 shaving head (see the added magnetic interface concept sketch).

Fig. 130: Adding legs to remove forces on the hinge. This was already tried in the old pro model (left), but its design could potentially be improved through accentuating the circular design of the 360 head (right).

9.1.4 **External protection**

While not allowed for testing if the repeated free fall reliability will come to shavers, external protection is interesting because it was found that currently most breaks happen outside of shaving (see Fig. 35 on page 52). Two concept directions were found.

Firstly chance of forgetting to apply external protection can be circumvented by incorporating it as an on-off switch (see Fig. 131).

Secondly the head falling on the floor can be circumvented by not having it be attached outside of shaving in the first place, as it is stored in the charging stand (see Fig. 131). This has two additional bonuses. Firstly you can more easily swap between shaving heads you use for your face and your private areas. Secondly as shaving heads can get quite dirty, cleaning could potentially be integrated in the charing stand.

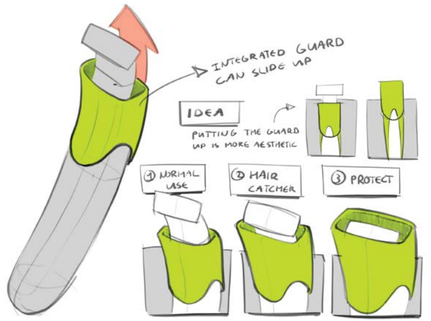


Fig. 131: Integrated cover power switch

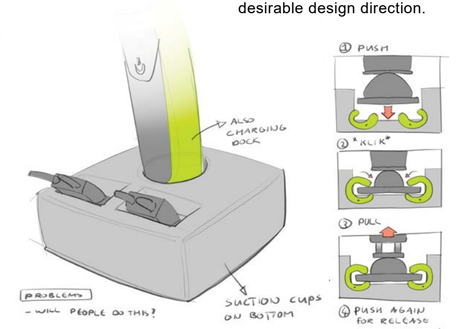


Fig. 132: Shaving head holder / cleaner

9.1.5 **Shaving head strong enough to survive fall**

If all mentioned solutions don’t work, I think the only solution left would be to strengthen the shaving head. However as mentioned on page 92 this would mean the blade would have to dissipate all the impact force, which it can’t. This means that it will bend or break (as shown e.g. on page 84), becoming dangerous or unusable (Philips (7), 2023).

So then the blade would first have to be redesigned for increased strength. This would probably mean increasing material thickness, reducing shave cleanness. As this is a primary selling point, I don’t think this is viable or desirable design direction.

9.2 | Increasing OneBlade use time

Taking a step back, the goal of this research was to decrease e-waste by increasing use time. Impact resistance has been researched, however two other categories were found that had a bigger impact but were out of scope for this research (see 3.3.3 on page 48).

9.2.1 Better communicate how OneBlade works

Better communicate shave closeness

As discussed in Chapter 3 a significant amount of users mentioned stopping because they expected the OneBlade to shave as close as a razor which, of course, it doesn't. In my opinion the cost of this outweighs the benefit of more sales.

- Firstly from a from an environmental perspective this needlessly increases e-waste.
- Secondly from a Philips perspective I think this will decrease brand image, with Haines-Gadd et. al. (2018) stating that you should "Ensure (that) a product delivers what it promises. Authenticity is crucial when nurturing attachment; its absence will dissolve any empathy developed up until that point, also towards the brand itself."
- Thirdly for happy users I don't think closeness is the selling point of the OneBlade. They mention it is the ability to do everything related to shaving and grooming) with one device that reduces complexity, thus enabling creativity. Personally I even dislike closeness, instead shaving with a 1mm add-on
- Fourthly non-closeness is a selling point for people with sensitive skin, as the longer hairs can't grow in and the blade doesn't cause skin burn.

So I think advertising (the benefits of) the rougher shave could be beneficial for all, and that it's potential should be researched.

Body grooming without an add-on

The annoyance of expecting the OneBlade to be able to shave the body well without an add-on was mentioned by a few users. However it is primarily a personal frustration.

For about ten years I have been using a trimmer for body grooming that works fine, but cannot shave clean, cannot reach some areas due to its size and occasionally cuts me. When I started using a OneBlade 8 months ago I mainly thought it would solve these issues with the 'one blade for everything' proposition. Instead I found out that the finer teeth don't catch the hairs well (resulting in a slow shave) and that it still cut me.

So while mainly inspired by personal broken expectations, I think designing a blade that enables body grooming without an add on (e.g. through longer and more spaced teeth) could increase customer satisfaction, leading to longer use.

9.2.2 Increase price vs durability

Slightly reduce consumer prices

Shaving heads are sold with a markup, as Philips has to make profit. If the high cost of shaving heads is a major reason for stopping, decreasing cost might be beneficial. The reduction in the profit margin per head might be offset by the increase in total sales. While I expect Philips to already have researched this, I would still advise taking another look.

Increase blade durability

The price per shave for users can also be reduced by increasing blade durability.

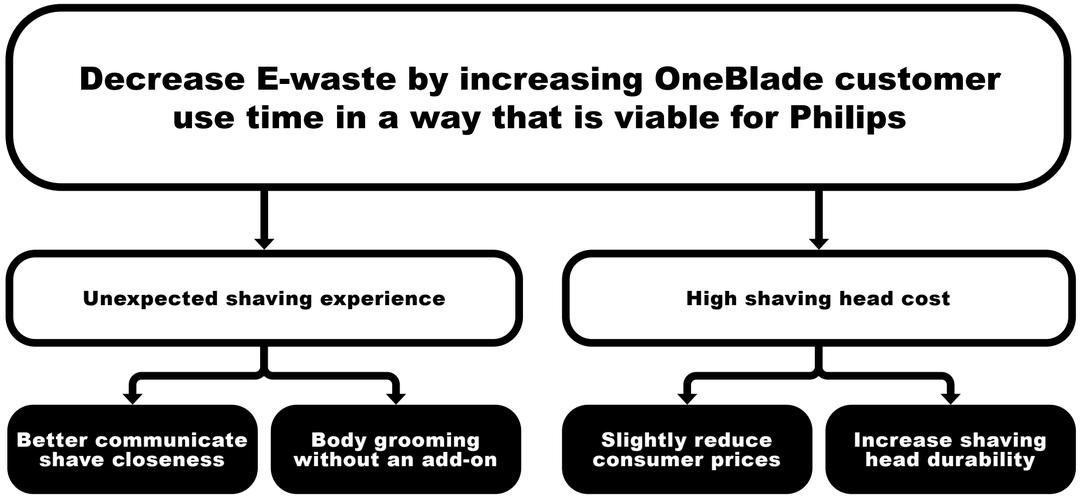


Fig. 133: Other potential direction for increasing OneBlade use time.

Chapter 10

Reflection

This chapter will go into the what could have been better, what the main take aways are from being part of Philips for 8 months, and what I think my future will be.

10.1 | Introduction

This project has been challenging to say the least. This was both because it was outside my usual competences, and because of external factors related to Philips. However, looking back, it was also extremely interesting. Here are some topics I want to reflect on.

Firstly I want to discuss the roller-coaster that was my time at Philips. What are the main take-aways?

Secondly I have some tips for Philips about how the organizational aspects of a future intern / graduate can be smoothed.

Thirdly I want to through a few key parts of the process itself. What went well? What could be improved?

Lastly I want to go think about the future now that my student life is coming to an end.

10.2 | Project management learnings

This project ended up being about a significant problem of an important product of a big corporate (i.e., about the OneBlade, the most sold Philips shaver and its breaking behavior, apparently one of its most important issues). This lead to many difficult moments. However through reflection sessions with my Philips coaches, team lead and my dad it was turned into one big learning: the importance of project management / organizational aspects on success (of innovation). In the end I have grouped all learning that fall under this into three groups.

10.2.1 Initial project brief

The first thing I learned about project management is the importance of the initial project brief. It should:

- Have all stakeholders present
- Have a clear goal for a defined team
- Have all stakeholders agree that the goal is a knowledge gap that offers value when researched and is within the competences of the team to work on.

It was learned that otherwise stakeholders who are left out will not feel like they have to contribute. That, or the project will be based on outdated / incomplete knowledge, reducing the value the project can offer.

This was learned as in this project the initial design challenge was formulated with people from Philips who were not OneBlade experts. The result was that most topics from the challenge had already been researched, and that most specialists did not care enough to actively help.

10.2.2 Stakeholder management

The second thing I learned about project management is the importance of stakeholder management, with three points being identified

Communicate

- Identify who the relevant stakeholders are and keep them in the loop.

This continues on the learning from the previous point.

Enable communication

- Know how to communicate with all relevant stakeholders, and have the ability to do so.

The first half of the project I could not be on-site, as Delft and Drachten were too far apart. However I quickly found out that, at least at Philips, this is where initial contacts with stakeholder were made, really showing down my process. However once I could work on site, I learned a lot about different kinds of communication, and which work best for e.g. c-level contacts.

Align expectations:

Know that, unless explicitly discussed, you and others will not have the same expectations about e.g. confidentiality.

This was learned as in the final phase of this project confidentiality became a problem. The TU (and I) had made clear that publishing a thesis is a perquisite for graduating from the TU, and was discussed at the initial project brief. However as OneBlade specialists were not included here, they did not know this. Now Philips mainly deals with the university of Groningen, where publishing is not mandatory. Because of this engineers that knew how sensitive my project was thought it would never see the light of day, while I thought the fact that it would be published was properly discussed. Alignment would have saved a lot of trouble here.

10.2.3 Change management

Research will probably lead to a need for rescoping a project. This change should be discussed and solved with all relevant stakeholders. Otherwise you will start working in a vacuum.

This was learned when the user test showed that all found design directions had been partially solved, with impact resistance remaining but being deemed unsolvable by engineers. I saw this as a personal mistake (which it wasn't), with my reaction being to choose impact resistance anyway and just start working really hard, not communicating until I could show results.

Instead, if I had realized it was not a mistake but an inherent part of innovation, I have planned a meeting with stakeholders and explained my struggle. When brought in a solution-oriented way, I'm quite certain we could have found something in an hour.

10.3 | **Tips for Philips**

Using these learnings I would also like to advise Philips on how the next graduate student or intern could be more effectively guided.

1. Before starting it should be clear how the intern will be able to be physically on site, as otherwise stakeholder management will become exponentially more difficult for them.
2. When a graduation project is started the three points from 10.2.1 should be met, with confidentiality also immediately being discussed between the company (Philips) and the university. In case you are working with the TU Delft, do know that the process and findings will have to become public!
3. Additionally, next to an onboarding, there should also be an 'outboarding', at least for interns. This should again discuss confidentiality with relevant stakeholders, and explicitly mention to students that at the end of their internship they will lose access to all their data, as everything made within Philips must be expected to be confidential.

10.4 | **Design process**

Looking back at the process itself, I think it was 'fine' considering everything that I had to go through. I will not go through the whole process, but define some big tips and tops.

User testing

Probably the biggest regret in this graduation is how the user test was done. It really should have been conducted earlier on, it should have been qualitative and a method should have been defined with the help of specialists (I mean Philips has a dedicated user testing group full of nice people). This might have shown more latent needs, done so earlier in the process, and done so in a more reliable way. Also less participants would have been needed, meaning that data of actually lapsed users could have been used.

Be solution oriented

Also I think the project could have been smoother and more fun if during the process I would have focussed more what value I was offering. As touched upon in 'Align expectations:' on page 149 I saw the fact that I was experiencing difficulties as failures, when instead I could have understood this is inherent, enjoyed it and solved it with others.

Delft way of thinking

However I also really saw the fruits of the design method taught at IDE. The mindset of always questioning the design challenge did I think lead to me finding an actual problem. Additionally understanding the iterative nature of design, and being trained in structuring its chaos really helped me find concepts. The learning by doing approach that cycled ideation, validation, and exploration (drop tests and understanding requirements) at least felt like it worked quite well.

10.5 | **My future**

I do not want to be a researcher, that's for sure (I heard you Ruth). I think me staying far away from deep research and writing is best for everybody. Honestly the fact that I was able to make a vaguely coherent report surprises me.

However this project showed me I also do not want to be an engineer. While being a perfectionist, I love being creative, radical and playful, which means I think up a 'better' approach to a project every ~5 minutes. This makes the process of diligently proving and fine tuning maddening to me.

However I did find out how much I love working *with* engineers. As my twin and dad are both physicists their direct and solution oriented mindset just feels right.

Additionally I learned how much I enjoy the seriousness of big corporate, more than I enjoy a dedicated design agency (I interned at VanBerlo)

This, and the wonderful conversations with Ruth, Gianni, Lotte, Han, Oege and others really did show me that I want to become a designer in some radical place, while still working closely together with engineers, and that I like the seriousness that big corporate brings. Philips design...?

10.6 | **One last conclusion**

So, although it was certainly a roller-coaster, in the end I'm happy that I did it, tough times and everything.

Because Philips was such a serious environment, and because this project came way closer to the fire than would normally happen, there were so many valuable experiences. Looking back it really feels like I went to a boot-camp about how the real world works. Using the discussed points (and many more that I don't have the space for here), I'm certain I will be more professional in my next project, which, in the end, I think is the real goal of graduating.

Thanks for tagging along, and to more design adventures ;)

Chapter 11

References

4C Design. (2018). Technology Readiness Levels (TRLs) in Design and Engineering | 4c. https://www.4cdesign.co.uk/blog/technology-readiness-levels/

Achterberg, E., Hinfelaar, J., & Bocken, N. (2016). MASTER CIRCULAR BUSINESS WITH THE VALUE HILL. www.circle-economy.com

Ackermann, L., Tuimaka, M., Pohlmeyer, A. E., & Mugge, R. (2021). Design for Product Care—Development of Design Strategies and a Toolkit for Sustainable Consumer Behaviour. Journal of Sustainability Research, 3(2). https://doi.org/10.20900/jsr20210013

Amazon.com. (n.d.). Philips Norelco OneBlade Hybrid Electric Trimmer and Shaver, Frustration Free Packaging, QP2520/90. Retrieved October 30, 2023, from https://www.amazon.com/product-re-views/B01D328BG6/ref=acr_dp_hist_1?ie=UTF8&filterByStar=one_star&reviewerType=all_reviews#reviews-filter-bar

Amazon.com. (2019). Customer Review. https://www.amazon.com/gp/customer-re-views/R2WWN2RT7QUBD7/ref=cm_cr_arp_d_viewpnt?ie=UTF8&ASIN=B01D328BG6#R2WWN2RT7QUBD7

Amazon.de. (n.d.). Philips OneBlade Face, Trimmen, Stylen, Rasieren, inkl. 2 Originalklingen und 3 Trimm-Aufsätzen (Modell QP2520/30). Retrieved October 30, 2023, from https://www.amazon.de/-/nl/product-re-views/B01B1NVB66/ref=acr_dp_hist_1?ie=UTF8&filterByStar=one_star&reviewerType=all_reviews#reviews-filter-bar

Bocken, N. M. P., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33(5), 308–320. https://doi.org/10.1080/21681015.2016.1172124

Chapman, J. (2009). Design for (Emotional) Durability (Vol. 25, Issue 4). http://direct.mit.edu/desi/article-pdf/25/4/29/1714666/desi.2009.25.4.29.pdf

de Boer, A. (2023). Interview with OneBlade blade function developer.

De Fazio, F., & Tittle, C. (2022). Design for disassembly strategy for Grooming Technical investigation of key value drivers.

de Olde, L. J. (2022). EcoDesign requirements 2025.

del Latte, M. (2023). Consumer Marketing manager OneBlade - Short interview.

EU. (2023). Circular electronics initiative - In “A European Green Deal.”

Euopean commission. (2023). Supplementing Regulation (EU) 2017/1369 of European Parliament and of the Council with regard to the energy labelling of smartphones and slate tablets.

European commission. (2022). Ecodesign and Energy Labelling Working Plan 2022-2024. 2.

European Parliament. (2015). Circular economy: definition, importance and benefits. https://www.europarl.europa.eu/news/en/headlines/economy/Fonteijne, L. (2022a). Sigma Recyclability assessment.

Fonteijne, L. (2022b). Sigma Recyclability assessment.

Gadgetsnow. (2022). Philips OneBlade Pro trimmer review: The ‘pro’ of men’s grooming. https://www.gadgetsnow.com/reviews/philips-oneblade-pro-trimmer-review-the-pro-of-mens-grooming/articleshow/93617928.cms

Ganapini, C. (2023). The EU battery directive will make it easier to replace batteries - Right to Repair Europe. https://repair.eu/news/the-eu-battery-directive-will-make-it-easier-to-replace-batteries/

Geisendorf, S., & Pietrulla, F. (2018). The circular economy and circular economic concepts-a litera-ture analysis and redefinition. Thunderbird International Business Review, 60(5), 771–782. https://doi.org/10.1002/tie.21924

Gilette. (2023). Wet Shaving or Dry Shaving? Blade vs. Electric Shaving | Gillette. https://gillette.com/en-us/shaving-tips/how-to-shave/wet-dry-shaving-comparison-razor-vs-electric

Haines-Gadd, M., Chapman, J., Lloyd, P., Mason, J., & Aliakseyeu, D. (2018). Emotional durability design Nine-A tool for product longevity. Sustainability (Switzerland), 10(6). https://doi.org/10.3390/su10061948

Healthline. (2023). Everything You Need to Know About Razor Burn. https://www.healthline.com/health/beauty-skin-care/razor-burn

Heideveld Johnny Kerkhof Aglaia Fischer, A. (2016). MASTER CIRCULAR BUSINESS WITH THE VALUE HILL. www.circle-economy.com

HQTS. (2022). What is EU Right to Repair? [2022 Guide] - HQTS. https://www.hqts.com/right-to-repair-electronics/

Huijzer, M. (2016). OneBlade body proposed project plan.

Lewis, N. (2023). Interview with OneBlade system architect.

Longmans, V. P. (1960). The Waste Makers.

luxuryshavingrazors. (2023). How Often Should You Replace an Electric Razor? (Easy Guide). https://luxuryshavingrazors.com/best-electric-razor-shaver/how-often-should-you-replace-

an-electric-razor/

Manscaped. (2023). The lawn mower 4.0. https://eu.manscaped.com/products/lawn-mower-4

Matthews, L. (2021, March 15). How Disposable Shaving Products Hurt the Planet. https://www.leafscore.com/eco-friendly-bath-products/environmental-impact-of-shaving-products/

Meloni, M., Souchet, F., & Sturges, D. (2018). Circular Consumer Electronics An initial exploration. https://ellenmacarthurfoundation.org/circular-consumer-electronics-an-initial-exploration

Moo.review. (2023). Philips Norelco OneBlade Tested and Reviewed. Philips Norelco OneBlade Tested and Reviewed

Mugge, R. (2017). A consumer's perspective on the circular economy.

Oberschelp, A. (2023). European Commission Publishes Directive on the Right of Repair Proposal | Global Policy Watch. https://www.globalpolicywatch.com/2023/04/european-commission-publishes-directive-on-the-right-of-repair-proposal/

Osterwalder. (2010). Business Model Canvas. https://en.wikipedia.org/wiki/Business_Model_Canvas

Philips. (2016). Philips OneBlade guidebook - version 2016.

Philips. (2017). OneBlade playbook.

Philips. (2019). Philips celebrates landmark year of helping men 'do what feels right. https://www.philips.com/a-w/about/news/archive/standard/news/articles/2019/20190424-philips-celebrates-landmark-year-of-helping-men-do-what-feels-right.html

Philips. (2021 (1)). Source of Business: OneBlade - Insights program Philips Nordics. MetrixLab.

Philips. (2023 (2)). DQD drive 08.04.08.

Philips. (2023 (3)). Rijsewijk, H., various interviews.

Philips. (2023 (4)). Eijkelkamp, M., various interviews.

Philips. (2023 (5)). Lewis, N., various interviews.

Philips. (2023 (6)). AST 245M-212542 AD Tridente - A Brief History.

Philips. (2023 (7)). de Vries, A, various interviews.

Philips. (2023 (8)). van de Schootbrugge, M., model .

Philips. (2023 (9)). del Latte, M., Consumer Marketing manager OneBlade - Short interview.

Philips. (2023 (10)). AD Tridente drive.

Philips. (2023 (11)). Monsbourgh, P., various interviews.

Philips. (2023 (12)). AD tridente rubustness level OneBlade powerpoint.

Philips. (2023 (13)). How do I use my OneBlade on my body? https://www.philips.co.uk/c-f/XC000016195/how-do-i-use-my-oneblade-on-my-body

Philips. (2023 (14)). OneBlade 360 Face + Body. https://www.philips.nl/c-p/QP2830_20/oneblade-gezicht-plus-lichaam.

Philips. (2023 (15)). de Boer, A., various interviews.

Philips. (2023 (16)). OneBlade First Shave https://www.philips.nl/c-p/QP1324_20/oneblade-1st-shave-1st-shave.

Philips. (2023 (17)). Fonteijne, L., various interviews.

Philips. (2023 (17)). Tijme, various interviews.

Philips. (2023 (17)). van Es, M., various interviews.

Philips. (2023 (17)). Petrelli, M., various interviews.

Philips Grooming & Beauty. (2022). OneBlade - A Re-design for Repair.

Reddit. (2016). An HONEST opinion on the new Philips Norelco OneBlade. https://www.reddit.com/r/shaving/comments/4kqm6m/an_honest_opinion_on_the_new_philips_norelco/

Reddit. (2023). How could the OneBlade shaver be improved? and for people who stopped using a OneBlade: why did you? (graduation project). https://www.reddit.com/r/shaving/comments/12l2bsc/how_could_the_oneblade_shaver_be_improved_and_for/

Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why We Buy What We Buy: A Theory of Consump-tion Values (Vol. 22).

Statista. (2021). Leading "Razors And Razor Blades And Electric Shavers" brands among men in FR 2021 | Statista. https://www.statista.com/statistics/443995/razors-and-razor-blades-and-electric-shavers-usage-by-type-in-france/?locale=en

Statista. (2022a). Men's grooming products: sales volume France 2010-2020 | Statista. https://www.statista.com/statistics/747972/sales-volume-men-s-grooming-products-france/?locale=en

Statista. (2022b). U.S. population: Usage of electric and battery shavers from 2011 to 2024. https://www.statista.com/statistics/285898/usage-of-electric-and-battery-shavers-in-the-us-trend/

Statista. (2023a). Global E-Waste - Statistics & Facts. https://www.statista.com/topics/3409/electronic-waste-worldwide/#topicOverview

Statista. (2023b, March 31). Population of the Netherlands in 2023, by age and gender. https://www.statista.com/statistics/755052/population-of-the-netherlands-by-age-and-gender/

TU Delft. (2021). LCA calculator, IDEMAT 2021 v2.

Tweakers. (n.d.). Philips OneBlade QP2520/30. Retrieved October 30, 2023, from https://tweakers.net/pricewatch/768883/philips-oneblade-qp2520-30/reviews/

van den Berge, R., Magnier, L., & Mugge, R. (2021). Too good to go? Consumers' replacement be-haviour and potential strategies for stimulating product retention. In Current Opinion in Psychology (Vol. 39, pp. 66–71). Elsevier B.V. https://doi.org/10.1016/j.copsyc.2020.07.014

Webster, K. (2015). The Circular Economy: A Wealth of Flows. Ellen MacArthur.

Youtube. (2018). Beard Trimming - Philips Norelco OneBlade Trimmer and Shaver - Model QP2520. https://www.youtube.com/watch?v=9kpNQBslae8

Youtube. (2019). Philips OneBlade Review - 6 Months Later. https://www.youtube.com/watch?v=v4pTNzN_hbg

Youtube. (2020). Philips Norelco One Blade VS Safety Razor - Which Shaves Best? https://www.youtube.com/watch?v=e2HTioN7rgI

Images:
OneBlade 360 blade front: https://www.bol.com/nl/nl/p/philips-oneblade-360-blade-qp410-30-vervangmesje-1-stuk/9300000099141701/?Referrer=ADVNLYAH002028-BJNQQAAB627HS-9300000099141701&msclkid=14b8a336a770161faa84c7fd2209bddc

OneBlade nice pic: https://www.philips.nl/c-m-pe/oneblade-trimmen-modelleren-scheren/oneblade-360

Value hill: (Heideveld et. Al., 2016)

Old cheap add-ons: https://www.conrad.cz/cs/p/philips-oneblade-qp263030-presny-zastrihovac-zastrihovac-vousu-holici-strojek-na-tvar-omyvatelny-cerna-zelena-strib-2300392.html

OneBlade head replace: https://www.philips.nl/c-p/QP2530_30/oneblade

Carbon steps: https://www.royalhaskoningdhv.com/en/challenges/resilience/naval-base-climate-adaptation

360 head bending: https://www.galaxus.de/en/page/philips-oneblade-a-smoother-shave-with-this-360-degree-blade-26081

Add-ons, chargers etc. https://www.philips.nl/c-p/QP2830_20/oneblade-gezicht-plus-lichaam

Chapter 12

Appendix

Damn you must be really interested in this dumpsterfire of a project that you have ended up here and are actually reading this text.

12.1 | **Interface force test**

Had to figure out what kind of force the shaving head connection (interface) must be able to withstand in order not to detach during shaving or trimming.

- Which shaving or grooming action would result in the biggest force on the interface?
- What is the size and direction of the maximum force put on the interface?

17.2.1.1 Scenario with biggest force

- In what orientation is the biggest force applied on the interface?
- What add-ons cause the biggest moment on the interface?
- On what part of the body is the biggest force applied?
- What is the effect of skin type and humidity?
- What is the difference in force applied between users?

It is expected that maximum force will be applied when shaving up or down. This is because expert data shows that during shaving users put little sideways force on the blade (Philips (8), 2023), as the full sideways range of motion of the blade is never used.

Based on expert interviews it was hypothesized that two shaving orientations (illustrated in figure fixme a and b) will lead to the maximum force. This is because they result in a force parallel to the interface, causing the biggest moment. Testing showed that scenario fixme caused a higher force. The reason is that more force can be applied when the blade is flat on the skin, as the contact area is bigger.

Add-ons increase the distance between the blade and the skin, increasing the arm and thus the force on the interface. All add-ons were tested. It was found that the 5 in 1 comb causes the biggest force.

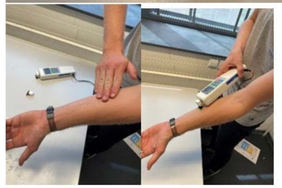
The blade can get stuck behind bony areas, loose skin or hair, causing a higher force. Additionally whet skin was found to have higher friction, causing higher force. The most extreme found situation was loose whet skin.

17.2.1.2 Method

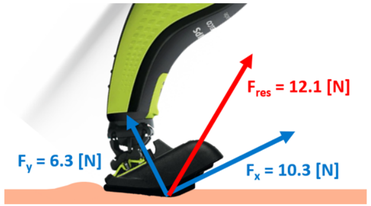
Newton meter: MRC DFG500 digital push gauge

Two pieces for on the meter were 3D printed so that force is measured in-line and perpendicular to the blade

Making skin whet, then going over it with a force meter with a 5 in 1 add op attached to it.



17.2.1.3 Results



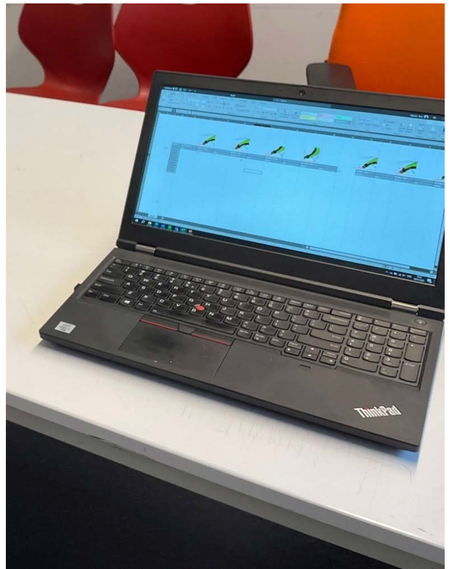
17.2.1.4 Limitations

- No actual shaving was done, with participants having to pretend to shave on hairless areas, pressing until it hurt. Because of this the results might deviate from actual shaving
- Due to the testing method, the measured force will be higher than the actual force. Force is not applied straight on the newton meter. When tested the meter also registers force perpendicular to the testing pin, causing higher readings.
- Results might have been higher due to the weight of the newton meter. At 630 gram it is about 6 times heavier than a normal OneBlade

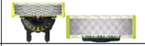
Main take away

- The shaving head should not detach when a force of 15 [N] (parallel to the interface) or 12 [N] (parallel to the blade) is placed on the blade.

There was also an excel file with 7 users and all shaving forces. However this file was unfortunately lost when losing my philips laptop



12.2 | **Grooming devices (price) comparison**

	Safety razor	Disposable razor	Cutthroat	Cartridge razor	OneBlade	Trimmers	Foil / rotary shavers
							
Blade type	Razor blade 	Attached blades	Single knife	Cartridge 	Cartridge (2D & 3D) 	Linear trimming head	Linear or rotary head
Pros/cons	+premium feel +relatively cheap -a bit hard to master -can cause razor burn/ingrown hairs	+Easy -expensive -generate a lot of waste -can cause razor burn/ingrown hairs	+premium feel +Very cheap if used longer -hard to master -can cause razor burn/ingrown hairs	+faster shave +easy to use -expensive -generate some waste -can cause razor burn/ingrown hairs	+quite close shave +can shave any length of hair +No razor burn +Cheap buy in -Expensive use	+Durable blades +can shave any length of hair +cheap if used longer +no razor burn -Cannot shave close	+Very close shave Cheap if used longer -trimmer needed for longer hair --can cause razor burn/ingrown hairs
Handle cost	€50,-	€1,20	€250,-	€15,-	€25,- to 85,-	€30,- to €200,-	€40,- to €250,-
Handle lifetime	10 years	/	50 years	4 years	7 years	7 years	7 years
Blade cost	€0,33	/	/	€3,50	€15,-	/	/
Blade lifetime	5 uses	4 uses	50 years	14 uses	4 months	7 years	7 years
Cost per year*	€22,-	€79,-	€5,-	€69,-	€49,- to €57,-	€4,- to €29,-	€6,- to €36,-

*Based on shaving 5 times per week (261 days per year)

https://sharpologist.com/shaving-for-life/

12.3 | **Droptest**

12.2.1 **Droptests with highspeed camera**

Unfortunately my list of results was all titles of the highspeed camera files I had, and lost. Again if you are a Philips employee reading this: Philip Monsbourgh has access to the files.

Report Header

GTS number: TTR GTS 08.04.08 v4		Description: Drop test till failure
Date : Test number : Quantity :		Type Project : 2D COFO
Product specification : Test specification : Requirement :		
Equipment used: Droptester (Philips build)	Registration number: 71049300	Calibration due date: ASV 230S-170722
Gage R & R: n/a	Room conditions: T = 22°C, RH = 57,5%	GTS version: v8

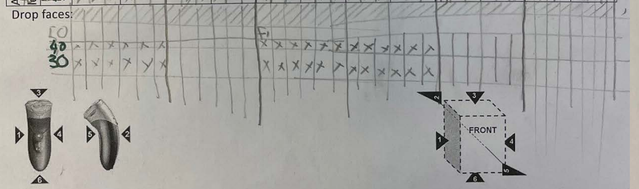
12.3.1 **(GTS 08.04.08)**

Goal

Conclusion

Drop face	1				2				3				4				5				6			
Device no.	1			7	2			8	3			9	4			10	5			11	6			12
Drop no.	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3
Drop height 150					X	X	X	X X X													X	X	X	X X X
130					X	X	X	X X X													X	X	X	X X X
110					X	X	X	X X X				FI									X	X	X	X X X
90				FI	X	X	X	X X X				X	X	X										
70	X	X	FI	X X X	X	X	X	X X X			FI	X	X	X		FI								
Air leak before																								
Air leak after																								

Drop faces:



Tested by	Tijme de Jonge
Reviewed by	Jurre de Vries
Applicant	André Kuijper

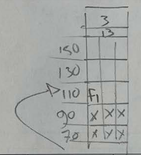
1	70-3 BACK RIGHT HINGE BREAK
7	90-1 LEFT CLICK-IN DETACH
2	X
8	X
3	50-1 GUARD DETACH
9	70-1 BACK HINGES BREAK
4	70-1 BACK LEFT HINGE B.
10	
5	45-1 GUARD DETACH
11	50-1 GUARD DEPACH
6	X
12	X

Report Header

GTS number: TTR GTS 08.04.08 v4		Description: Drop test till failure
Date : Test number : Quantity :		Type Project : 4D COFO Reason
Product specification : Test specification : Requirement :		
Equipment used: Droptester (Philips build)	Registration number: 71049300	Calibration due date: ASV 230S-170722
Gage R & R: n/a	Room conditions: T = 22°C, RH = 57,5%	GTS version: v8

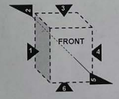
Goal

Conclusion



Drop face	1				2				3				4				5				6			
Device no.	1			7	2			8	3			9	4			10	5			11	6			12
Drop no.	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3
Drop height 150					X	X	X	FI X X				X X X									X	X	X	X X X
130					X	X	X	X X X				X X X									X	X	X	X X X
110				X	X	X	X	X X X				X X X									X	X	X	X X X
90				X	X	X	X	X X X			FI	X X X				FI					X	X	X	X X X
70	X	X	FI	X	X	X	X	X X X		FI	X	X X X				X X X	FI				X	X	X	X X X
Air leak before																								
Air leak after																								

Drop faces:



Tested by	Tijme de Jonge
Reviewed by	Jurre de Vries
Applicant	André Kuijper

Sample	Failure mode and cause, F1:	Failure mode and cause, F2 (150cm):
1	CLICK-IN SNAP, SNAPFIT SNAP	
7		
2	150-2 CLICK-IN BROKE OFF	
8		
3	ANVIL ~~DETACH~~ SNAP	
9	SIDE FLAP BROKE	@ 90-1 EVERYTHING BROKE
4		
10		
5	HINGE SNAPFIT BROKE	
11	90-1 FLAP + ANVIL BROKE	
6		
12		

3-13 110-1 ANVIL DETACHED
X-7 110-1 ANVIL D.+B., HINGE P.B.

Pictures

Drop face	1				2				3				4				5				6			
Device no.	1			7	2			8	3			9	4			10	5			11	6			12
Drop no.	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3
Drop height 110																								
90																								
70																								
50																								
45																								
40																								
35																								
30																								
Air leak before																								
Air leak after																								

Tested by	Tijme de Jonge
Reviewed by	Jurre de Vries
Applicant	André Kuijper

12.4 | All comments

12.3.2 Answers from (Nilsson. Anna et al., 2021)

Answers to: 'You indicated you used a Philips OneBlade in the past, but not anymore. Why did you stop using it?
Performance:
- "I did not like how hot it gets against one's body"
- "I did not like how it felt on my beard"
- "It did not work so well" / "It was not so good"
- "For poor results, had to run over the same area 3-4 times before taking all the hair"
- "Struggling on the skin"

Breaking down:
- "I switched to another brand after it broke"
- "It broke"
- "Poor battery life and did not live up to my expectations at all"
- "Because it was cumbersome, and the batteries died quickly"

Found a better alternative:
- "I got another one that is better"
- "Find something that was better"

Expensive:
- "Expensive"
- "The blades needed to be replaced and new blades are expensive"

Reasons in general: Disappointing results, failure to function, better alternative methods and price are key reasons to stop using OneBlade.

12.3.3 Internet reviews

https://moo.review/philips-norelco-oneblade/ / https://www.reddit.com/r/shaving/comments/4kqm6m/an_honest_opinion_on_the_new_philips_norelco/
- While the OneBlade is an exciting new way to shave your hair, it definitely isn't for everyone.
- The recurring cost of replacement blade will put you frugal-minded folks right off the OneBlade.
- Likewise, the OneBlade is unsuitable for those of you with thick, coarse and flat laying beard hairs.
- But if neither of those last two points applies to you then the OneBlade is a well designed and innovative product that genuinely makes us excited for the future of shavers; proving that it is possible to have a single tool for both trimming and shaving.

https://www.youtube.com/watch?v=v4pTNzN_hbg
- Comment section
- Good for irritable skin
  - I've had a One Blade for a couple years (still using the original cartridge) and it continues to impress. As someone who gets razor bumps pretty badly with traditional razors, the One Blade has been somewhat revolutionary for me. I recommend the product without reservation.
- Trim add ons look / are fragile
  - I've been using one since they were first released, for my face and crew cut.
    It's good but the 1 trim guard is really his weakest point. It's REALLY fragile and once it loses a tooth, you're basically f*cked. Because it didn't fit snuggly on top of the OneBlade anymore, and falls every few seconds whilst you're shaving.
  - How has the clip on comb held up? I get the feeling like it won't last very long and the clip on plastic will wear off
  - The comb has held up great, even after weekly use for the past two years!
- Other
  - One major disadvantage of Philips OneBlade is that it will NOT operate while connected to the power supply, so when the battery is completely drained you are stuck with an unfinished shaving, unless you wait 30 minutes or so for the battery to be charged just enough to finish the job.

https://www.youtube.com/watch?v=e2HTioN7rgI
- Review
  - Expensive compared to safety razor
  - Less clean shave
- Comment section:
- Perfect for irritable skin
  - The one blade is designed for people with sensitive skin. It goes almost as close as any razor goes but without scraping your skin. Been a godsend for me with Eczema.
  - I prefer the One blade to safety razors, cartridge or other electric razors. It cuts close, but not too close. I can shave dry and get zero irritation. It cost more per shave, but definitely worth it for me. Baby smooth = breakout and major irritation for me.
  - The Philips one blade is the most comfortable razor I have ever used to clean shave. I don't think anything else can be as comfortable. It's the only one I use now to shave. There's no skin irritation, cuts or pulling of the hair like rotary razors. It's the best choice.
- Shaving can be an experience
  - nothing will ever beat a safety razor! Watching your channel inspired me to amass my own collection of vintage Gillette safety razors! I've bought 4 of them from various shops on Etsy it's like my crack now lol I've purchased 3 super speed flare tips and also a 1967 Slim adjustable! My fiancé also bought me a special wooden display stand for them all and my brushes

https://www.amazon.com/product-reviews/B01D328BG6/ref=acr_dp_hist_1?ie=UTF8&filterByStar=one_star&reviewerType=all_reviews#reviews-filter-bar
- Scarring from using the blade turned and pressing hard
  - https://www.amazon.com/gp/customer-reviews/R2WWN2RT7QUBD7/ref=cm_cr_arp_d_viewpnt?ie=UTF8&ASIN=B01D328BG6#R2WWN2RT7QUBD7
- Expensive blades
- Fragile blades
- Some people don't seem to understand that you have to shave against the hairs, so upwards

https://www.amazon.de/-/nl/product-reviews/B01B1NVB66/ref=acr_dp_hist_1?ie=UTF8&filterByStar=one_star&reviewerType=all_reviews#reviews-filter-bar
- TBA

https://tweakers.net/pricewatch/768883/philips-oneblade-qp2520-30/reviews/
- Niet robuust
  - is van plastic dus niet lomp mee doen..
  - Niet robuust gebouwd
  - Lage kwaliteit
  - niet robuust

https://www.youtube.com/watch?v=9kpNQBslae8
- This thing actually works very very well and is more than versitile. Only problem is that its veey thin plaatic up around the razor and it broke veey easily. Stayed with Phillips but so much for the Oneblade!
- Actually the replacement blades cost 25 euro a pair while the shaver itself (only face version) costs 30. So 1) you basically will have to spend as much money almost every 10 months as if you were buying a new shaver 2) which makes completely senseless buying replacement blades, because a new shaver, with its 3 included replacement blades, lasts for 12 months. And after all, I'm not eager to spend 30 euro for a shaver that only lasts one year.

Interviews
- Short interview at Manometric. Bearded man, using OB for 3 months
  - Perfect as it can do everything at once: trimming, edging shaving.
  - Do you care about the looks of it? No not even a little

12.3.4 Reddit post comments

https://www.reddit.com/r/shaving/comments/12l2bsc/how_could_the_oneblade_shaver_be_improved_and_for/

1.3.1.1 Reactions

1. Razors like OneBlade can't be improved unless they're open to the idea of making a razor head that was capable of using DE safety razor blades inserted beneath the skin shield. Anything electric or battery powered is doomed to fail. Go DE safety razor or straight razor all of the way
2. For one thing, the blades are $1 each for one edge. Astra blades are 8 cents each for 2 edges.
3. I bought a oneblade, it was absolutely terrible. Tried it once and threw it directly in the trash after. Complete waste of money. Honestly you are better off using razors for shaving and clippers for clipping. Anything that tries to "do it all" just does a shitty job at all of it.
4. Since I have thick hair and sensitive skin, plus the growth pattern around my neck area has the hairs grow parallel to the skin, I'm very susceptible to irritation and ingrowns. That's why I use electric and the oneblade gets close enough to look alright and not give me horrible blemishes from cutting too close or below the skin. So I would say my biggest things are the fact it's got a flat head so some jawlines aren't so easy to get nice and neat. The other brands, like king c Gillette look like they got a bit of a curve on the head. Also the way it connects leaves tiny hair particles that are hard to completely clean off the back of the head when I rinse it. The different models should probably all have battery indicators as complimentary and the price differences should be in the motors. The more expensive one needs to be buffed and possibly different speed options you can set it to. Would also be cool to see different heads for different purposes. Could keep the flat and do curved heads, as I previously mentioned, or an extra wide head for large areas you might clean up other than the face. Maybe even one with longer teeth to keep the blade further from the skin for manscaping the boys too, as that's big nowadays after the company Manscaped took off. Different heads would fit the idea of it being

a one tool for multiple jobs too, as I just don't see one design being good at all these different jobs and hair/skin types.
5. As a user of the oneblade for several years and the competition intermittently I'm going to give my 2 cents.
a. Improve the blade durability. Main competition has a 5 year blade that can handle a beating Phillips has a 4 month blade with flimsy hinges on each side that breaks if you look at it the wrong way.
b. Durablade does the flexible head just as well with a metal hinge and is way more reliable.
c. I give up on oneblade once a year once the plastic hinge breaks 1 month in or similar.
d. I'm not that rough with it but it's flimsy sorry
e. In the last 2 years I've spent 0 on durablade upkeep and about 100 on oneblade upkeep because of the hinge falling apart(this doesn't include the 4 month renewal if a blade makes it to 4 months it may be kept and set aside for when a sharper blade hinges break until I can renew again). It's hard to justify even if it's the best option for me at the moment.
f. Yes the hinge fell off mid shave last night yet again and I have a trip to the supermarket to fix it today.
6. I don't get a good shave on my face with OneBlade. It's quick and easy but not the best job!
7. I bought the OneBlade Pro 360 a month ago, and I'm super disappointed. Shaving used to be a 5 minutes thing, and now it's almost double the time because some hairs are properly shaved but some others not. I'm watched the "how to use" video, but it doesn't really get any better. Battery is pretty good though, but overall just not worth it.

12.3.5 Questionnaire 1 + 2 comments

Dislikes ("what you dislike about having a OneBlade?")
NOTE: all participants used 2D cofos and old add-ons (so not the 5in1)
1. expensive blades
2. The tip falls off every now and then, not just the adjustable trim heads but also the complete top part. It is also not that flexible, I find shaving the jaw and what is just beneath not that easy
3. Overall shaving experience is simply not very good. Has trouble achieving a good shave.
4. Sometimes i cut myself
5. Doesn't really shave as well in the area on my neck (hals).
6. The trim pieces dont work so I can basically only shave at the shortest. Doesnt remove all hairs, works best against the grain.
7. The heads that can be used to choose the trim size easily fall off and break. A lot of hairs are stuck inside the shave head
8. You need to replace the blade
9. It's doesn't work that well when you want to trim a more grown (fuller) beard and is less efficient in a clean shave.
10. For some reason the bladed misses some hairs everytime. So I have to run over the same hairs multiple times.
11. And the add-ons for body hair pop off very easily
12. Not much
13. the hairs are all over the sink, but nothing that a bit of water cant wipe away
14. Nothing
15. Sometimes my skin gets irritated by using the oneblade. Even though I'm cleansing my blade and replace them on time.
16. Blades breaking down
17. Plastic opzet stuk
18. Since I always use it with these clips, the dullness indication on the blade doesn't work well. Additionaly I experienced a few times that I couldn't finish because of empty battery. Gives nice laughs but not very practical. You can't see how much usetime is left.
19. At times, if the battery is low, it won't shave off a lot at first. If I can shave a lot in one go, that's more what I want.
20. It doesn't shave as good as a gillete fusion
21. If you drop it with the blade attached, the blade brakes almost every time
22. Not 100% hair shave rate, sometimes leaves little wounds on hilly skin
23. It doesn't completely remove hairgrow, so i always do it over with a regular razor to make it completely smooth.
24. blades are too fragile. plastic hinge breaks
25. Blades get bold quickly
26. Shave is often not very smooth.
27. Flimsy blades. I travel a lot and the plastic pieces often snap
28. De add-ons en de blade vallen er nog wel eens af.
29. Ongelijk trimmen
30. The fact that it has a battery and very fucking expensive blades. It's like the printer of shaving machines, super affordable to buy but expensive to use.
31. The blades are very expensive and it could still be a little bit better shaving clean
32. Nothing
33. sometimes the hairs get stuck in the blade
34. Blades are too expensive.
35. The replacement blades are quite expensive

Likes ("what you dislike about having a OneBlade?")
1. Not having to put a lot of effort in shaving because it's electric, the possibility to be able to trim instead of fully shaving
2. Versatile. Can use for body + face
3. Cuts clean, easy to use
4. Convenient, water-proof, works good enough.
5. Cheap, easy and safe to use, waterproof, light weight, versatile
6. Small design and easy to choose trim size (the length of the hair to remain)
7. No irritations after shaving
8. The versatility and ease of use
9. Very easy to use for both face as body hair. No shaving foam needed.
10. It's fast and easy to use, even if the hair is long
11. Easy shaving and barely irritating skin after shaving
12. It Shaves almost as close as a razor
13. It's quick and shaves quite smoothly. Easy to use and easy to handle.
14. Easy to use everywhere
15. Waterproof
16. I use it mostly with these additional clips for trimming. It works great (if the blade is sharp and battery full), it doesn't give me rashes and ingrown hairs (like my previous Braun electric shaver would) and you can still easily see where you're shaving/trimming because it's rather small. It's also in general a nice size product, easy to take when travelling and can be also used for body hair (under the shower).
17. It's great with giving a pretty clean shave, which sets a base for a cleaner shave with another blade.
18. I like that you can do a quick shave without the use of water. Furthermore, it is nice to trim your hairs around the balls.
19. Easy to use and it's very versatile
20. Easy to use, long battery life
21. Easy to use, quick
22. It's easy to use and cuts well, also it's versatile because you can use it for other parts on your body with the help of the accessoires.
23. effective and fairly close cut without harming myself
24. No shaving cream
25. ease of use and result
26. Easy to use, body safety additions are also very useful.
27. Love that it can be easily used on body and face
28. Lekker klein, lange batterij duur, gemakkelijk om mee te nemen
29. It does not irritate my skin after shaving
30. It's not too expensive and it does it's job
31. Easy to use, no irritantion, smooth skin
32. it does very good job
33. They are pretty good for touch ups.
34. Really good battery, it's quick to shave

Aesthetics
- Aestetics is important in everything, however a shaving machine is maybe least important in my opinion. It needs to be small and easy to grip with robust parts. That's it.
- if it shave good that is all that matter
- I like it to be balanced so that it's easy to hold in hard places to reach.
- I don't really care about the way it looks, but it does feel nicely in the hand
- Aesthetics matter when initially buying a shaver, but after that it is purely about functionality so not important

7.2 OneBlade dislikes

7.2.1 Shaving

7.2.1.1 Shaving speed

Customers complain about shaving speed, having to go over areas multiple times, especially the chin area. It is mentioned that it is also not good with flat laying hairs or thicker hair. A mentioned solution is to shave against the hair direction, as otherwise they glide under the blade. This is not being communicated and not something needed with other razors or shavers.

7.2.1.2 Shaving quality

As explained in paragraph fixme the OneBlade does not shave as clean as other razors and shavers. While this is also a feature, some customers do not seem informed about it and complain about the shave quality. Better communication from marketing might be beneficial.

7.2.1.3 Feel on the skin

- Lauded for causing no irritation
- However some people have cut themselves. This was after pressing the blade hard into the skin with the cutting teeth facing down, an unintended way of use

7.2.2 Build quality

7.2.2.1 Handle

Little comments are made about the mechanical build quality of the handle

7.2.2.2 Battery life, quality and charging time

Some people complain about the battery life and charging time. However this only seems to be about the cheapest handle that is equipped with a slower charging battery with less capacity. Another complaint is that after falling the battery can stop working. During personal drop tests from max 110 cm this was also seen, with both tested handles stopping to work after about the 5th fall. Also one customer disliked that if the battery is empty, it cannot be used while charging.

7.2.2.3 Shaving head hinges breaking

An often mentioned problem is that the hinges of the shaving head break easily. The hinge of the old shaving head is mentioned breaking after falling of the sink, during transport, by tapping it on the side of the sink too hard or even mid-shave. The new 360 head is said to better withstand all this. However, as it just entered the market no data is available, needing further research.

7.2.3 Cleaning

7.2.3.1 Hairs shooting everywhere

During shaving a complaint is that hairs shoot everywhere due to the absence of a hair catcher.

7.2.3.2 Cleaning handle and shaving head

Additionally a lot of hairs are caught in the shaving head and little hair particles are hard to clean off the body. However it is said that a tap on the side of the sink and a quick rinse solve these issues. Hairs can also get stuck between the body and the shaving head and in the variable distance add-on. These are harder to remove.

7.2.4 Shaving head (replacement)

7.2.4.1 Shaving head replacement cost

One of the most mentioned dislikes is the cost of replacement blades compared to their lifetime. As mentioned in paragraph fixme shaving with the OneBlade is comparatively expensive, which consumers notice.

7.2.4.2 Shaving head detaching

Multiple complaints have been made about the shaving head detaching during use. If it detaches, due to the springs holding it down, it shoots away which is not expected.

7.2.4.3 Blade size

Few comments were also made about blade size, with it either being too small to shave quickly, or too big for precision cutting your beard style. These however sound like suggestions other than real dislikes.

7.2.4.4 Environmental concerns

Few comments were also made about the perceived environmental impact of having to throw away also the hinge when the blade becomes dull.

7.2.5 Storage

7.2.5.1 Small so good for traveling

The OneBlade only seems to be lauded for its compact size that allows for easy traveling.

7.2.6 Add-ons

7.2.6.1 Add-ons not shaving properly

Customers complain about the resulting shaving quality and speed of the add-ons. Most complains are about the fixed distance add-ons (see paragraph fixme figure fixme). It is unknown of this is because they are not good or because these are sold the most. New add-ons have been brought on the market recently that seem to tackle these issues. However as no reviews have been found it is unknown if the issues have been solved.

7.2.6.2 Add-ons detaching

An often mentioned dislike is that while shaving add-ons can detach easily. If a grooming add-on detaches this can lead to cuts in sensitive areas.

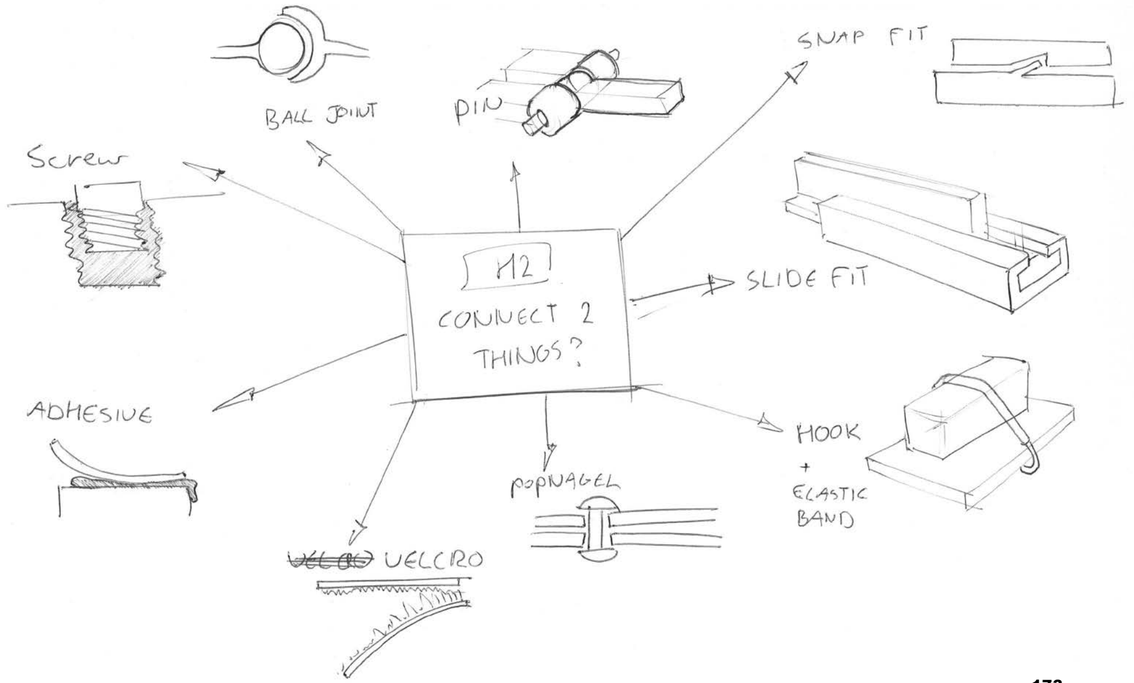
7.2.6.3 Teeth break easily

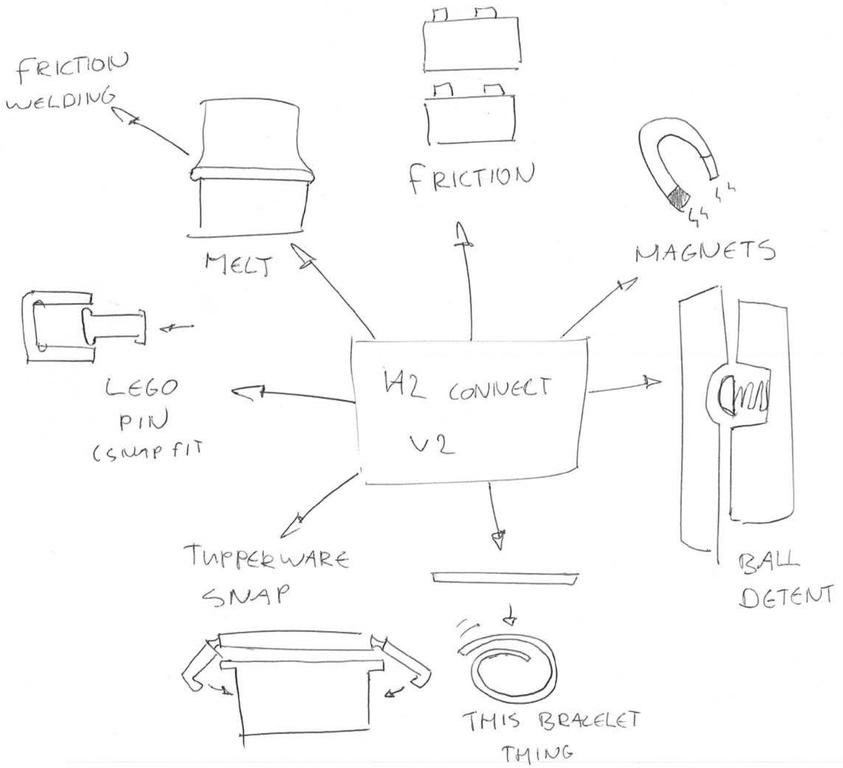
It was also mentioned that, if it falls, the teeth of the add-ons break easily. Others however mention that at least the variable length add-on is quite strong. It is unknown if in the previously mentioned new add-ons this issue still exists.

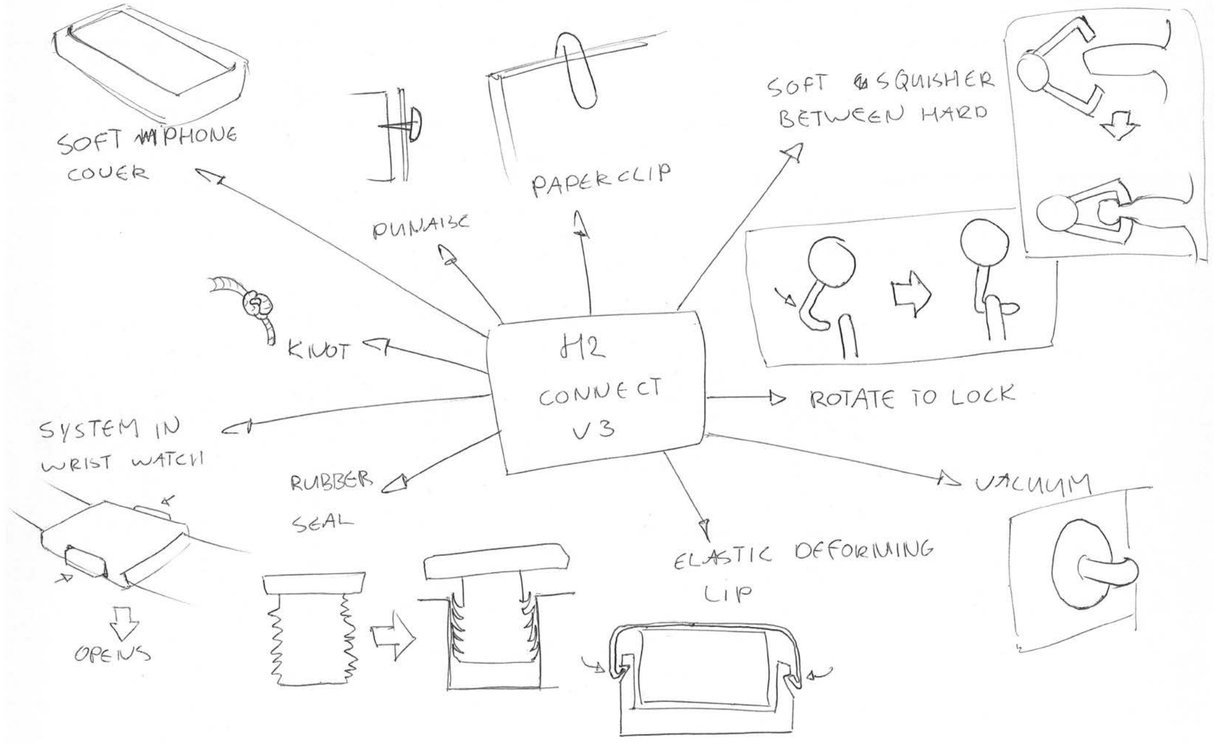
12.5 | **Ideation process**

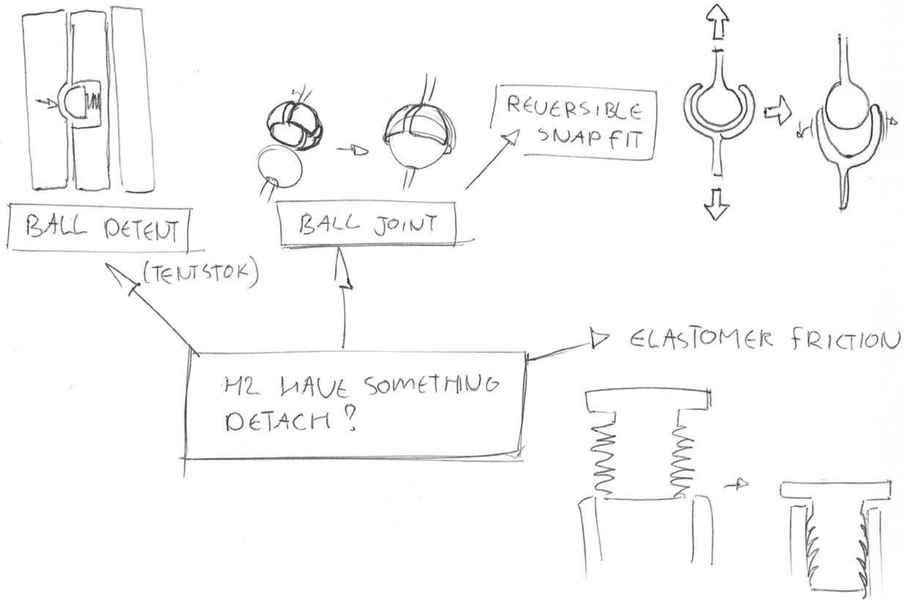
This part chronologically lists most ideas that were attained during personal ideation and two creative sessions. They are mostly meant to inspire. Hope it will be a fun read ;)

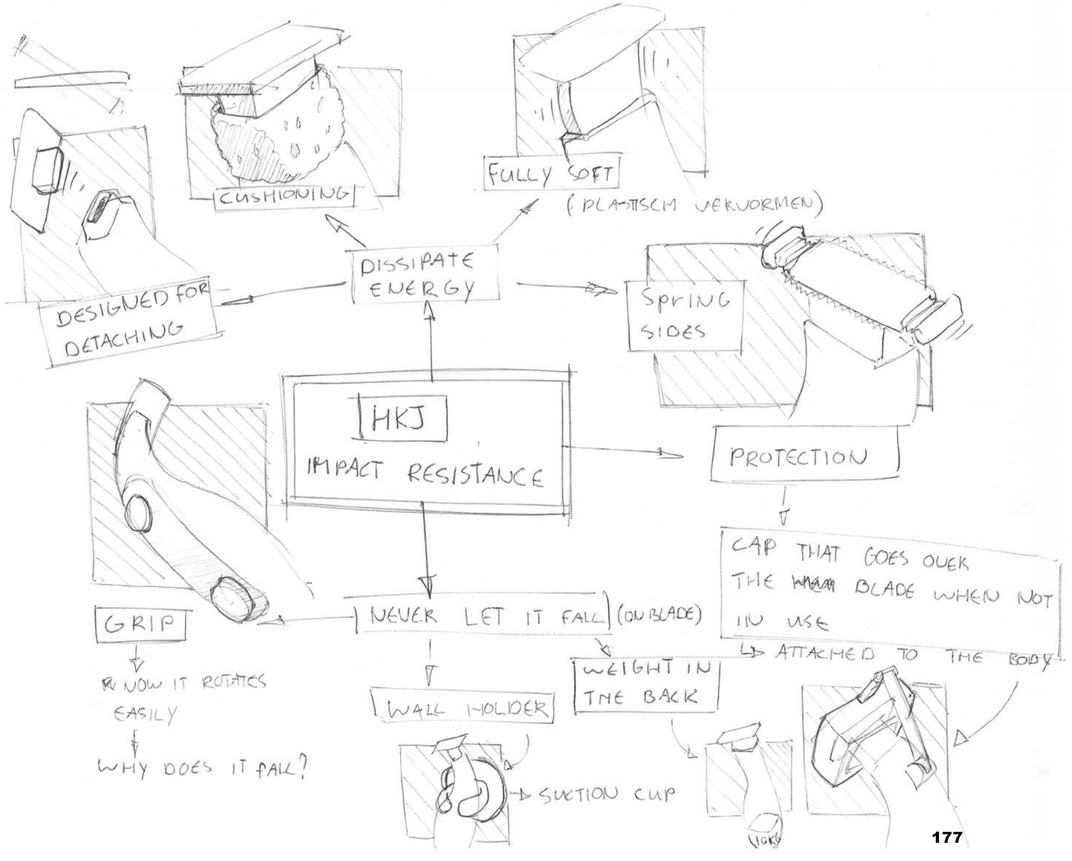
12.5.1 **H2s before ideation**




FRICTION WELDING
FRICTION
MELT
MAGNETS
LEGO PIN (SNAP FIT
H2 CONNECT V2
TUPPERWARE SNAP
BALL DETENT
THIS BRACELET THING


SOFT PHONE COVER
PUNAISE
PAPERCLIP
SOFT SQUISHER BETWEEN HARD
KNOT
H2 CONNECT V3
ROTATE TO LOCK
SYSTEM IN WRIST WATCH
RUBBER SEAL
VACUUM
ELASTIC DEFORMING LIP
OPENS


BALL DETENT
(TENTSTOK)
BALL JOINT
REVERSIBLE SNAP FIT
M2 HAVE SOMETHING DETACH ?
ELASTOMER FRICTION


CUSHIONING
FULLY SOFT
(PLASTISCH VERVORMEN)
DESIGNED FOR DETACHING
DISSIPATE ENERGY
SPRING SIDES
HKJ
IMPACT RESISTANCE
PROTECTION
CAP THAT GOES OVER THE BLADE WHEN NOT IN USE
ATTACHED TO THE BODY
GRIP
NOW IT ROTATES EASILY
WHY DOES IT FALL?
NEVER LET IT FALL (ON BLADE)
WALL HOLDER
SUCTION CUP
WEIGHT IN THE BACK

Shaving head decouples before breaking

Blade decouples before breaking

Strong materials

External protection

12.5.2 Current solutions for breaking in- and outside the grooming market

Easy-to-attach cover

Ball hinge

Magnet + click

Pouch

Torgue limiter

Air hinge

Rotation in handle

Low weight

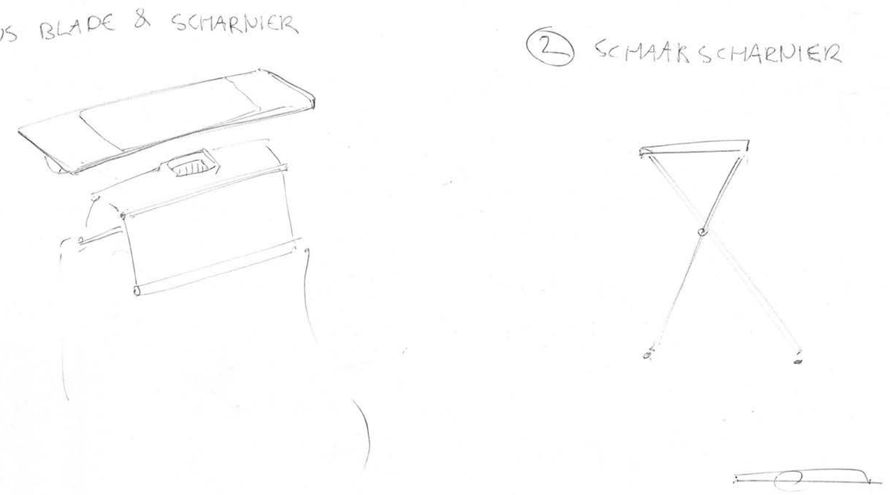
Lot of surface area -> dissipate energy

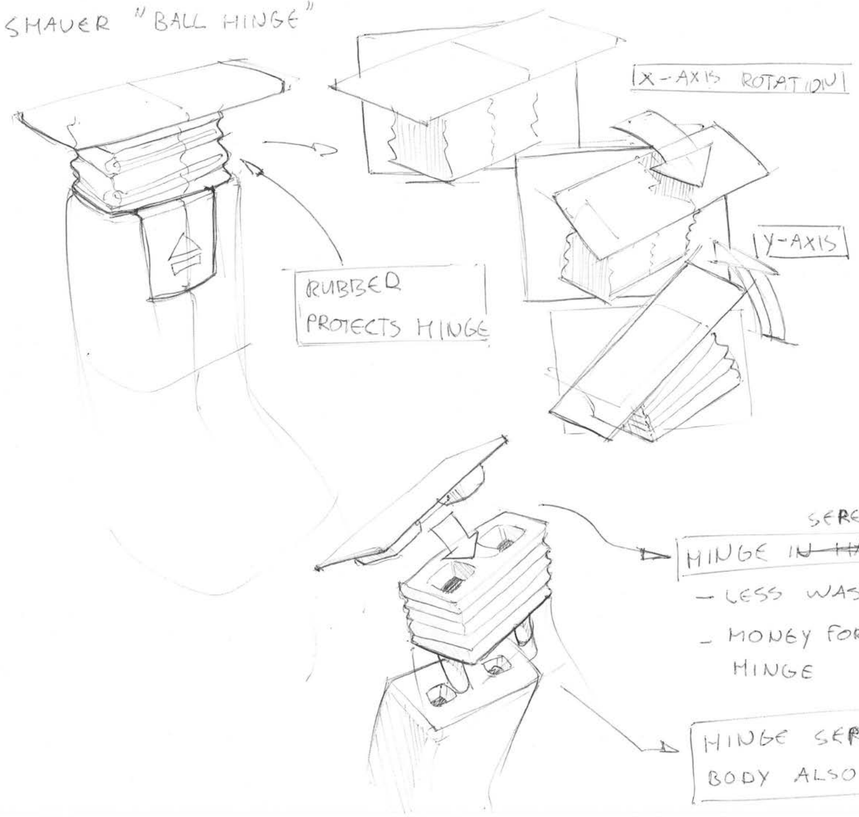
No protrusions -> no big moment arms

Be able to de-tension the shaving head?

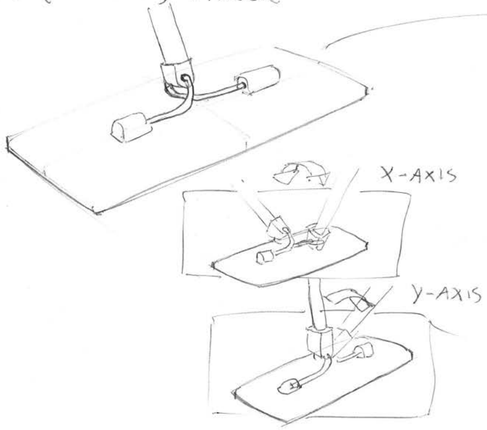
Thumb push puppet

12.5.3 **Ideation 1**

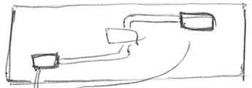




5 MOP (DWELL) HINGE



TOP VIEW



"KNOBS" CAN BE PLACED OFF-CENTRE FOR DIFFERENT SHAVE FEEL

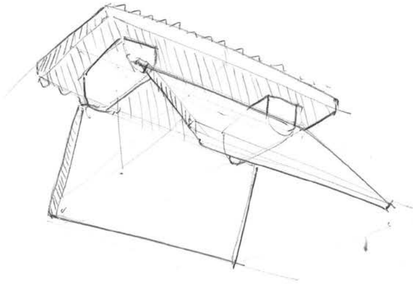
↓

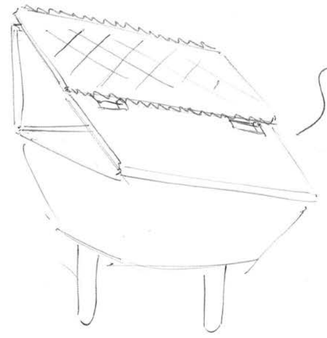
CAN IT THIS?

↓

NO NOT LIKE THIS

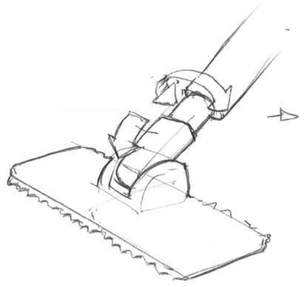
6 4D HINGE ON 2D CUTS





→ STRONGER THAN FILM HINGE (MARK, PHILIPS)

(7) STOF ZUIGER MINGE



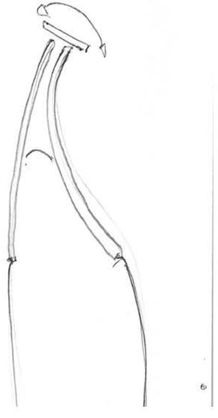
→ NO CLUE WHAT THE PRO'S ARE, IS FUN THO ☺

(8) WHOLE BODY IS A MINGE

→ ONLY CAANGE KNIFE/BLADE

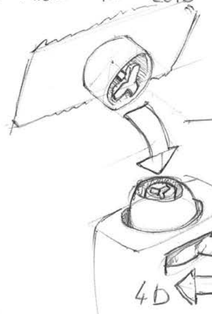
→ WHEN IT FALLS BLADE POPS OFF → REDUCED # FORCE ON HINGE

→ CAN BE MADE STRONGER & MORE AESTHETIC DUE TO LONGER USETIME



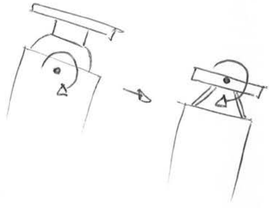
(9) BALL MINGE YOU CAN LOCK

"2D AND 4D COPD IN ONE"



→ SAME CONNECTION AS SHAVERS

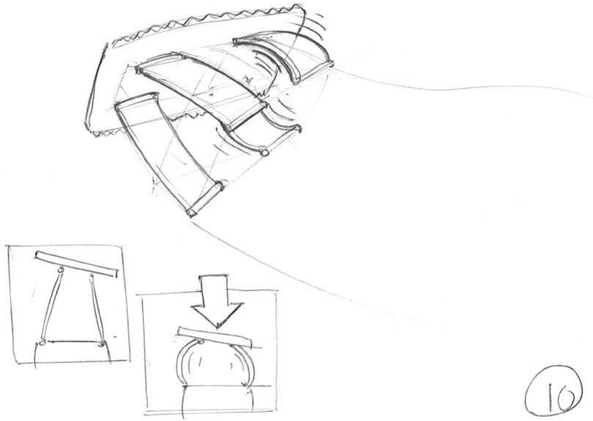
→ WRONG ROTATION POINT → SHOULD BE AT BLADE



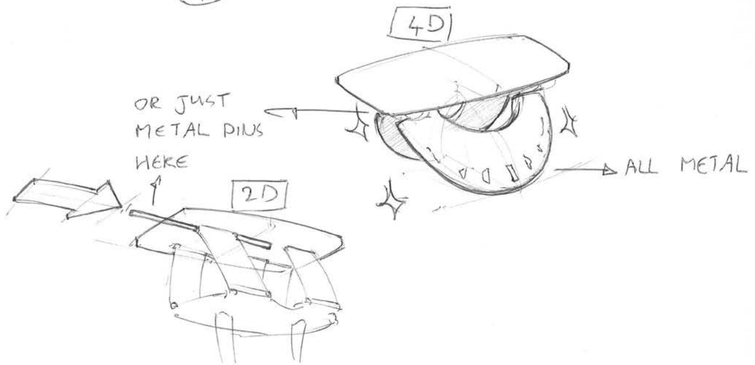
→ SWITCH CAN LOCK SIDEWAY MOVEMENT

→ NO DIFFERENT BLADE TYPES ~~M~~ NEEDED ANYMORE

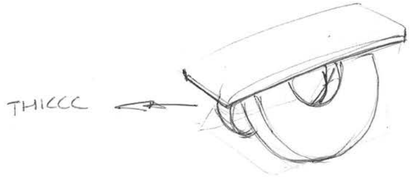
(9) 2D COFO WITH SOFTER MATERIAL HINGES



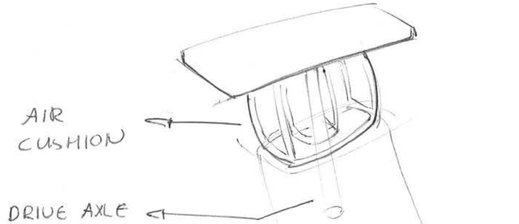
(10) CHANGE MATERIAL (TO METAL)



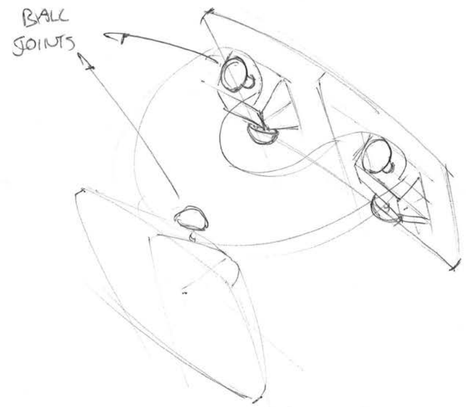
(11) JUST INCREASE # OF MATERIAL IN HINGE



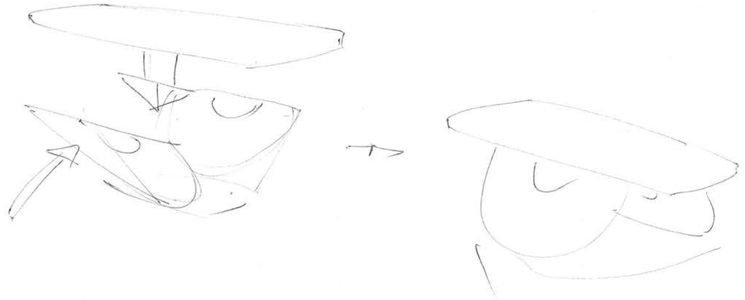
(12) AIR HINGE



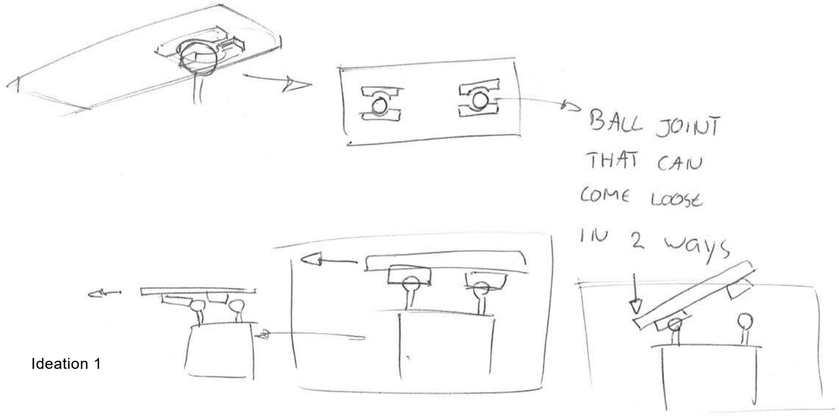
(13) ALL BALL JOINT 4D COFO



14 INSERT / REMOVE BLADE BY OPENING 4D HINGE

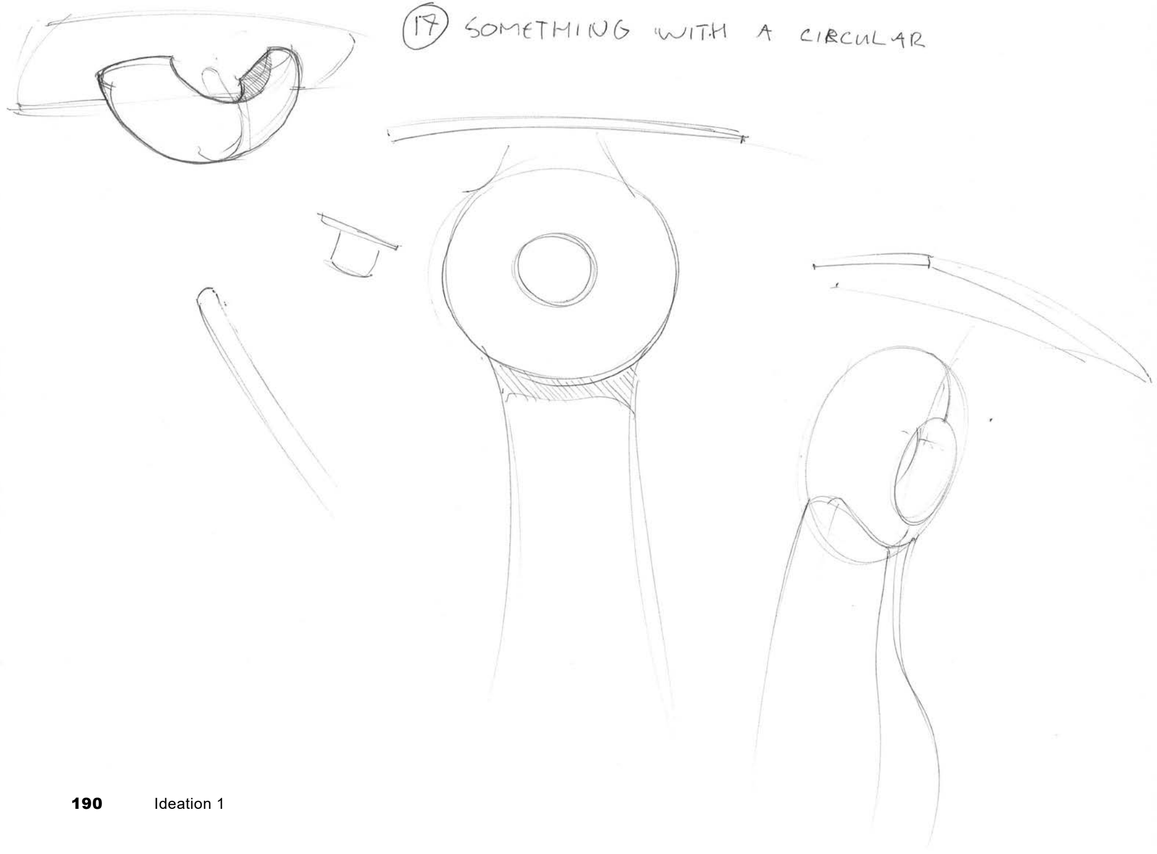


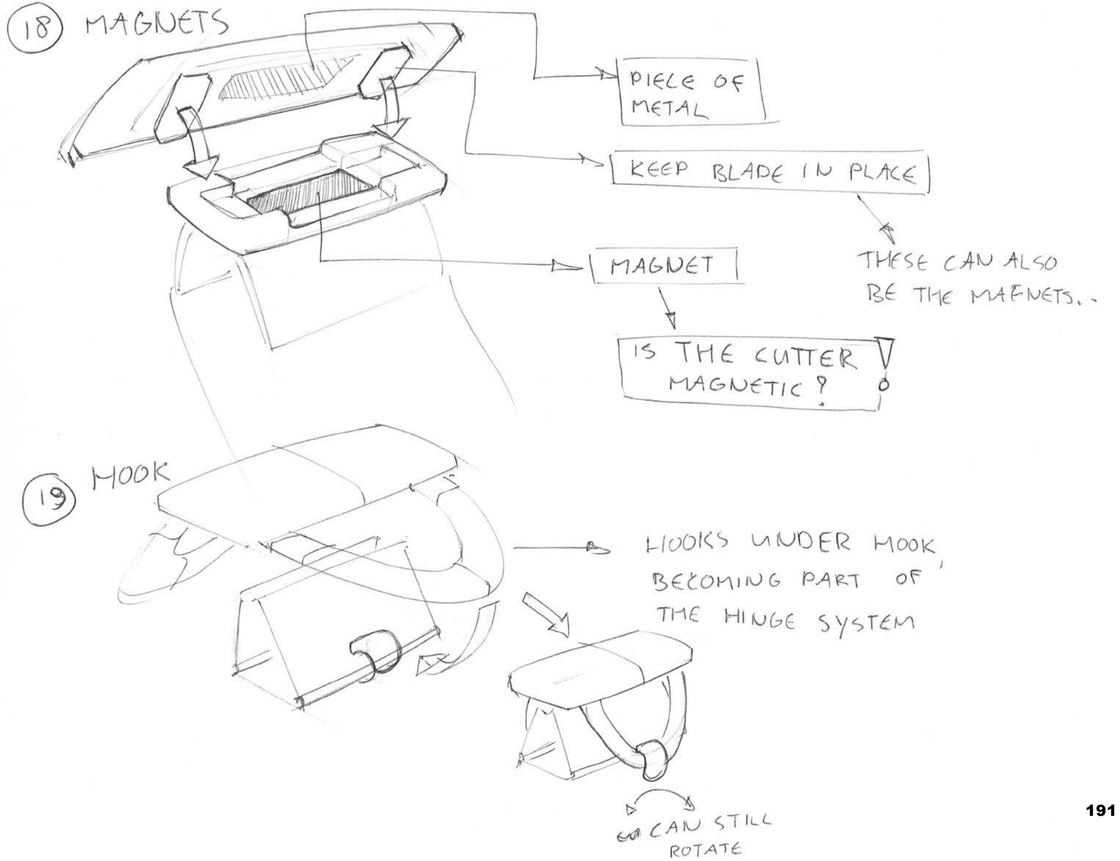
13 BLADE DETACHING FOR ENERGY DISSIPATION DESIGN



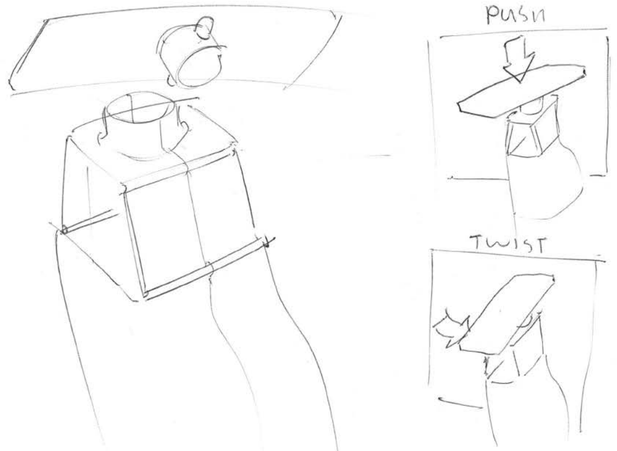
16 TORQUE LIMITER

17 HINGE FROM META MATERIAL


17 SOMETHING WITH A CIRCULAR

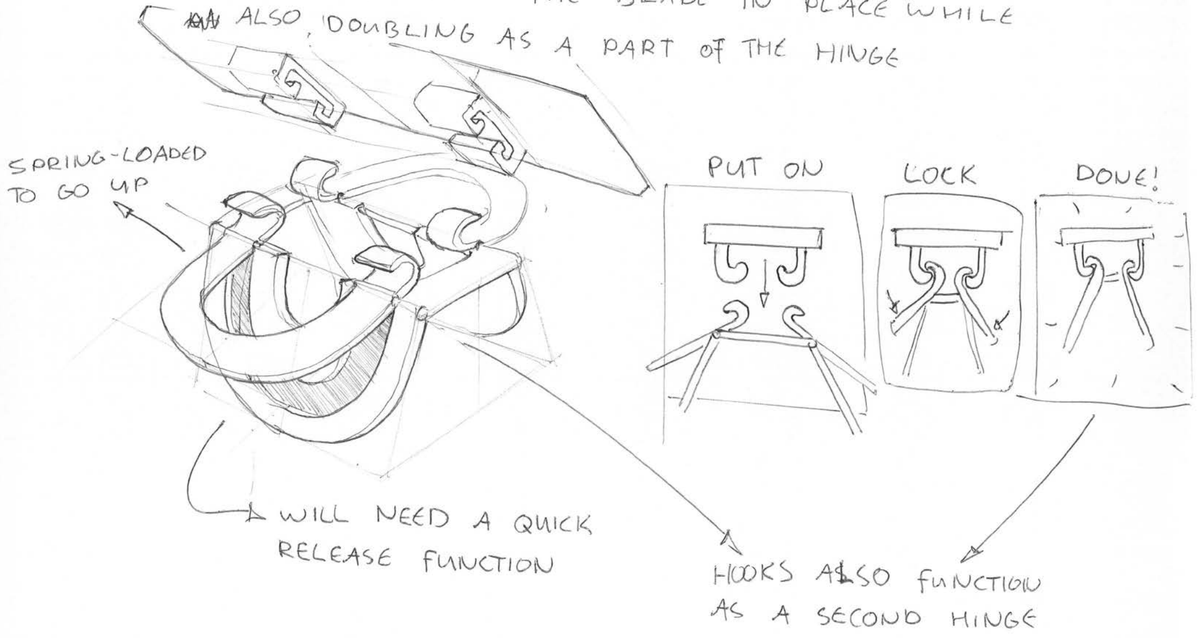

18 MAGNETS
PIECE OF METAL
KEEP BLADE IN PLACE
THESE CAN ALSO BE THE MAGNETS..
MAGNET
IS THE CUTTER MAGNETIC ?
19 HOOK
HOOKS UNDER HOOK, BECOMING PART OF THE HINGE SYSTEM
CAN STILL ROTATE

(20) TWIST-ON BLADE



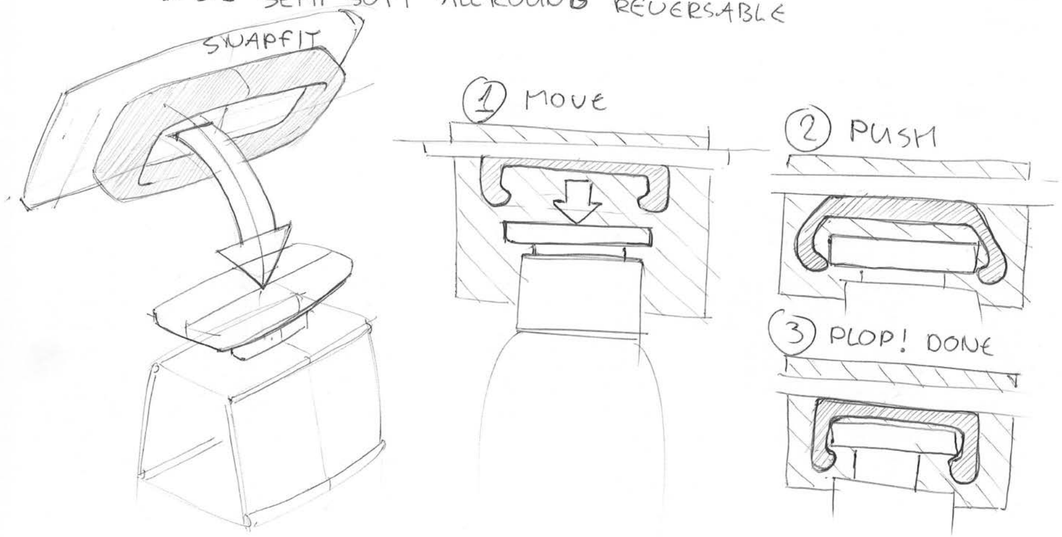
(21) MORE HOOK

↳ HINGES HAVE "FLAPS" ON THEM THAT CAN OPEN AND CLOSE, LOCKING THE BLADE IN PLACE WHILE ~~AN~~ ALSO, DOUBLING AS A PART OF THE HINGE

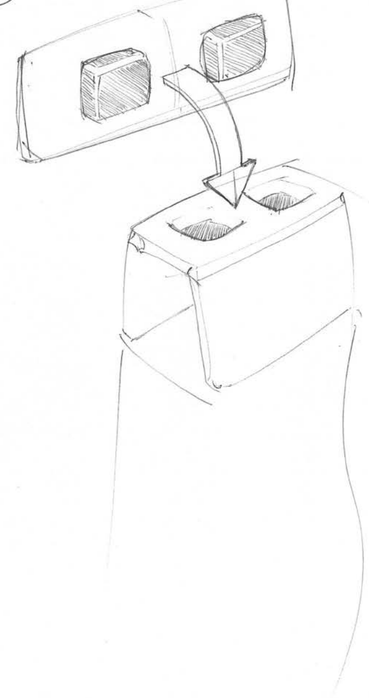


22 SMARTPHONE COVER

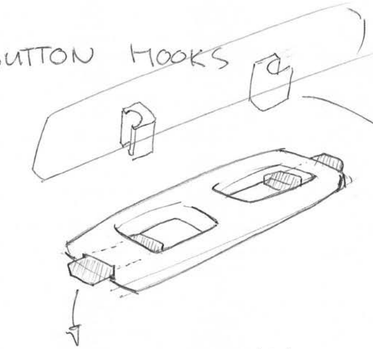
↳ I.E SEMI SOFT ALL ROUND REVERSABLE



23 RUBBER KNOBS

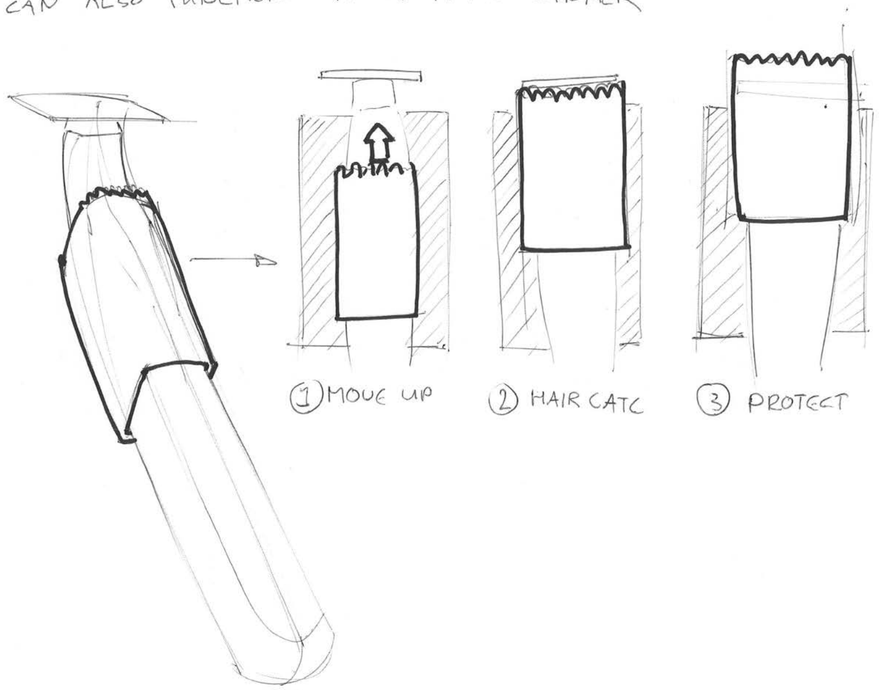


24 BUTTON HOOKS

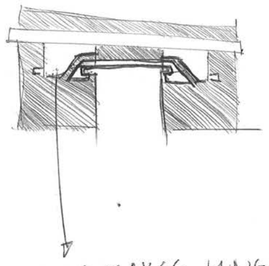


(~~I~~ SHOULD BE DRAWN THE OTHER WAY AROUND)

(24) SLEEVE TO PROTECT HINGE
↳ CAN ALSO FUNCTION AS A HAIR CATCHER



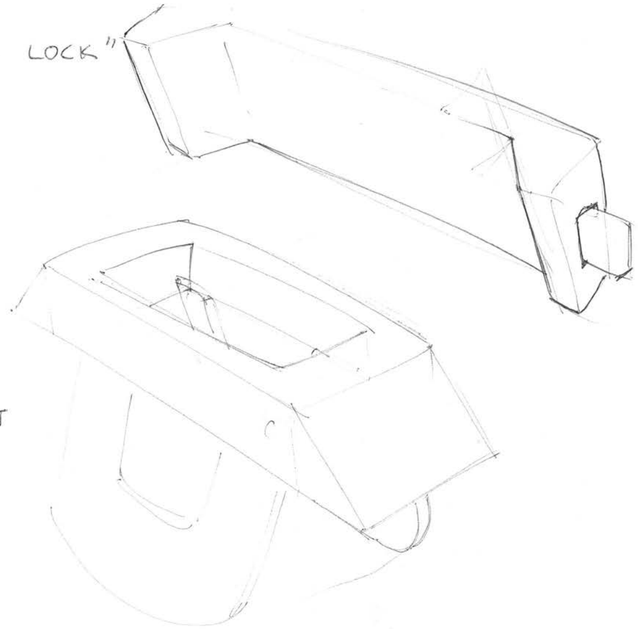
(25) IMPROVED "WATCH LOCK"



INDENT MAKES HINGE SIT CLOSE TO THE BLADE

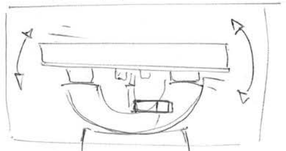
↓

GENERAL PROBLEM W. SERRATE BLADE: HOW TO KEEP THE HINGE TOGETHER?

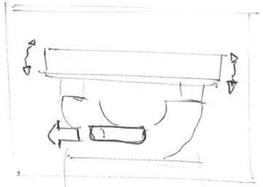


(26) LOCK THAT EATS UP ENERGY OF THE FALL

PULL LEVER TO LOCK MECH.

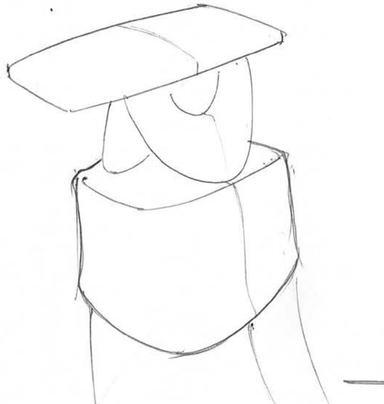


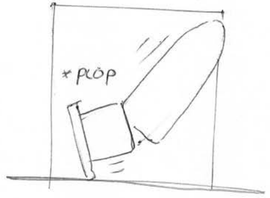
LEVER RIGHT: EASY MOVEMENT



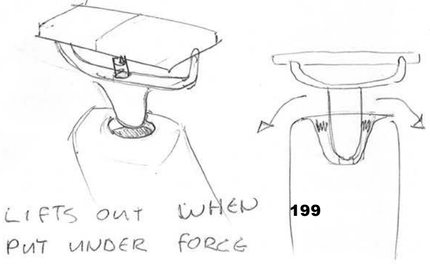
LEVER LEFT: TOUGH MOVEMENT
↳ THIS TAKES THE ENERGY

(27) HEAD DETACHING, DISSIPATING ENERGY



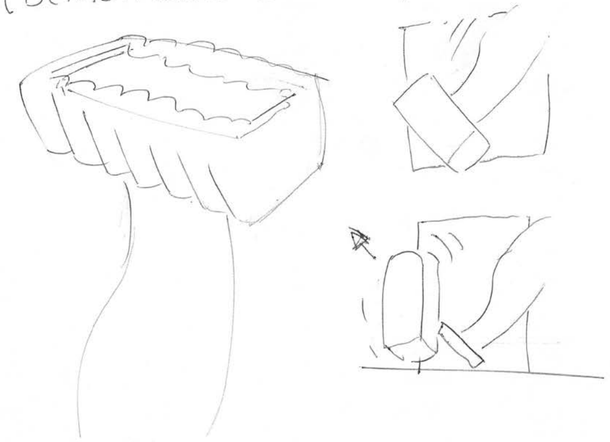


(28) ONLY SIDEWARDS ROTATION IN THE BODY, WITH CONNECTION THAT EASILY DETACHES

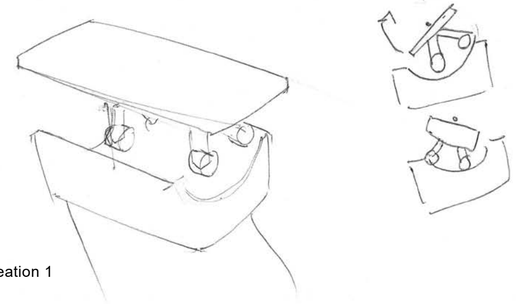


LIFTS OUT WHEN PUT UNDER FORCE

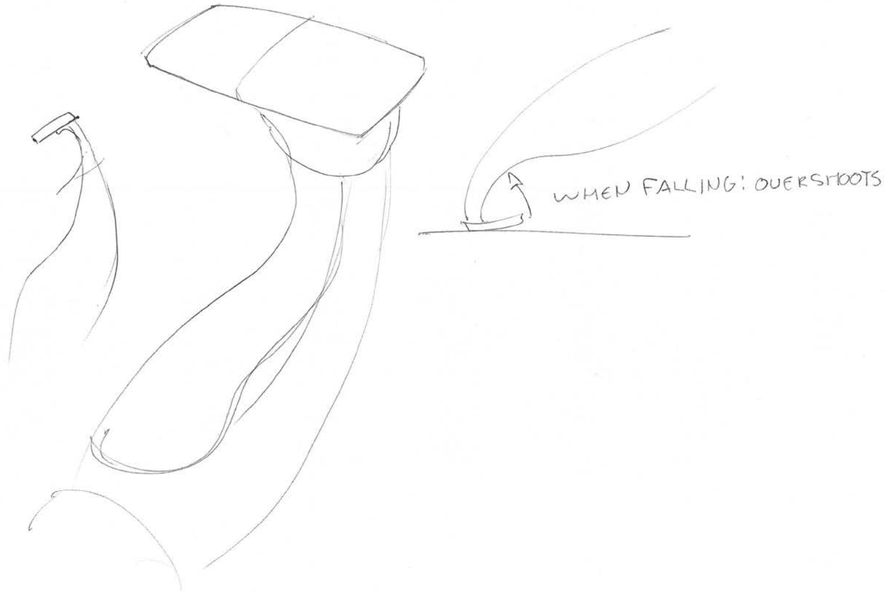
29 (DETACHABLE) BUMPER (BASICALLY GROOMING ADD-ON)



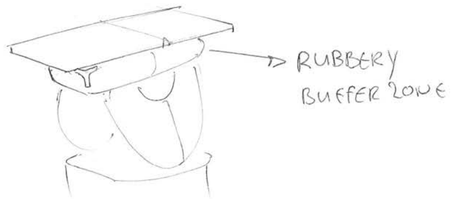
30 HINGE ON WHEELS



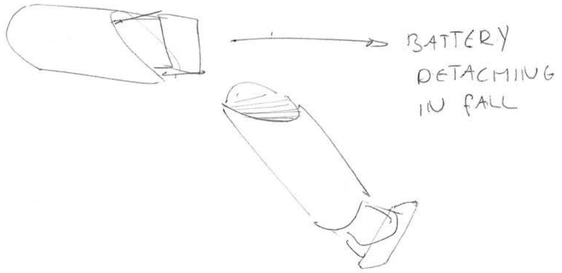
31 HINGE ON (1) SIDE, ALLOWING TO SHOOT AWAY



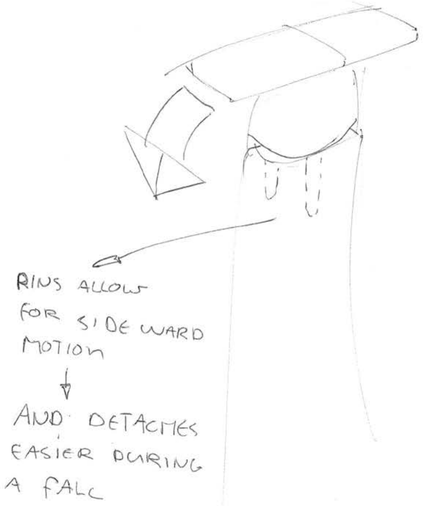
32 RUBBERY MATERIALS



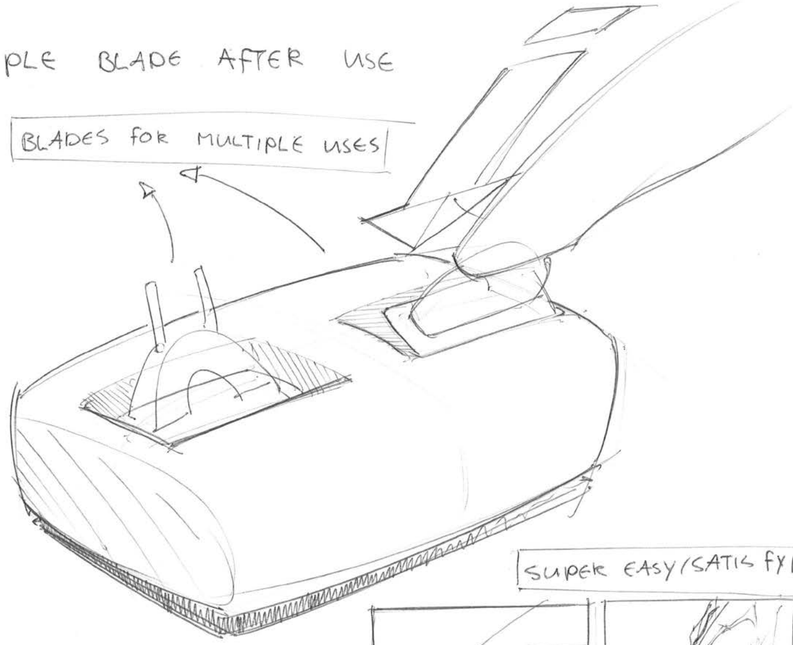
33 LOSING WEIGHT



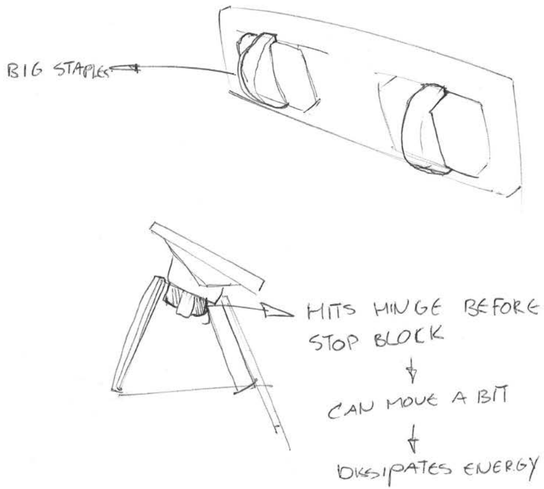
34 ROTATED INTERFACE



35 DECOUPLE BLADE AFTER USE



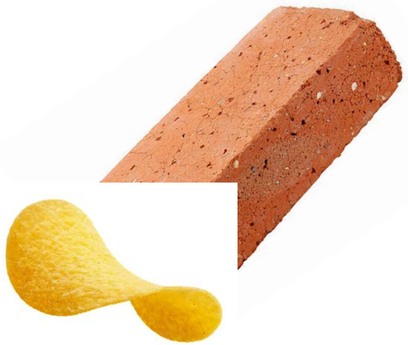
(33) ENERGY DISSIPATING STAPLES



12.5.4**Creative session**

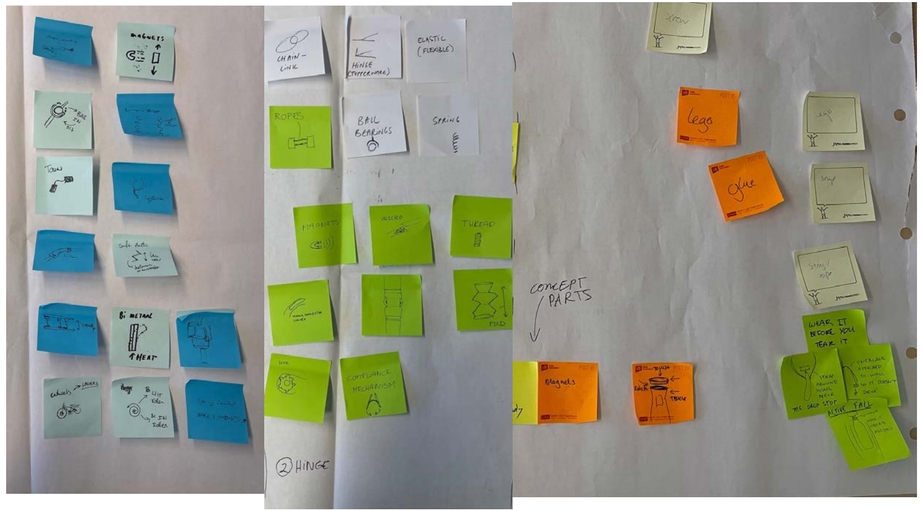
As my own creativity had run dry, A creative session was done with 9 designers. See here the steps and results. Findings were added to the morphological chart.

1. H2 Make this impact resistant?



2. H2 Make something impact resistant?

3. H2 Connect two things and allow movement?

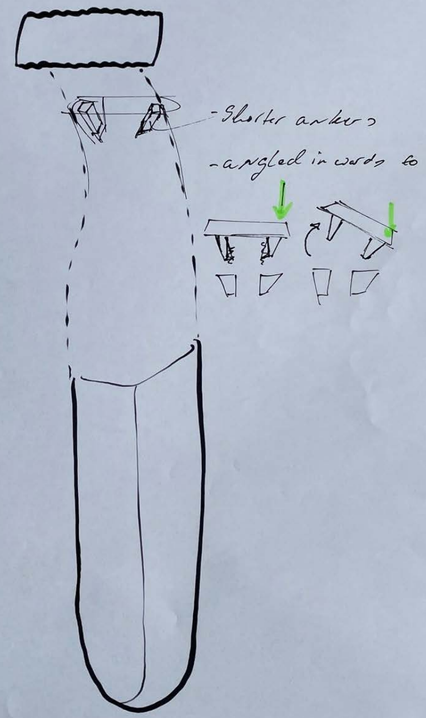


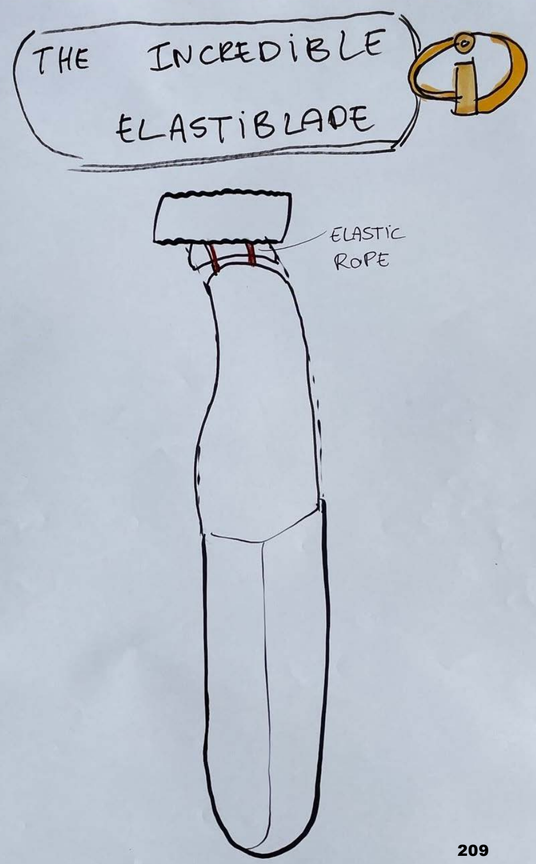
Team 2: we hate green

4. H2 Make OneBlade impact resistant?

DOG CAMP SHADE

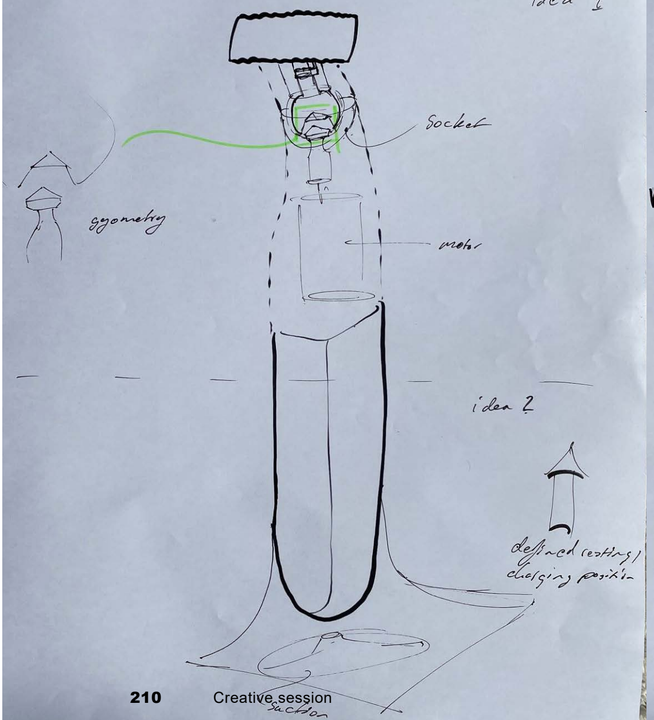
Tiny pins





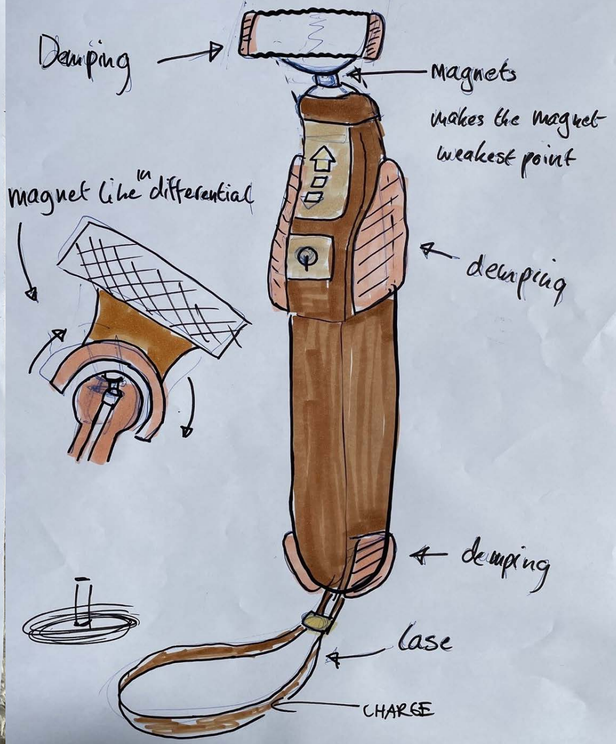
Complicated Triangular ball joint

idea 1



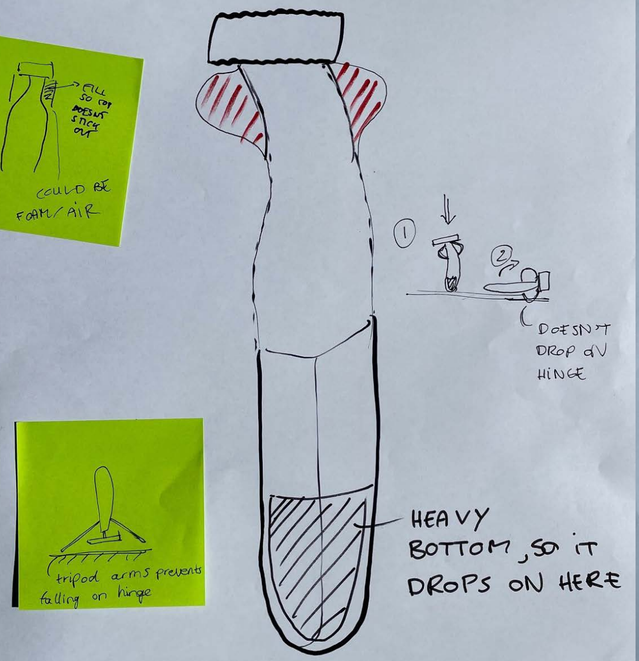
team 2 : We Hate green

Big Magnet.

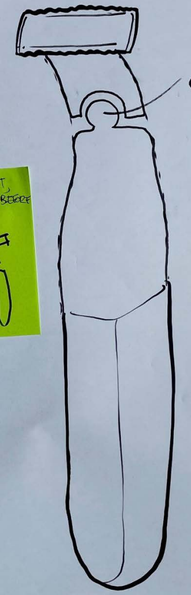


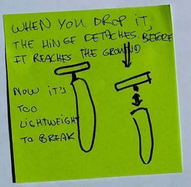
(BE SAFE)

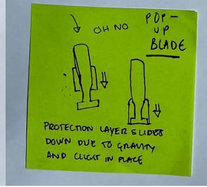
WRAP IT

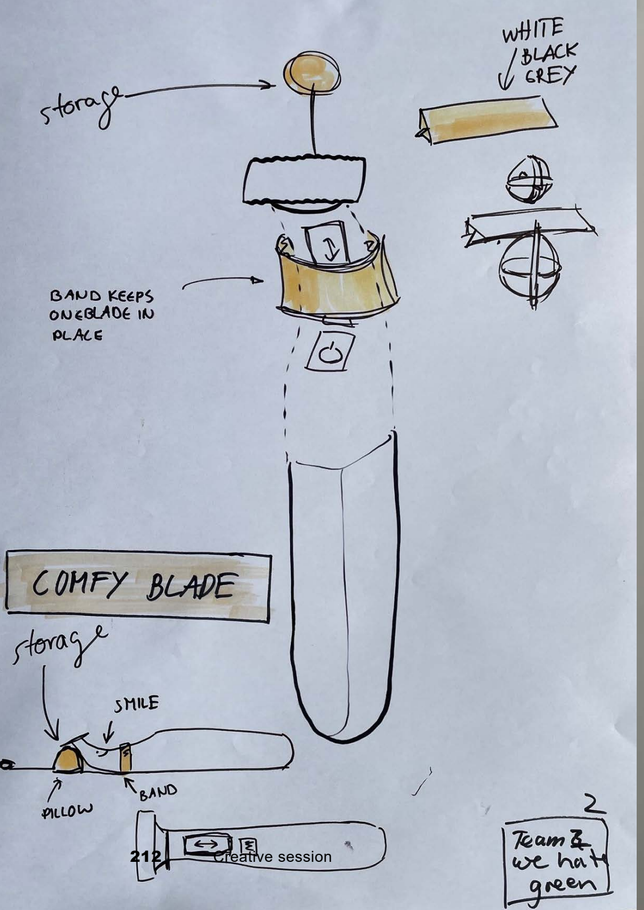


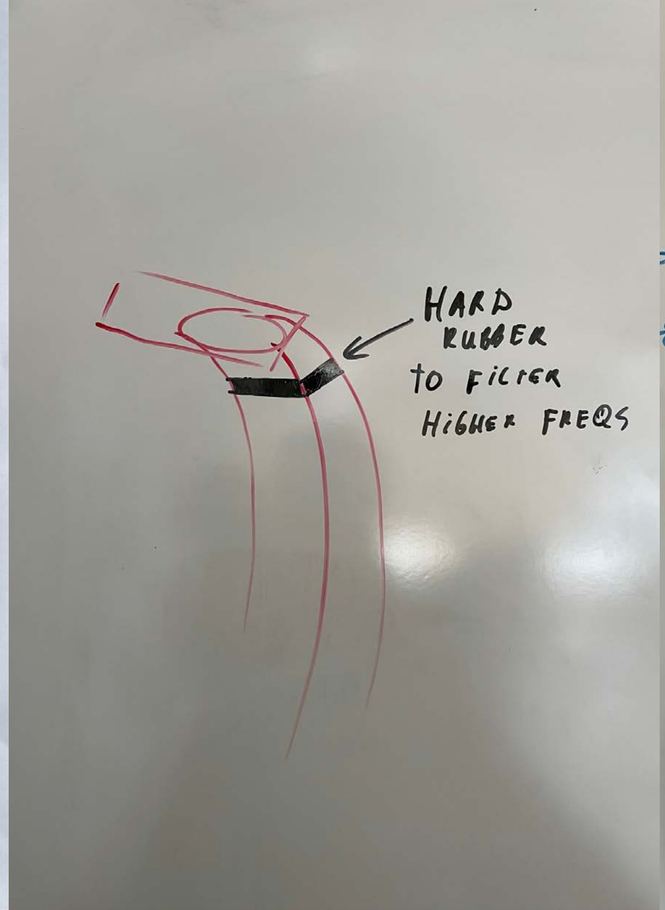
FLYING SOLO

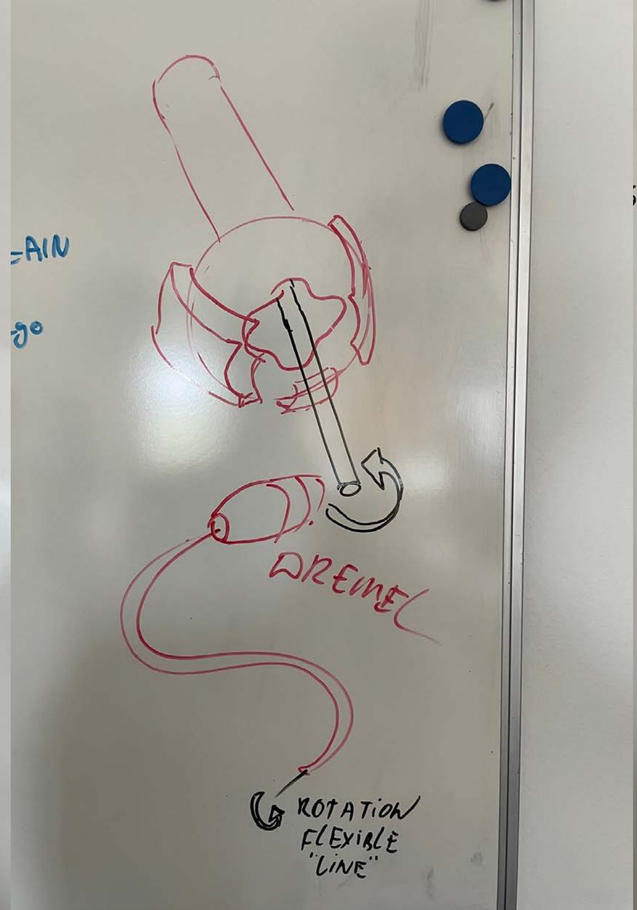


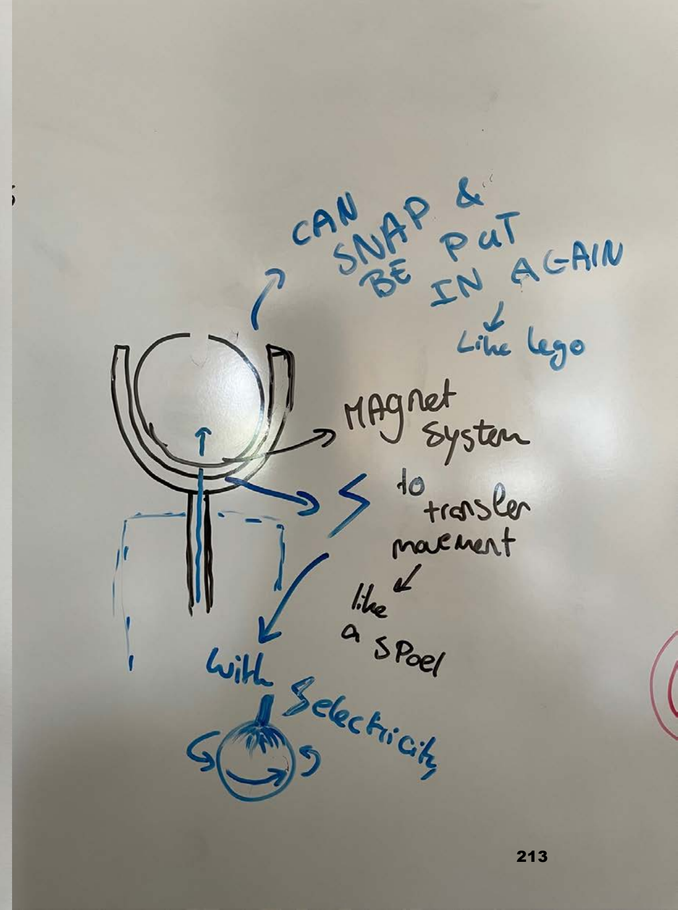


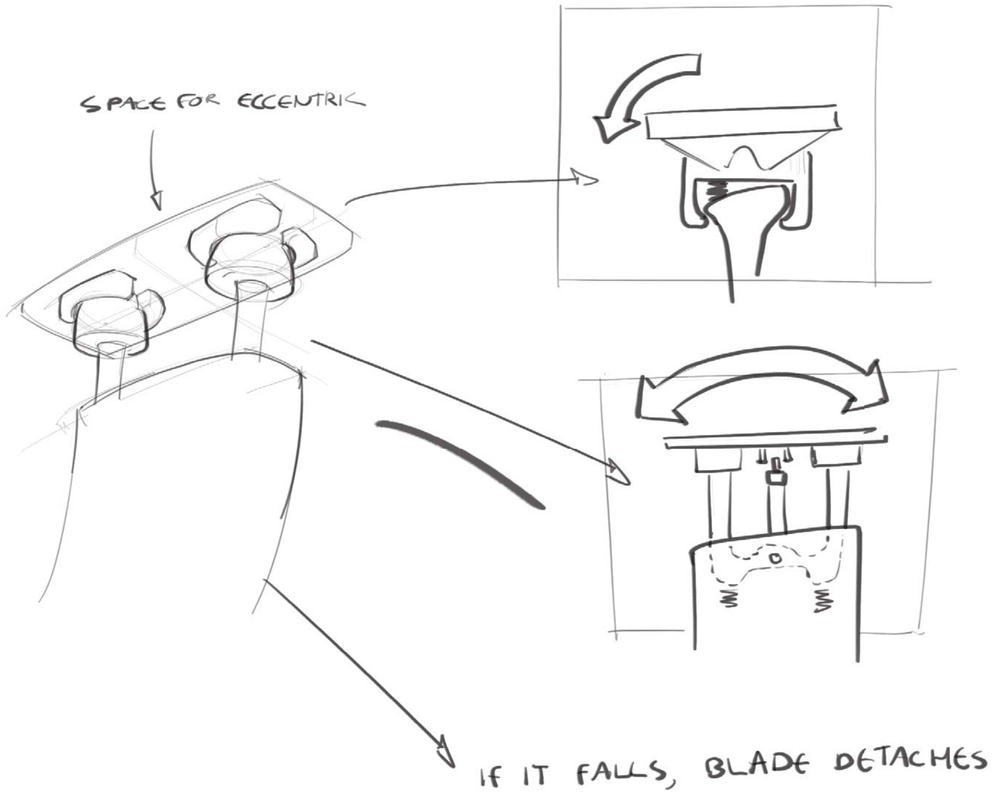


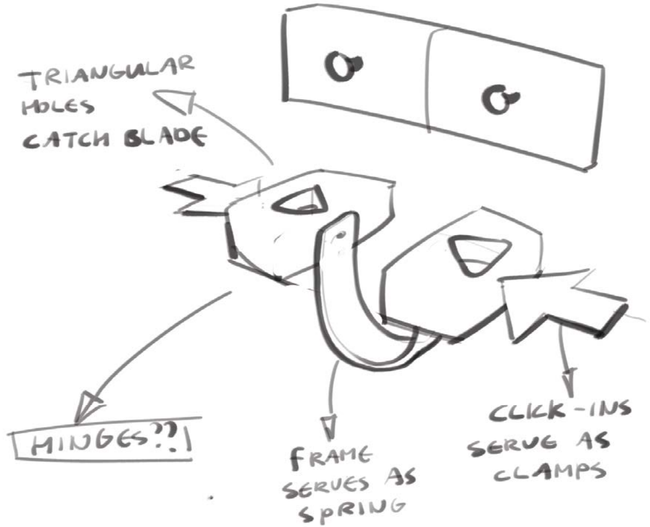

storage
WHITE
BLACK
GREY
BAND KEEPS ONE BLADE IN PLACE
COMFY BLADE
storage
SMILE
PILLOW
BAND
2
Team 2 we hate green

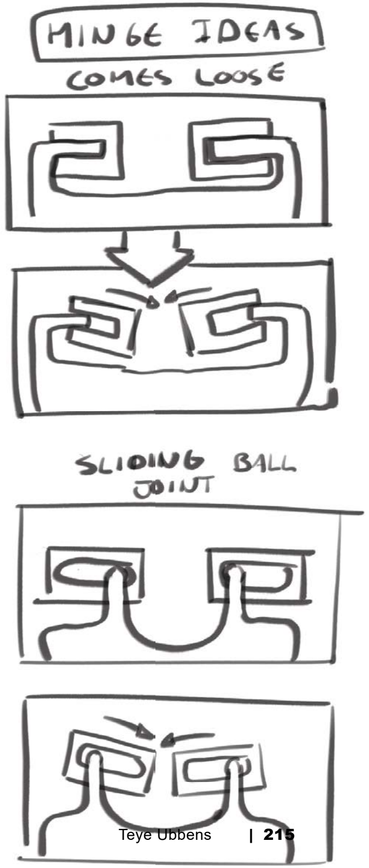

HARD RUBBER
TO FILTER
HIGHER FREQS

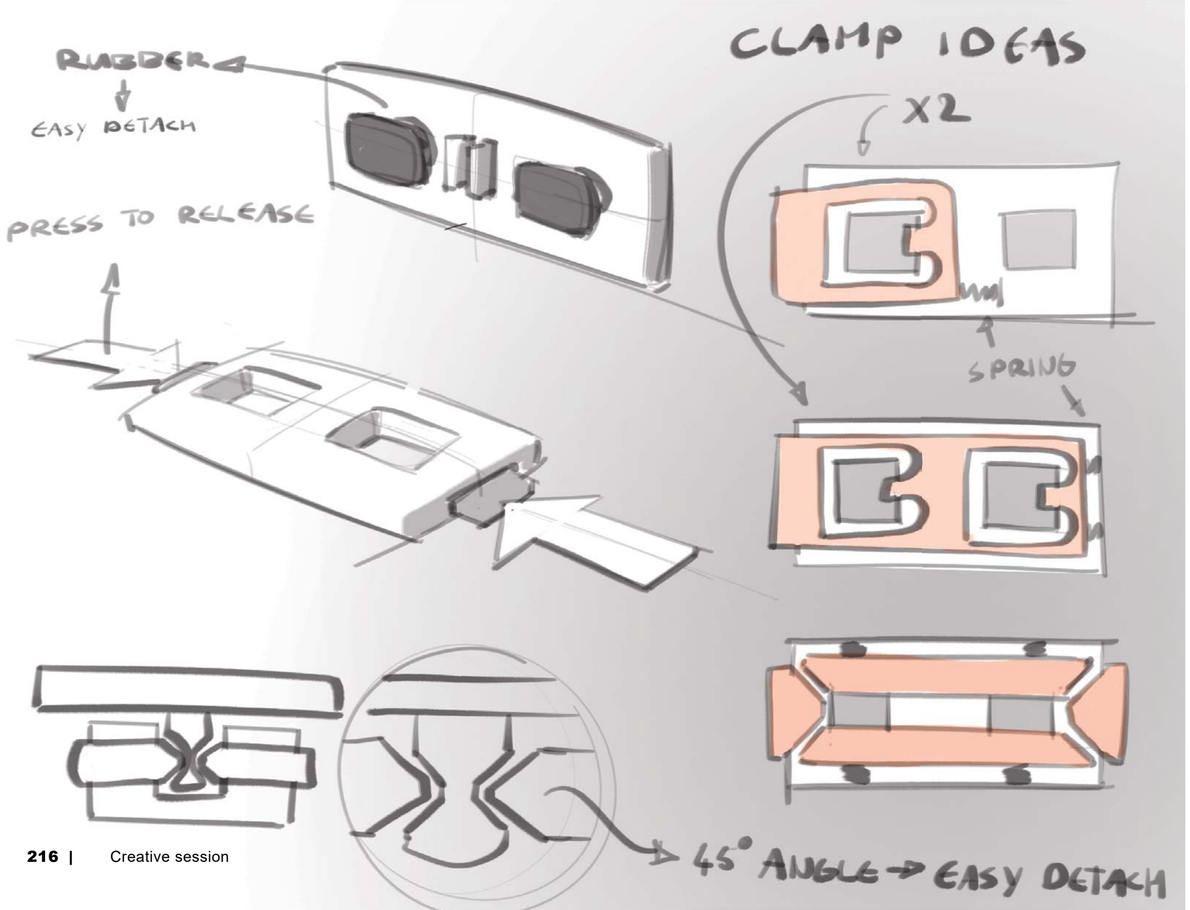

-AIN
go
DREMEL
ROTATION
FLEXIBLE
"LINE"

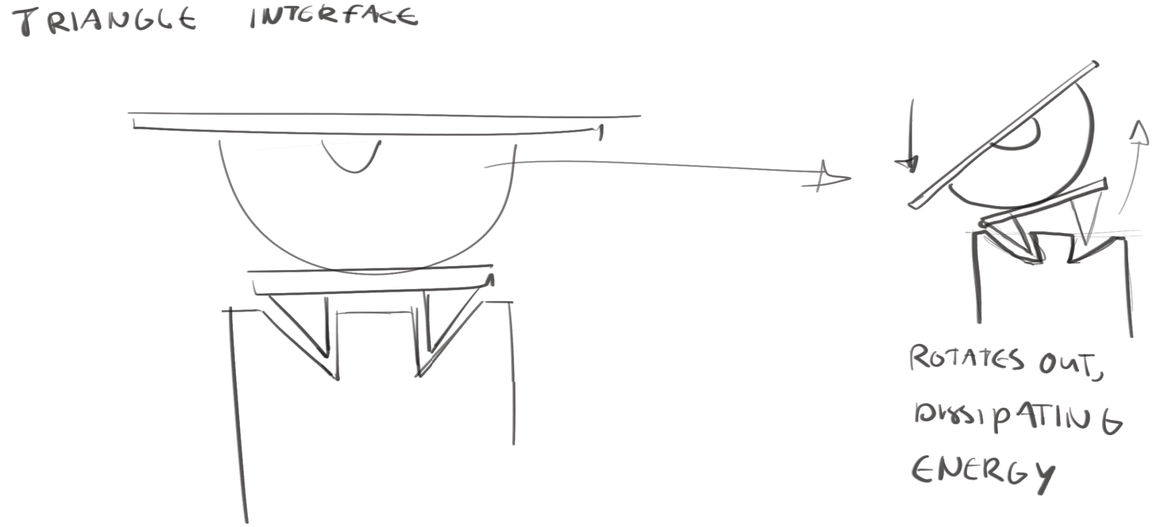

CAN SNAP & BE PUT IN AGAIN
Like lego
MAGnet System
to transfer movement
like a SPoel
With Electricity


SPACE FOR ECCENTRIC
IF IT FALLS, BLADE DETACHES

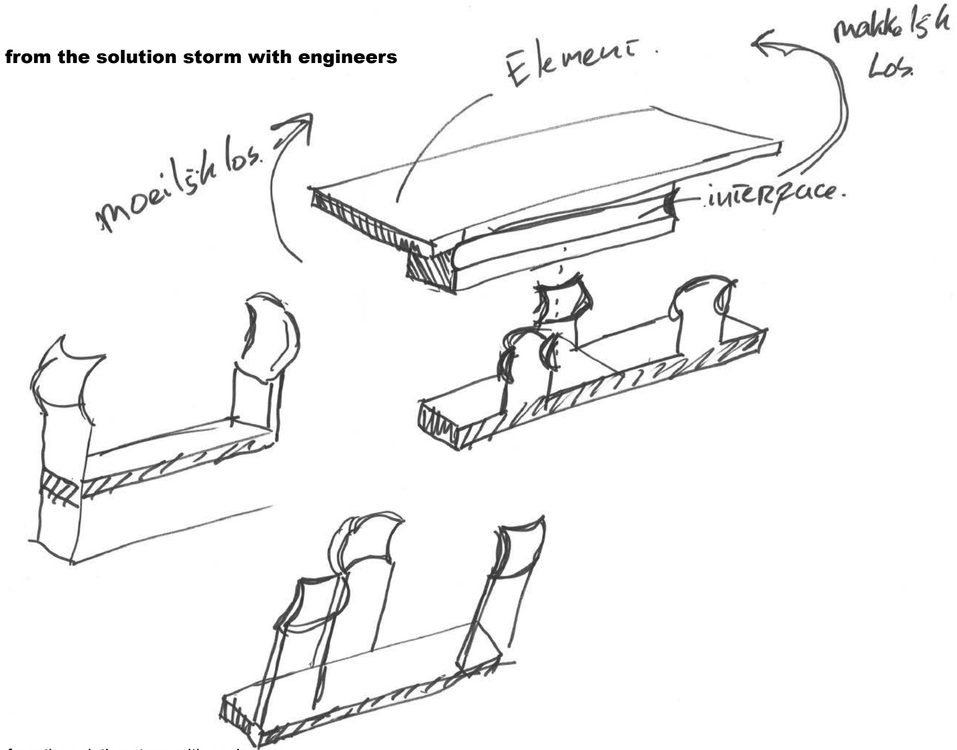

TRIANGULAR HOLES CATCH BLADE
HINGES?!
FRAME SERVES AS SPRING
CLICK-INS SERVE AS CLAMPS

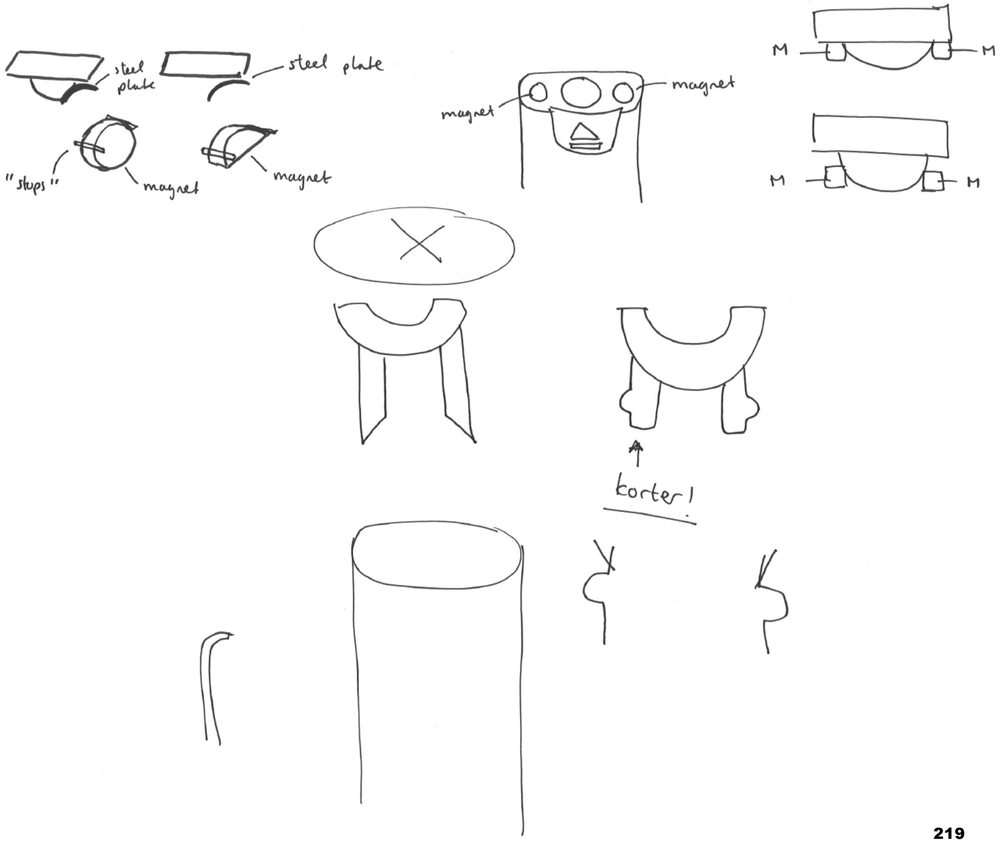

HINGE IDEAS
COMES LOOSE
SLIDING BALL JOINT

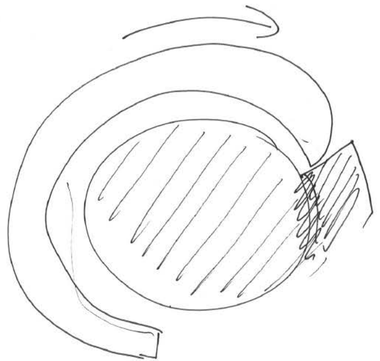

CLAMP IDEAS
RUBBER
EASY DETACH
PRESS TO RELEASE
X2
SPRING
45° ANGLE → EASY DETACH

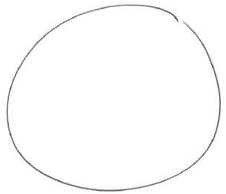

TRIANGLE INTERFACE
ROTATES OUT, DISSIPATING ENERGY

12.5.5**Scribbles from the solution storm with engineers**

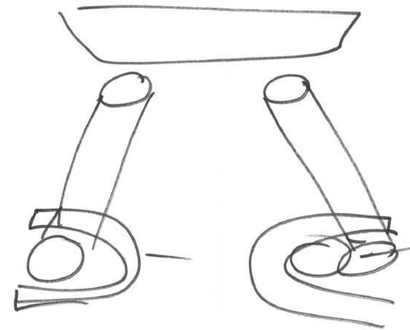




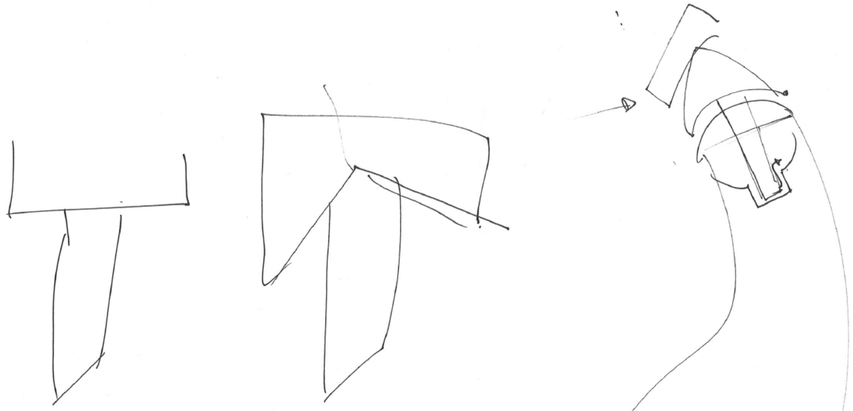


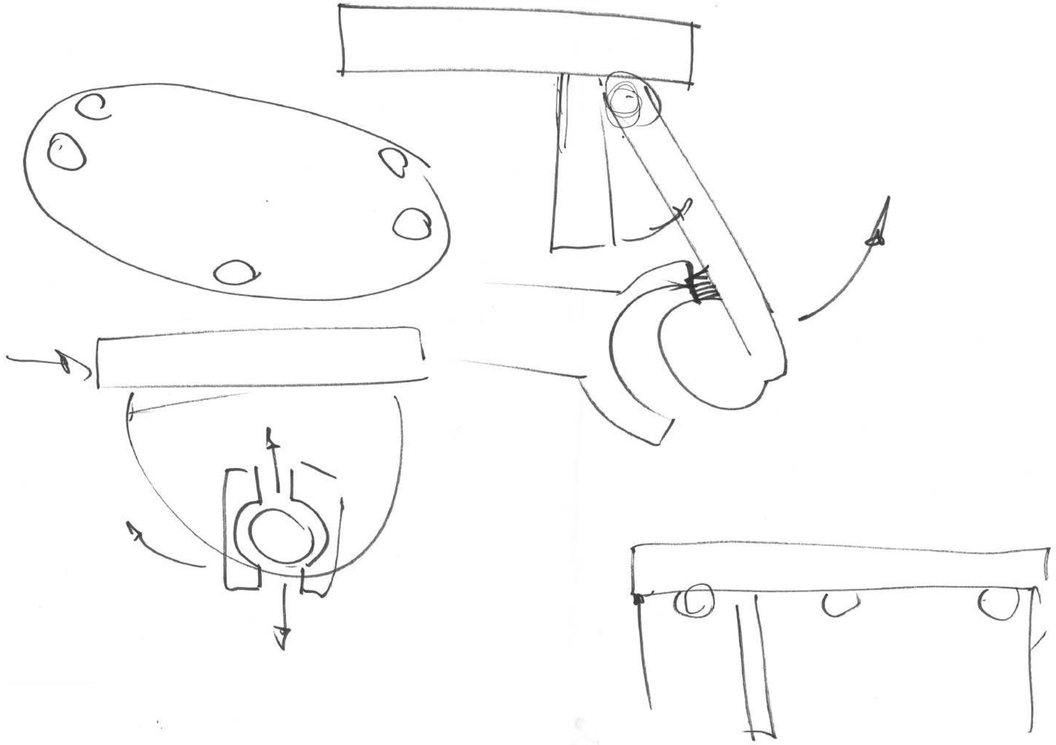


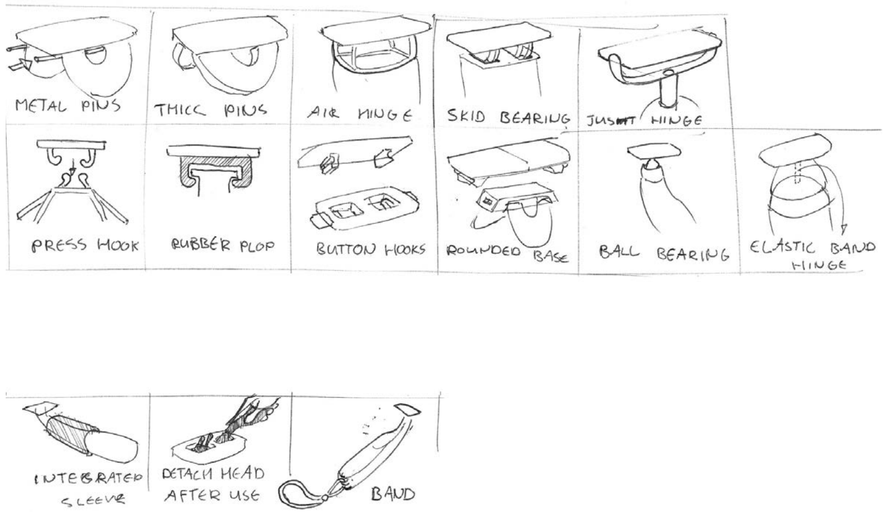
Aanslag op de bal maken
waardoor de klik zich eruit werkt.



Klik kracht aanpassen
Klik hoek
naar beneden
gerichte haken
schieten gemakkelijk

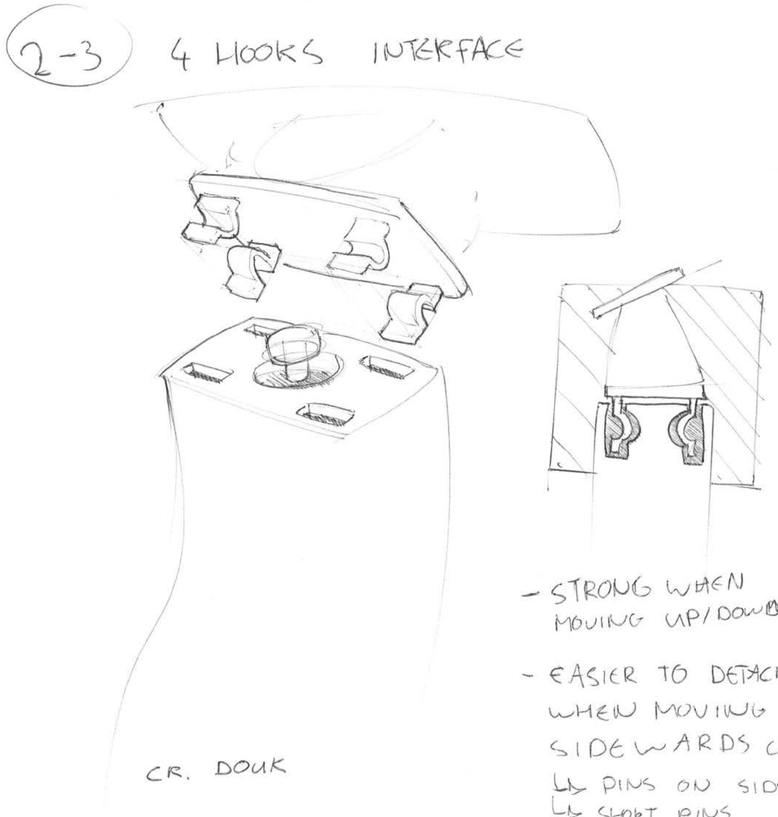






12.5.6**Morphological chart**

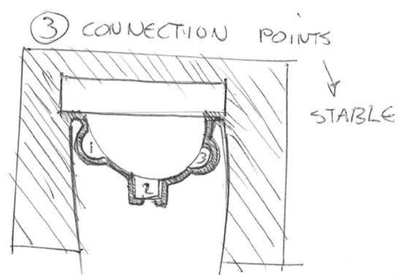
12.5.7 **Ideation for solution finging (V2)**



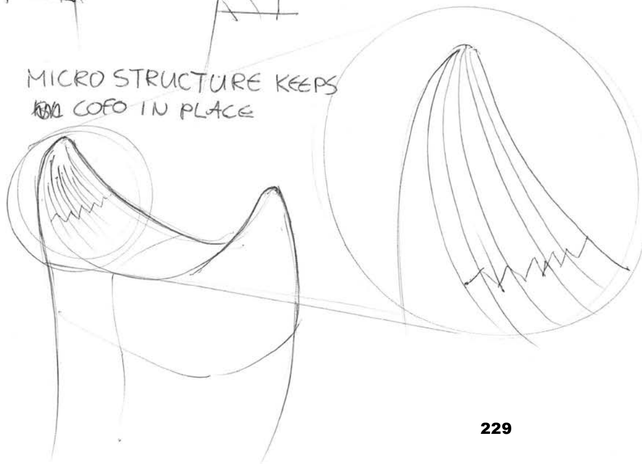
2-4 JUST SHORTER PINS

2-5 ROUND 2 MAGNET INTERFACE

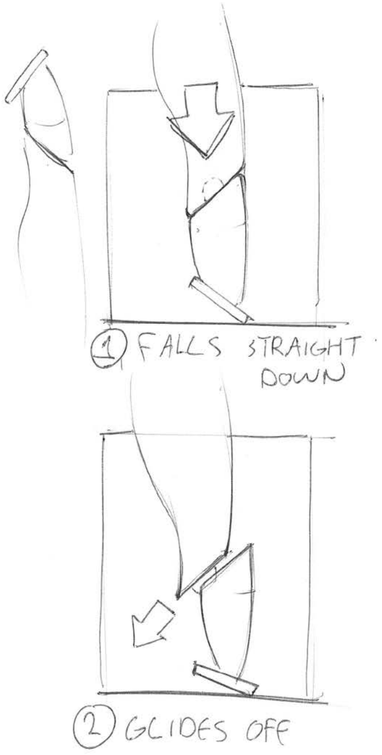
↳ VISMAN CONNECTION AS 3RD CONNECTION



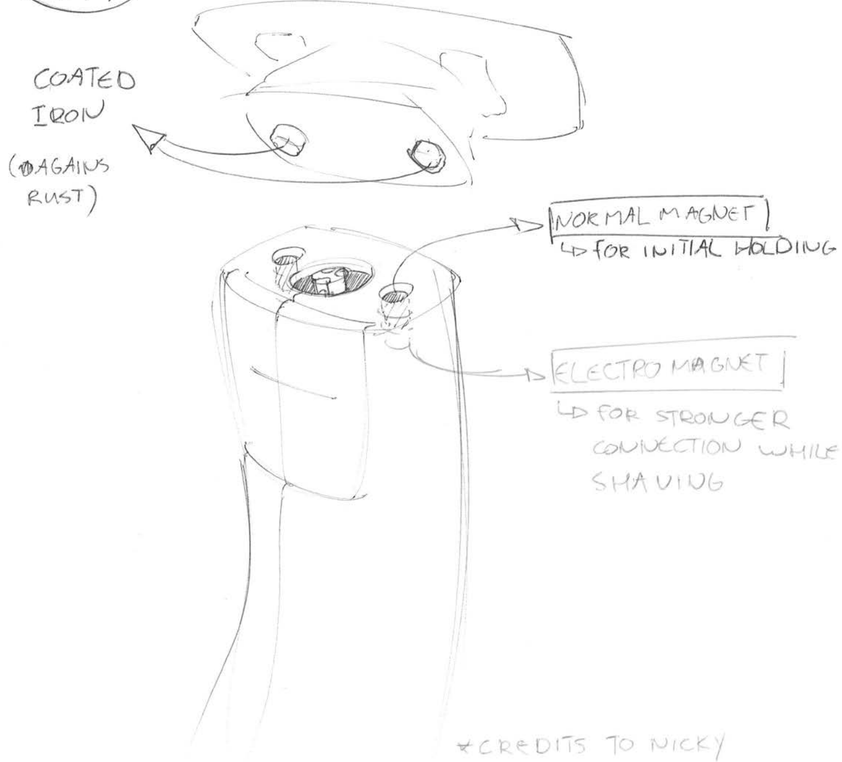
MICRO STRUCTURE KEEPS COFO IN PLACE



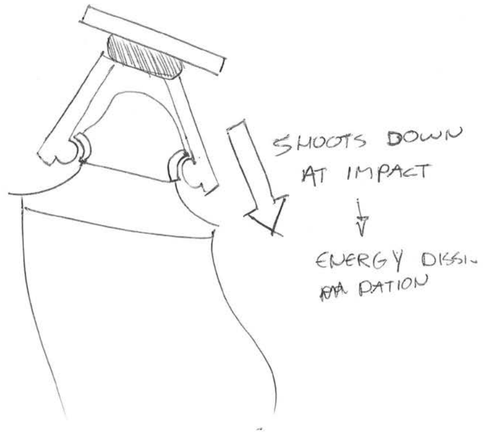
2-6 ANGLED INTERFACE



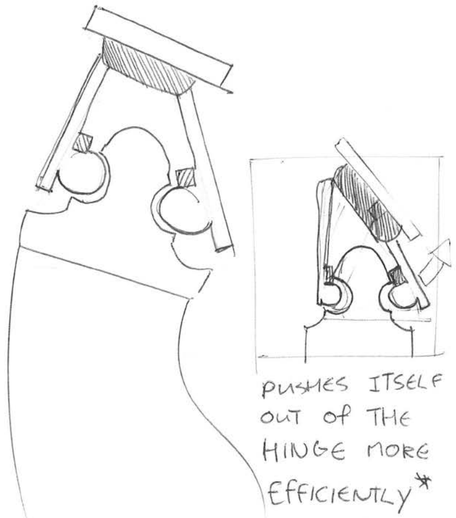
2-7 ELEKTRO MAGNET INTERFACE



2-8 ANGLED DOWN BALL HINGE



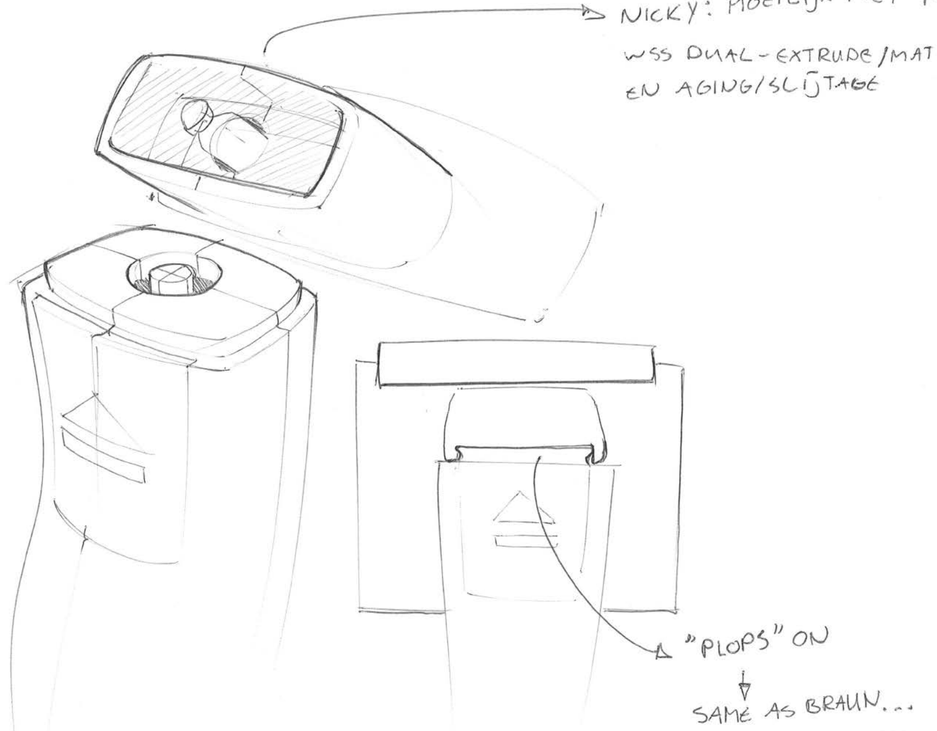
2-9 STOP IN BALL HINGE



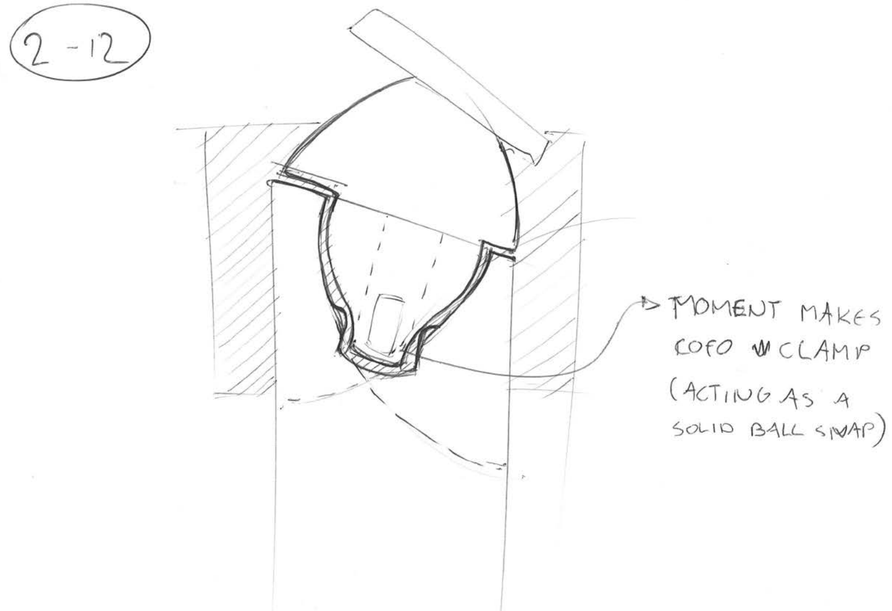
* PREVIOUSLY UP HIGH

CREDITS TO MARK E

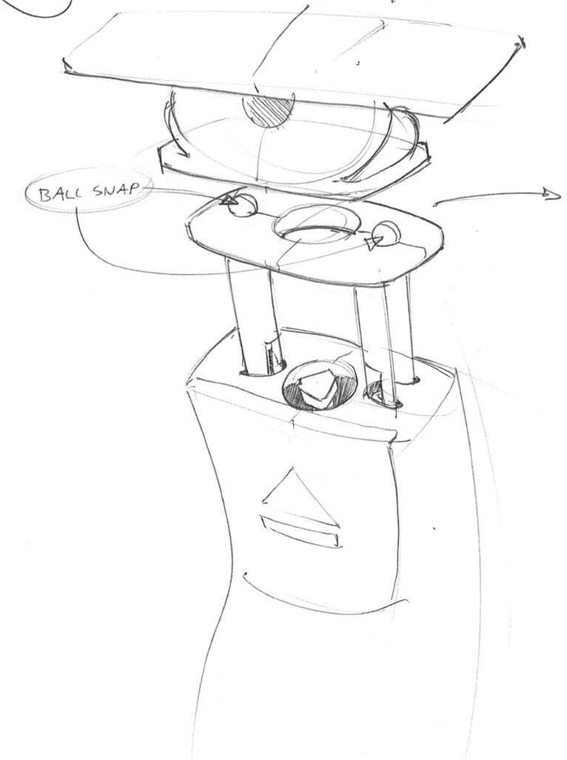
2-10 RUBBER PLOP




2-11
BALL
WHEN FALLING
CAN ROTATE LOOSE


2-12
MOMENT MAKES
COFO W CLAMP
(ACTING AS A
SOLID BALL SNAP)

3-1 2 BASE DETACH SYSTEMS



HEAD CAN DETACH FROM THE BASE, TAKING WAY MORE FORCE THAN NORMAL DETACHING

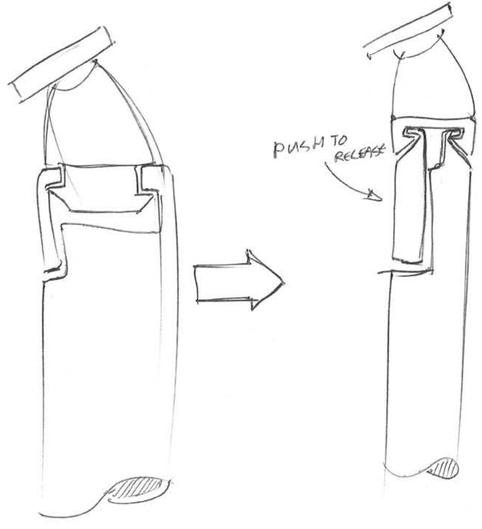
↓

ONLY HAPPENS DURING A FALL

↓

DISSIPATES ENERGY

3-2 BUTTON IS HOOK

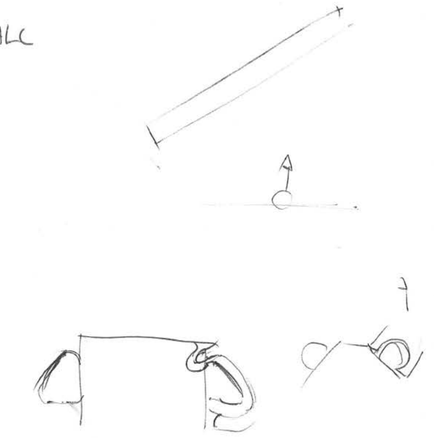


5-3 BASE BECOMES INTERFACE

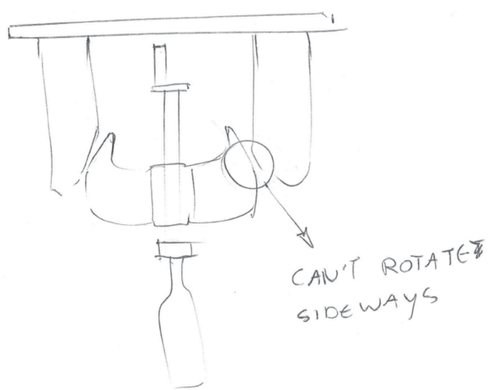
- ANGLED BALL SNAP → CAN DETACH WITH PULLING FORCE
- SHORT UPPER VISMAN WITHOUT LEGS → BASE AND BLADE CAN SEPERATE
- SADDLE WITH LONG PINS → SADDLE DOESN'T DETACH

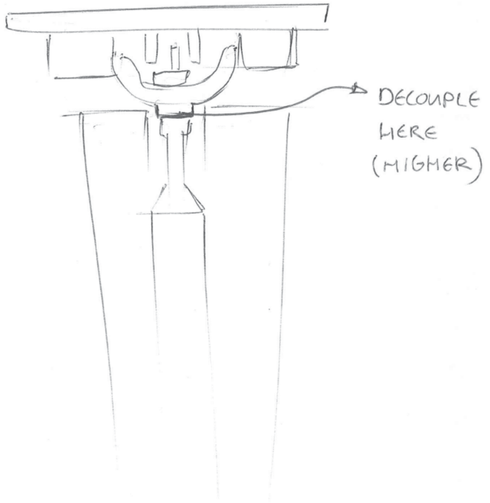
BALL SNAP SHOULD DETACH WITH:

- ROTATION
- TOP (PUSH)
- PULL

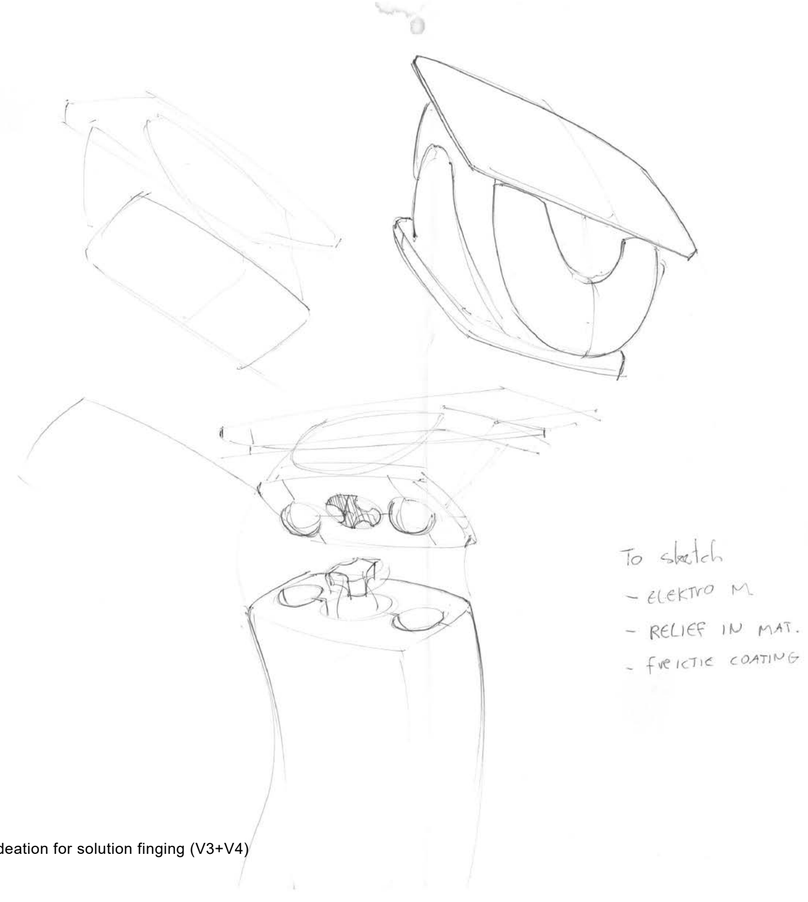


3-¾ SHORT UPPER VISMAN





4-1 IMPACT ABSORBING RODS → NO MOMENT DESTROYING COFOS!


To sketch
- ELEKTRO M
- RELIEF IN MAT.
- FRICTIE COATING

12.6 | **Quesionnaires**

Questionnaires are insesterd as seperate PDFs. Because of this headings are described here:

12.6.1 **Questionnaire 1 (long)**

12.6.2 **Questionnaire 2 (short)**

12.6.3 **Questionnaire 3 (original vs 360 breaking chance)**

OneBlade user test

Heyo!

Thank you for wanting to participate in this research about OneBlade shavers. Right now I'm graduating at Philips on improving the OneBlade shaving experience so your help is greatly appreciated. Quick disclaimer: this is not a short questionnaire, taking about 20 minutes. Thank you in advance!

Good luck ;)

- Teye

* Indicates required question

1. Do you, or have you ever owned a OneBlade shaver? *

Mark only one oval.

- ◯ Yes *Skip to question 2*
- ◯ No *Skip to section 5 (Thank you for participating!)*

General

First lets get some demographic and other general questions out of the way. You can answer these and other questions both in English (preferred) or Dutch.

2. How old are you?

_____

3. What is your gender?

Mark only one oval.

- ◯ male
- ◯ Female
- ◯ Prefer not to say
- ◯ Other: _____

4. What is your nationality?

_____

5. What type(s) of OneBlade(s) do or did you use? *

Tick all that apply.

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
- [ ] 8

6. What do you use the OneBlade for? you can select multiple

Tick all that apply.

- [ ] Face
- [ ] Head
- [ ] Body
- [ ] Other: _____

7. What style of facial hair are you maintaining?

Tick all that apply.

- [ ] None
- [ ] clean
- [ ] stubble
- [ ] short beard
- [ ] long beard
- [ ] partial beard
- [ ] mustache
- [ ] Other: _____

8. Do you still use your OneBlade? *

Mark only one oval.

- ◯ Yes *Skip to question 9*
- ◯ No *Skip to question 52*

OneBlade - Still using

Great that you are still using your OneBlade. The rest of the questionnaire will be about your experience with the OneBlade. This will start with general questions, after which we will go into:

- Shaving experience
- Build quality
- Cleaning
- Aesthetics
- Blade and Blade replacement
- Storage
- Add ons
- And other, if you what you want to mention doesn't fit any of the catagories

After this we will look a bit at the past and future by going into

- Initial buying reasons
- What would make you stop using your OneBlade

This sounds like a lot, but each part only consists of only a few questions, and if you really don't have an opinion about a certain part, you can leave it blank (although please try to fill them all in :)). Nevertheless this is not a short questionnaire so thank you again for taking the time for it!

1 of 12: General experience

9. In general, how do you experience having a OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

10. The next two questions are about elaborating on your experience: First can you say in general what you dislike about having a OneBlade? Do know that after this we go more in depth

11. And now can you say what you like about having a OneBlade?

12. And how attached do you feel to your OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not	◯	◯	◯	◯	◯	◯	◯	Very

13. Can you think of reasons why you feel this level of attachment to your OneBlade?

14. How could your attachment to your OneBlade be increased?

15. If you have ever used a different shaver, how does the OneBlade compare to it?

2 of 12: Shaving experience

16. How is the experience of specifically shaving with your OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

17. Please elaborate on why you feel this way about the shaving experience by giving at at least one pro and one con

3 of 12: OneBlade toughness

18. How do you experience the build quality /toughness of your OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

19. Please elaborate on the build quality / toughness by giving both pros and cons

4 of 12: Cleaning

20. How clean is your OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Filth	◯	◯	◯	◯	◯	◯	◯	As new

21. How easy is it to clean the oneblade (and the surroundings)? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not	◯	◯	◯	◯	◯	◯	◯	Very

22. Please elaborate on the cleaning experience by giving both pros and cons

23. Do you mind how clean it is? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not	◯	◯	◯	◯	◯	◯	◯	Very

5 of 12: Aesthetics

24. How damaged is your OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not	◯	◯	◯	◯	◯	◯	◯	Very

25. How important do you find aesthetics for a shaver? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not	◯	◯	◯	◯	◯	◯	◯	Very

26. Please elaborate on shaver aesthetics

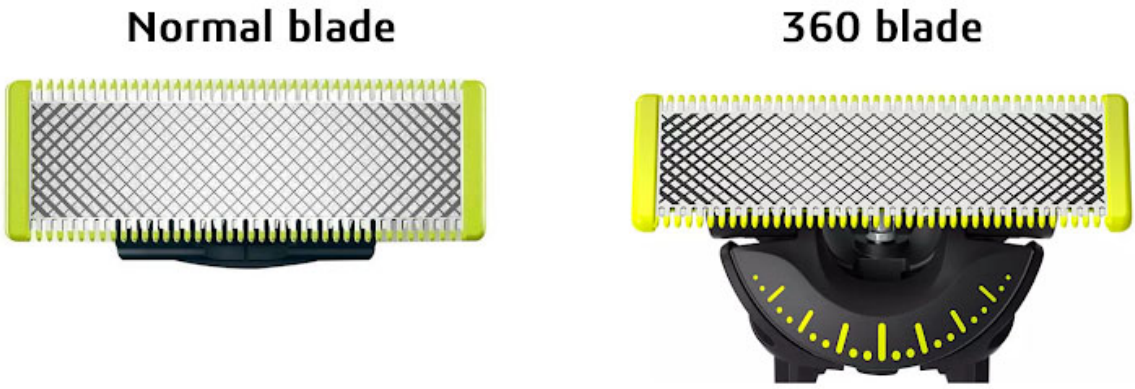
27. How important do you find aesthetics in general? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not	◯	◯	◯	◯	◯	◯	◯	Very

6 of 12: Blade and blade replacement

28. What type of blade do you use? *



Tick all that apply.

- [ ] Normal blade
- [ ] 360 blade
- [ ] Other: _____

29. How do you like the blade of your OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

30. How do you like the price of the blades? *

Mark only one oval.

	1	2	3	4	5	6	7	
Way	◯	◯	◯	◯	◯	◯	◯	Way too cheap

31. How many times have you replaced a blade? *

Mark only one oval.

- ◯ Never
- ◯ 1 time
- ◯ 2-5 times
- ◯ More then 5 times

32. If you have replaced a blade, how was this experience? (otherwise leave it blank) *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

33. Please elaborate on all the previous questions around blade experience by giving both pros and cons

7 of 12: Storage

34. Where do you store your OneBlade when you are not using it?

35. How do you like the storing experience? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

36. Please elaborate on storing the OneBlade

_____

_____

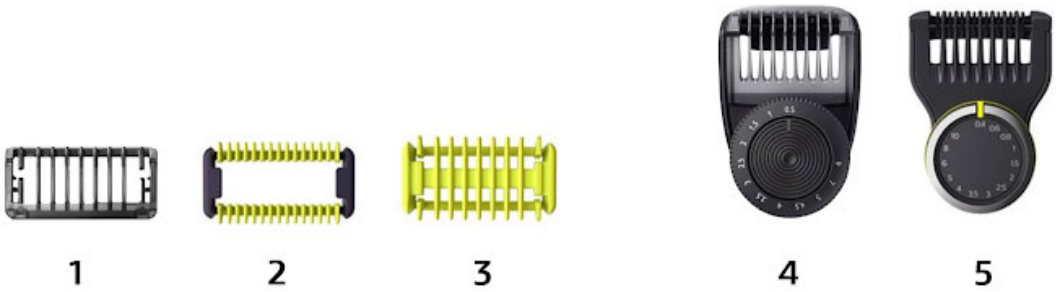
_____

_____

_____

8 of 12: Add-ons

37. What kind of add-ons do you use for your OneBlade?



Tick all that apply.

- [ ] None
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] Other: _____

38. How is the experience of using this or these add on(s)? If you don't use any, skip this question and the next

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

39. Please elaborate on your experience regarding OneBlade add-ons by giving both pros and cons

9 of 12: Other

40. Is there anything else you thought of that you would like to say about your experience with your OneBlade?

41. Based on everything you wrote down, please select all the things you dislike about the OneBlade. If you see something you haven't written down but also don't like, please also select this. For all the things that aren't in the list, just select 'other'. *

Tick all that apply.

- [ ] Doesn't allow for a clean enough shave
- [ ] Doesn't allow for enough control over my beard length
- [ ] Doesn't allow for an even shave
- [ ] Doesn't allow for enough control
- [ ] Shaving takes too long
- [ ] Have to run over the same part too many times
- [ ] Doesn't feel nice on my skin
- [ ] Hard to clean
- [ ] Doesn't look nice anymore
- [ ] Don't like how it looks in general
- [ ] Rubber on the handle is degrading
- [ ] Diminishing battery life
- [ ] Doesn't charge fast enough
- [ ] Lost the charger
- [ ] Expensive blade replacement
- [ ] Blades break easily
- [ ] Blades become dull too fast
- [ ] Blade pops out easily
- [ ] Don't like the waste the replacement blades generate
- [ ] It's in the way because I can't store it anywhere
- [ ] The add-ons don't work like I want them to
- [ ] The add-ons pop off easily
- [ ] Can't use it to shave sensitive parts (without using an add-on)
- [ ] Other

10 of 12: Initial buying reasons

42. Why did you initially buy a OneBlade? If there were multiple reasons please give all of them

43. Is the experience of shaving with your OneBlade as you expected it to be when you bought it? If not, how is it different?

11 of 12: Reasons for stopping to use your OneBlade

44. How long have you used your OneBlade now? *

Mark only one oval.

- Less then a month
- 1 to 3 months
- 4 to 6 months
- 7 to 12 months
- 1 to 1,5 years
- 1,5 to 2 years
- 2 to 3 years
- 3 to 4 years
- 4 to 5 years
- 5 to 6 years
- 6+ years

45. What are your main reasons for still using your OneBlade? Please try to give as many reasons as you can

46. Of all the points you mentioned already, what would be reasons for you to stop using the OneBlade? *

47. Do these reasons fit into one of the following catagories? If so please select it, you can select multiple. If a reason isn't in the list, please add it yourself *

Tick all that apply.

- [ ] Doesn't allow for a clean enough shave
- [ ] Doesn't allow for enough control over my beard length
- [ ] Doesn't allow for an even shave
- [ ] Doesn't allow for enough control
- [ ] Shaving takes too long
- [ ] Have to run over the same part too many times
- [ ] Doesn't feel nice on my skin
- [ ] Hard to clean
- [ ] Doesn't look nice anymore
- [ ] Don't like how it looks in general
- [ ] Rubber on the handle is degrading
- [ ] Diminishing battery life
- [ ] Doesn't charge fast enough
- [ ] Lost the charger
- [ ] Expensive blade replacement
- [ ] Blades break easily
- [ ] Blades become dull too fast
- [ ] Blade is too small
- [ ] Blade pops out easily
- [ ] Don't like the waste the replacement blades generate
- [ ] It's in the way because I can't store it anywhere
- [ ] The add-ons don't work like I want them to
- [ ] The add-ons pop off easily
- [ ] Can't use it to shave sensitive parts (without using an add-on)
- [ ] I received a better shaver
- [ ] Other: _____

48. If you stopped using your OneBlade but it still works, what would you do with it?

Tick all that apply.

- [ ] Keep it
- [ ] Resell it
- [ ] give it away
- [ ] throw it away
- [ ] Bring it to an e-wast collection point
- [ ] send it to Philips (if you knew they would recycle it)
- [ ] Other: _____

49. If your OneBlade broke down while not falling under warranty anymore, what would you do with it?

Tick all that apply.

- [ ] Keep it
- [ ] Resell it
- [ ] Repair it
- [ ] give it away
- [ ] throw it away
- [ ] Bring it to an e-wast collection point
- [ ] send it to Philips (if you knew they would recycle it)
- [ ] Other: _____

12 of 12: Ideas

You're almost there :) I hope it wasn't too long.The last thing I want to ask you is to bring some of your own ideas to the table!

50. What would make you use the oneblade longer?

_____

_____

_____

_____

_____

51. Based on everything you came across during this questionnaire, please try to give at least one (crazy) idea for improving the OneBlade :)

Skip to section 5 (Thank you for participating!)

OneBlade - Stopped using

Sad to hear that you stopped using your OneBlade.
The rest of the questionnaire will be about how your experience with the OneBlade was. This will start with general questions, after which we will go into:

- Shaving experience
- Build quality
- Cleaning
- Aesthetics
- Blade and Blade replacement
- Storage
- Add ons
- And other, if you what you want to mention doesn't fit any of the catagories

After this we will look a bit at the past and future by going into

- Initial buying reasons
- What made you stop using your OneBlade

This sounds like a lot, but each part only consists of only a few questions, and if you really don't have an opinion about a certain part, just put a / in the open question part (although please try to fill them all in :)). Nevertheless this is not a short questionnaire so thank you again for taking the time for it!

1 of 12: General experience

OneBlade user experience test - short

Heyo!

Thank you for participating in this research about OneBlade shavers. Right now I'm graduating at Philips on improving the OneBlade shaving experience so your help is greatly appreciated. This is a short questionnaire with should take you **no more then 5 minutes**.

Good luck ;)

- Teye

* Indicates required question

1. Do you, or have you ever used a OneBlade shaver?

Mark only one oval.

- ◯ Yes
- ◯ No *Skip to section 5 (Thank you for participating!)*

General

First lets get some demographic and other general questions out of the way.

2. How old are you?

3. What is your gender?

Mark only one oval.

- male
- Female
- Prefer not to say
- Other: _____

4. What is your nationality? (optional, but would help me for validating my results)

_____

5. What type(s) of OneBlade(s) do or did you use? *

Tick all that apply.

- [ ] 1 (original)
- [ ] 2 (nimH)
- [ ] 3 (lit-ion)
- [ ] 4 (subscription model)
- [ ] 5 (old pro)
- [ ] 6 (old super pro)
- [ ] 7 (pro)
- [ ] 8 (super pro)

6. Do you still use your OneBlade? *

Mark only one oval.

- ◯ Yes *Skip to question 7*
- ◯ No *Skip to question 15*

Still using

Great to hear that you are still using it!
This main
part of the questionnaire will go into why you made this decision and will consist of 7 questions, after which
you're already done. Thank you again for participating :)

7. **1 of 8:** How long have you been using your OneBlade now? *

Mark only one oval.

- ◯ Less then a month
- ◯ 1 to 3 months
- ◯ 4 to 6 months
- ◯ 7 to 12 months
- ◯ 1 to 1,5 years
- ◯ 1,5 to 2 years
- ◯ 2 to 3 years
- ◯ 3 to 4 years
- ◯ 4 to 5 years
- ◯ 5 to 6 years
- ◯ 6+ years

8. **2 of 8:** Have you ever replaced the blade?

Mark only one oval.

- ◯ Yes
- ◯ No

9. **3 of 8:** In general, how do you experience having a OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

10. **4 of 8:** The next two questions are about elaborating on your experience: First can you say what you like about having a OneBlade?

11. **5 of 8:** And now can you say what you dislike about having a OneBlade?

12. **6 of 8:** Do your dislikes fit into one of the following catagories? If so please select it, you can select multiple. If you see something you haven't written down but also don't like, please also select this. If a reason isn't in the list, please add it yourself. *

Tick all that apply.

- [ ] Doesn't allow for a clean enough shave
- [ ] Doesn't allow for enough control over my beard length
- [ ] Doesn't allow for an even shave
- [ ] Doesn't allow for making clean (enough) trim lines
- [ ] Doesn't allow for enough control
- [ ] Shaving takes too long
- [ ] Have to run over the same part too many times
- [ ] Hairs get stuck into the blades
- [ ] Doesn't feel nice on my skin
- [ ] Hard to clean
- [ ] Doesn't look nice anymore (damaged)
- [ ] Don't like how it looks in general
- [ ] Rubber on the handle is degrading
- [ ] Diminishing battery life
- [ ] Too short battery life on a single charge to begin with
- [ ] Doesn't charge fast enough
- [ ] Lost the charger
- [ ] Expensive blade replacement
- [ ] (The hinges of the) blades break easily
- [ ] Blades become dull too fast
- [ ] Blade is too small
- [ ] Blade pops out of the handle easily
- [ ] Don't like the waste the replacement blades generate
- [ ] It's in the way because I can't store it anywhere
- [ ] The add-ons don't work like I want them to
- [ ] The add-ons pop off easily
- [ ] Can't use it to shave sensitive parts (without using an add-on)
- [ ] Other: _____

13. **7 of 8:** What would be reasons for you to stop using the OneBlade?

14. **8 of 8:** Again, do these reasons for stopping fit into one of the following catagories? * If so please select it, you can select multiple. If a reason isn't in the list, please add it yourself

Tick all that apply.

- [ ] I received a better shaver
- [ ] Doesn't allow for a clean enough shave
- [ ] Doesn't allow for enough control over my beard length
- [ ] Doesn't allow for an even shave
- [ ] Doesn't allow for making clean (enough) trim lines
- [ ] Doesn't allow for enough control
- [ ] Shaving takes too long
- [ ] Have to run over the same part too many times
- [ ] Hairs get stuck into the blades
- [ ] Doesn't feel nice on my skin
- [ ] Hard to clean
- [ ] Doesn't look nice anymore (damaged)
- [ ] Don't like how it looks in general
- [ ] Rubber on the handle is degrading
- [ ] Diminishing battery life
- [ ] Too short battery life on a single charge to begin with
- [ ] Doesn't charge fast enough
- [ ] Lost the charger
- [ ] Expensive blade replacement
- [ ] (The hinges of the) blades break easily
- [ ] Blades become dull too fast
- [ ] Blade is too small
- [ ] Blade pops out of the handle easily
- [ ] Don't like the waste the replacement blades generate
- [ ] It's in the way because I can't store it anywhere
- [ ] The add-ons don't work like I want them to
- [ ] The add-ons pop off easily
- [ ] Can't use it to shave sensitive parts (without using an add-on)
- [ ] Other: _____

Skip to section 5 (Thank you for participating!)

Stopped using

Unfortunate to hear that you stopped using it.. This main
part of the questionnaire will go into why you made this decision and will consist of 8 questions, after which
you're already done. Thank you again for participating :)

15. **1 of 8:** How long did you use your OneBlade *

Mark only one oval.

- ◯ Less then a month
- ◯ 1 to 3 months
- ◯ 4 to 6 months
- ◯ 7 to 12 months
- ◯ 1 to 1,5 years
- ◯ 1,5 to 2 years
- ◯ 2 to 3 years
- ◯ 3 to 4 years
- ◯ 4 to 5 years
- ◯ 5 to 6 years
- ◯ 6+ years

16. Did you ever replace the blade?

Mark only one oval.

- ◯ Yes
- ◯ No

17. **3 of 8:** In general, how did you experience having a OneBlade? *

Mark only one oval.

	1	2	3	4	5	6	7	
Terri	◯	◯	◯	◯	◯	◯	◯	Amazing

18. **4 of 8:** The next two questions are about elaborating on your experience: First can you say what you liked about having a OneBlade?

19. **5 of 8:** And now can you say what you disliked about having a OneBlade?

20. **6 of 8:** Do your dislikes fit into one of the following catagories? If so please select it, you can select multiple. If you see something you haven't written down but also don't like, please also select this. If a reason isn't in the list, please add it yourself. *

Tick all that apply.

- [ ] It stopped working
- [ ] Didn't allow for a clean enough shave
- [ ] Didn't allow for enough control over my beard length
- [ ] Didn't allow for an even shave
- [ ] Didn't allow for making clean (enough) trim lines
- [ ] Hairs got stuck into the blades
- [ ] Didn't allow for enough control
- [ ] Shaving took too long
- [ ] Had to run over the same part too many times
- [ ] Didn't feel nice on my skin
- [ ] Hard to clean
- [ ] Didnt't look nice anymore (damaged)
- [ ] Didn't like how it looked in general
- [ ] Rubber on the handle degraded
- [ ] Diminishing battery life / battery died
- [ ] Too short battery life on a single charge to begin with
- [ ] Didn't charge fast enough
- [ ] Lost the charger
- [ ] Expensive blade replacement
- [ ] (The hinges of the) blades broke easily
- [ ] Blades became dull too fast
- [ ] Blade popped out of the handle easily
- [ ] Didn't like the waste the replacement blades generated
- [ ] Couldn't store it properly
- [ ] The add-ons didn't work like I want them to
- [ ] The add-ons popped off easily
- [ ] Couldn't use it to shave sensitive parts (without using an add-on)
- [ ] Other: _____

21. **7 of 8:** What were the main reasons for you to stop using your OneBlade?

22. **8 of 8:** Again, do these reasons for stopping fit into one of the following catagories? * If so please select it, you can select multiple. If a reason isn't in the list, please add it yourself

Tick all that apply.

- [ ] It stopped working
- [ ] I received a better shaver
- [ ] Didn't allow for a clean enough shave
- [ ] Didn't allow for enough control over my beard length
- [ ] Didn't allow for an even shave
- [ ] Didn't allow for making clean (enough) trim lines
- [ ] Hairs got stuck into the blades
- [ ] Didn't allow for enough control
- [ ] Shaving took too long
- [ ] Had to run over the same part too many times
- [ ] Didn't feel nice on my skin
- [ ] Hard to clean
- [ ] Didnt't look nice anymore (damaged)
- [ ] Didn't like how it looked in general
- [ ] Rubber on the handle degraded
- [ ] Diminishing battery life / battery died
- [ ] Too short battery life on a single charge to begin with
- [ ] Didn't charge fast enough
- [ ] Lost the charger
- [ ] Expensive blade replacement
- [ ] (The hinges of the) blades broke easily
- [ ] Blades became dull too fast
- [ ] Blade popped out of the handle easily
- [ ] Didn't like the waste the replacement blades generated
- [ ] Couldn't store it properly
- [ ] The add-ons didn't work like I want them to
- [ ] The add-ons popped off easily
- [ ] Couldn't use it to shave sensitive parts (without using an add-on)
- [ ] Other: _____

Skip to section 5 (Thank you for participating!)

Thank you for participating!

I hope you enjoyed the questionnaire. Thanks again for participating, and have a nice rest of the day :)

- Teye

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Google Forms

OneBlade blade breaking behaviour

Heyo!

Thank you for participating in this research about breaking OneBlade blades. Right now I'm graduating at Philips on improving the OneBlade shaving experience so your help is greatly appreciated. This is a short questionnaire with should take you **no more then 2 minutes**.

Good luck ;)

* Indicates required question

1. Did you ever break a OneBlade blade? *

Mark only one oval.

- ◯ Yes (one or multiple) *Skip to question 2*
- ◯ No *Skip to section 3 (Thank you!)*

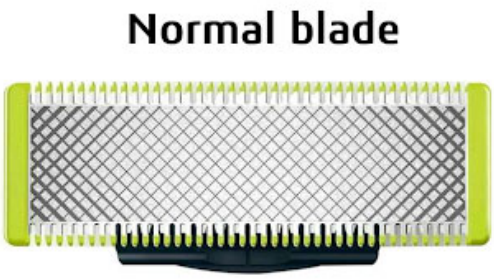
Blade breaking

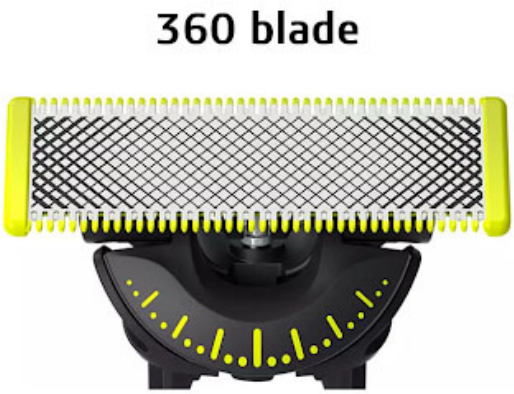
2. What type(s) of OneBlade(s) do or did you use? *

Tick all that apply.

- [ ] 1 (original)
- [ ] 2 (nimH)
- [ ] 3 (lit-ion)
- [ ] 4 (subscription model)
- [ ] 5 (old pro)
- [ ] 6 (old super pro)
- [ ] 7 (pro)
- [ ] 8 (super pro)

3. What type of blade broke? If you broke multiple and they were different kinds, please elaborate using the 'other...' option. *





Tick all that apply.

- [ ] Normal blade
- [ ] 360 blade
- [ ] Other: _____

4. How did your blade break? If you broke multiple, please also fill in how these broke using the duplicate questions below. You can also leave these empty. *

Mark only one oval.

- ◯ Low fall (0-60 cm) during shaving
- ◯ High fall (60+ cm) during shaving
- ◯ Low fall (0-60 cm) outside of shaving
- ◯ High fall (60+ cm) outside of shaving
- ◯ During transport
- ◯ during cleaning (e.g. tapping it on the side of the sink)
- ◯ Other: _____

5. If applicable, How did the second blade break?

Mark only one oval.

- ◯ Low fall (0-60 cm) during shaving
- ◯ High fall (60+ cm) during shaving
- ◯ Low fall (0-60 cm) outside of shaving
- ◯ High fall (60+ cm) outside of shaving
- ◯ During transport
- ◯ during cleaning (e.g. tapping it on the side of the sink)
- ◯ Other: _____

6. If applicable, How did the third blade break?

Mark only one oval.

- ◯ Low fall (0-60 cm) during shaving
- ◯ High fall (60+ cm) during shaving
- ◯ Low fall (0-60 cm) outside of shaving
- ◯ High fall (60+ cm) outside of shaving
- ◯ During transport
- ◯ during cleaning (e.g. tapping it on the side of the sink)
- ◯ Other: _____

7. If applicable, How did the fourth blade break?

Mark only one oval.

- ◯ Low fall (0-60 cm) during shaving
- ◯ High fall (60+ cm) during shaving
- ◯ Low fall (0-60 cm) outside of shaving
- ◯ High fall (60+ cm) outside of shaving
- ◯ During transport
- ◯ during cleaning (e.g. tapping it on the side of the sink)
- ◯ Other: _____

8. Did you stop using your OneBLade because the blade(s) broke? *

Mark only one oval.

- ◯ Yes
- ◯ No

9. If not, would you see it as a reason for stopping to use the OneBlade? Please elaborate.

_____

_____

_____

_____

_____

Thank you!

Thanks again for participating, and have a nice rest of the day :)

- Teye

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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: Ubbens
initials: _____ given name: Teye
student number: _____
street & no.: _____
zipcode & city: _____
country: _____
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: Gianni Orsini — dept. / section: HCD / HICD
2nd mentor: Lotte Fonteijne
organisation: Royal Philips
city: Drachten — country: Nederland

comments (optional)

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.

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

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair _____ date 08 - 03 - 2023 signature _____

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: 32 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:

ID4070 IDE Academy (4,0)

name Robin den Braber date 28 - 03 - 2023 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 _____ date - - signature _____

Initials & Name Ubbens Student number _____

Title of Project Redesigning OneBlade for longer same owner use by increasing value

Redesigning OneBlade for longer same owner use by increasing value — 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 27 - 02 - 2023 — 28 - 08 - 2023 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, ...).

The use of electric shavers for personal grooming is a widespread practice globally, with approximately 1/4th of all shavers being electric (Statista, 2022). Nevertheless, like any other consumer product, shavers eventually reach the end of their functional life and are replaced, leading to a significant environmental impact due to the presence of components such as PCBs, motors, and batteries (Matthews, 2021). Based on an estimated lifespan of 7 years (luxuryshavingrazors, 2023), and considering the entire 14+ male population in the Netherlands (40% of the population), it is estimated that roughly 250,000 electric shavers are replaced each year in this country alone, adding to the 53.6 Mt of e-waste being generated each year globally (Statista, 2019). A response to this is the upcoming "right to repair" legislation, which mandates e.g. the non-destructive disassembly of key components and easy battery replacement (i.e. repair), forcing companies to change their products, otherwise losing the right to sell them.

Philips is a major player in the shaving and grooming industry. One of their products is the OneBlade shaver family (see figure 1) , featuring electric shavers that are sold for a comparatively low price, going as low as €20,- during sale (Kruitvat, 2023). Shaver heads however need to be regularly replaced (Philips advises once every 4 months), with a new head costing around €18,- (Kruitvat, 2023).

Currently non destructive repair of many Philips products, including OneBlades, is not possible (Philips, 2023). As the right to repair legislation makes repair mandatory, Philips has updated their so called EcoDesign requirements (see figure 2). Following these OneBlades are being redesigned to allow for repair and easy battery replacement, potentially increasing the functional lifespan of the product (Philips, 2023).

Products, however, are often replaced before they reach the end of their functional life (Ackermann et al., 2021). Product replacement behaviour is influenced by a gap between the perceived value of a new product and the owned product, a value that is not solely based on functional (functional, utilitarian and physical product performance), but also emotional (extent to which the product arouses feelings and affective states), social (associations and belonging to a group), epistemic (arousing curiosity, providing novelty or the need for a change of pace) and conditional values (how specific situations or circumstances influence consumer decisions) (see figure 3) (Sheth et al., 1991). This means that product replacement decisions are not always made rationally (van den Berge et al., 2021).

Philips' current EcoDesign rules focus only on increasing the aforementioned functional part of owned product value, while having no knowledge regarding what role this plays in customer product replacement behaviour, or in general why currently Oneblades (and other Philips products) are being replaced.

In this context, Philips has expressed interest in exploring the opportunity of extending Oneblade lifespan (or at least that of key components i.e. motor, PCBA and battery) by maximizing use time by same product owners. This will achieved through researching why OneBlades are currently being replaced, using attained insights to propose a redesign. This research can also potentially serve as a case study for more products in Philips' portfolio.

However, a limitation might be how to extend the product lifespan in a manner that is economically viable for Philips. As previously stated the body is comparatively cheap, while shaving heads are expensive, hinting at a business case centered around fast replacement.

space available for images / figures on next page

introduction (continued): space for images

Focal Area		Mandatory*	Design Effort*
1.Use Less	**1.1. Design with Sustainable Materials** (recycled and/or bio-based materials) • For Philips products, all major, custom designed parts shall use sustainable plastics from the PDC-CMF where available (rationale must be provided when the requirement is not fulfilled). • For large metal parts, high recycled content should be used.	Yes	
	1.2 Design with Low Weight • All Philips products shall be optimized for low weight, such that the product weight shall be reduced compared to a predecessor or competitor's product. Any change in material shall not induce a negative environmental impact.**		Yes
	1.3 Design for Digitalization (reducing hardware) • All Philips solutions shall, where possible, be designed to minimize physical hardware in favor of software, e.g., by moving towards cloud-based solutions, consolidating to less IT hardware and higher utilization, replacing specialized with generic hardware, and enabling remote interactions.		Yes
2.Use longer	**2.1 Design for Disassembly & Reassembly** (enabling service, repair, spare parts harvesting, refurbishment, and remanufacturing) • All Philips products shall be designed for disassembly and reassembly in a non-destructive manner to access the priority parts. • Score of ≥80% when using the Disassembly Assessment Tool. • Compliance with EU legal removability/replaceability requirements for batteries (in EU Battery Directive). Personal Health: • Compliance with PH 'Right to Repair' strategy (including EU R2R regulation) to be published in 2023.	Yes	
	2.2 Design for Long Life (durability and reliability) • All Philips products shall be designed for a long functional life, with high durability and reliability.		Yes
	2.3 Design for Modularity and Standardization • All Philips products shall be designed for modularity and standardization. • Philips products shall use industry and/or Philips standard design elements, interfaces and connections, to enable upgradability and forward/backward compatibility between different product generations, as well as modularity within a platform.		Yes
	2.4 Design for Diagnostics (monitoring and assessing performance) • All Philips electronic products shall offer (remote) diagnostic capabilities (where relevant), enabling preventive maintenance, performance monitoring and/or easy fault assessment of the product.		Yes
	2.5 Design for Cleaning, Disinfection/Sterilization and Restoring Aesthetic State • All Philips products shall be designed for easy cleaning & disinfection/sterilization (if applicable), and restoration to their original aesthetic state.		Yes
3.Use again	**3.1 Design for Recycling** • All Philips products shall use materials and manufacturing/connection methods which enable technically and economically feasible, destructive dismantling into pure materials, with a product recyclability potential ≥ 75% *** based on the total product weight.	Yes	

image / figure 1: Figure 1: Philips OneBlade (OneBlade 360). Figure 2: Philips EcoDesign requirements (circularity) 2023

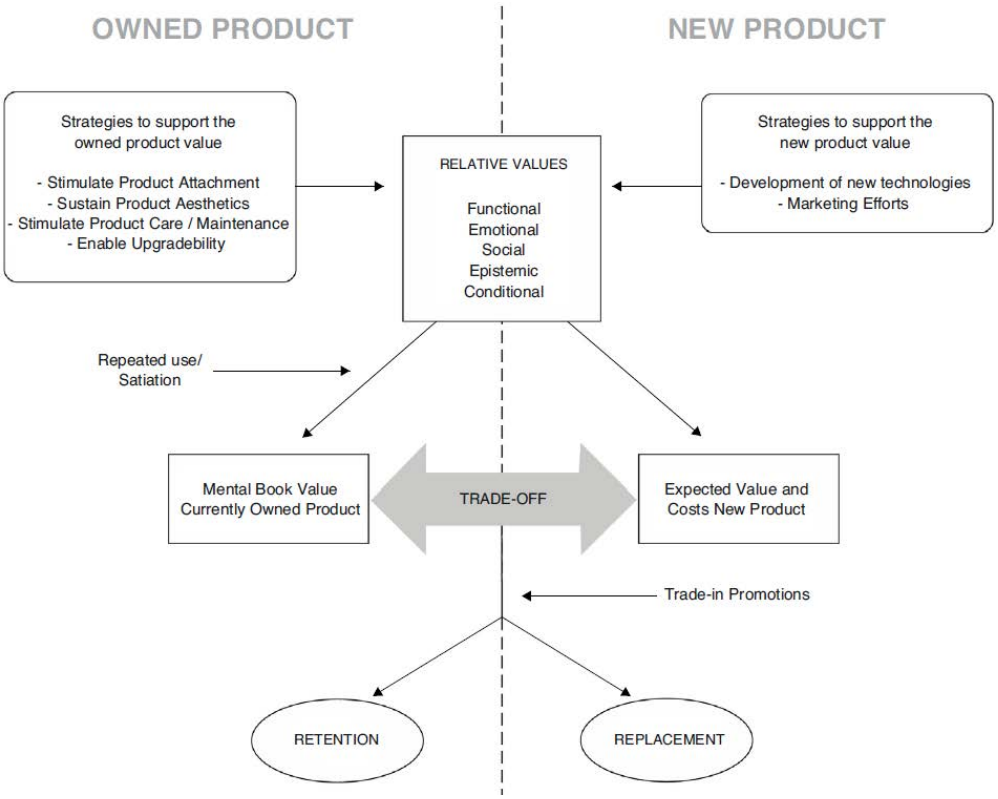

image / figure 2: Figure 3: Psychological process of product replacement (van den Berge et al., 2021)

Initials & Name Ubbens Student number

Title of Project Redesigning OneBlade for longer same owner use by increasing value

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.

As discussed in the introduction, replacement of products, in this case the OneBlade electric shaver, is dependent on a difference between owned and new product value, this value being influenced not only by functional, but also emotional, social, epistemic and conditional values. Philips wants to increase the sustainability of their product portfolio, being spearheaded by their EcoDesign requirements. These however disregard anything but functional product value, combined with Philips seemingly having little knowledge on why OneBlade shavers are being replaced to begin with.

Attaining this knowledge could enable for designing for longer product use, hopefully leading to a significant reduction in E-waste and thus environmental impact. With e-waste being the fastest growing waste stream, with 53.6 Mt being generated in 2019 of which small equipment accounts for the largest share, this could allow for significant impact reduction (Statista, 2023). A problem will however be how to make a redesign tailored for longer use (economically) viable for Philips. All this introduces the following research questions:

RQ1 When and why are OneBlades currently being replaced?
RQ2 How can the OneBlade or at least its priority parts be redesigned for maximized life time?
RQ3 What is the potential environmental impact of the redesign?
RQ4 How can this redesign be made economically viable for Philips?

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.

This project aims to research why Philips OneBlade shavers are currently being replaced, focussing on reseraching reasons for decreasing owned product value. This knowledge will be used to redesign the Oneblade product service system to ensure both longer use time for customers and economic viability for Philips.

The aim of the project is captured in the research questions mentioned in 'problem definition'

To answer these research questions my first goal is to deliver insights into why currently users choose to replace Philips OneBlade shavers, and will define if this project has to focus on the product, or more on the service part around it. This will be done through research with OneBlade users through user testing.

Using the insight from the user tests I aim to deliver a redesign of the OneBlade product (service system). This redesign will be used for further user testing to verify longer product use. Additionally It will be used to conduct a fast track LCA to compare the difference in environmental impact compared to the current OneBlade. Lastly it will be used to research the economic viability of the new design for Philips.

The goal is to deliver a redesign of the OneBlade of at least technology readiness level 4 defined as a "Proof of concept Prototype: testing done on core mechanisms and functions." (4C Design, 2018)

Initials & Name Ubbens Student number

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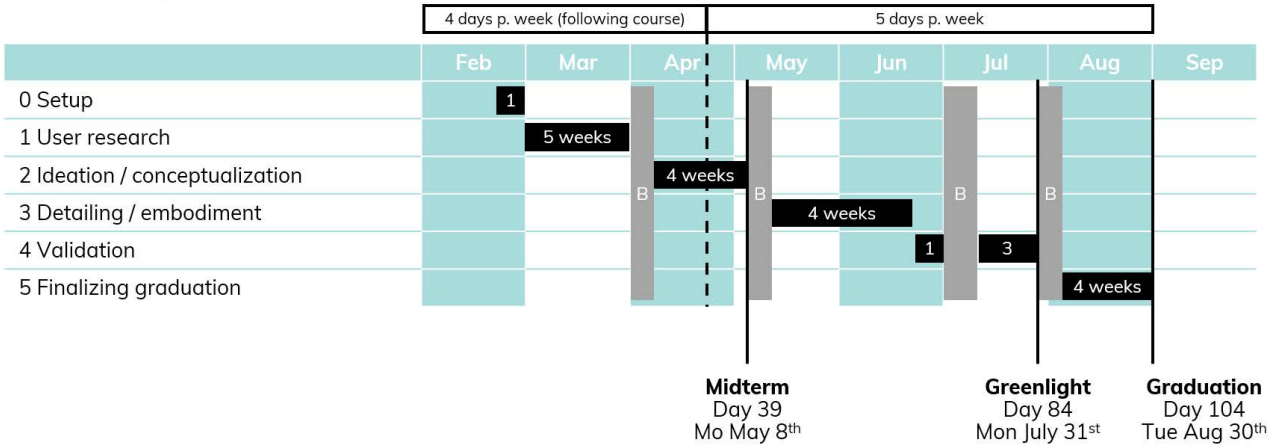
PLANNING AND APPROACH **

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 27 - 2 - 2023 28 - 8 - 2023 end date

Planning



The Graduation will consist of 5 main phases as shown in the planning above.

Setup consists of finishing the project brief and possible other steps

The first phase is about answering RQ1 (When and why are OneBlades currently being replaced?) through conducting user research. Steps to be taken are: Literature research about the OneBlade, it's business model and about replacement behaviour. Then defining the research approach (This will be done together with Philips PRC and marketing departments, and other potential specialists at the TU). Next is recruiting participants, conducting the research and working it out.

The second phase is about, based on the findings, defining the concept(s) to present at my midterm, working on RQ2 (How can the OneBlade or at least its priority parts be redesigned for maximized life time?) and RQ4 (How can this redesign be made economically viable for Philips?). Steps to be taken are: Analyse current LCA, update LOR, ideation process and initial prototyping.

The third and fourth phase are about finishing and validating the concept(s), answering RQ2 & 4, and also RQ3 (What is the potential environmental impact of the redesign?). Steps to be taken are: Working out concept, user testing, cost estimation, expert interviews, conducting and comparing LCAs and finishing the prototype for my greenlight.

The fifth phase is about finishing the report (that will be worked on throughout the project of course), poster, presentation and other deliverables for my graduation.

Initials & Name Ubbens Student number

Title of Project Redesigning OneBlade for longer same owner use by increasing value

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.

Firstly my main competences during my studies have been ideation, visualization and physical prototyping, skills I want to use in this project. Because of this I wanted to work on a physical product and go through a design project from start to finish.

Secondly I want to learn more about the psychological side of design. This interest was sparked while following the consumer behavior master elective, and I'm looking forward to use and further develop what I have learned there. Thirdly during my studies I have not focussed a lot on user testing, while being a valuable tool. Through this project I want to improve my skills regarding this topic.

Fourthly during my internship at VanBerlo I was inspired by their sustainability team and their strive to making viable sustainable alternatives for mainstream products. Through using tools such as rapid LCAs and disassembly maps I hope to increase my ability in this field as well.

Lastly, I am eager to learn what it is like to work at a large corporation, as compared to a design agency. This might help me in my career choice after graduating.

Sources

4C Design. (2018). Technology Readiness Levels (TRLs) in Design and Engineering | 4c. https://www.4cdesign.co.uk/blog/technology-readiness-levels/

Ackermann, L., Tuimaka, M., Pohlmeyer, A. E., & Mugge, R. (2021). Design for Product Care—Development of Design Strategies and a Toolkit for Sustainable Consumer Behaviour. Journal of Sustainability Research, 3(2). https://doi.org/10.20900/jsr20210013

de Olde, L. J. (2022). EcoDesign requirements 2025.

Kruitvat (2023). Philips Onebalde. https://www.kruidvat.nl/philips-oneblade/c/hybride-trimmer

luxuryshavingrazors. (2023). How Often Should You Replace an Electric Razor? (Easy Guide). https://luxuryshavingrazors.com/best-electric-razor-shaver/how-often-should-you-replace-an-electric-razor/

Matthews, L. (2021, March 15). How Disposable Shaving Products Hurt the Planet. https://www.leafscore.com/eco-friendly-bath-products/environmental-impact-of-shaving-products/

Meloni, M., Souchet, F., & Sturges, D. (2018). Circular Consumer Electronics An initial exploration. https://ellenmacarthurfoundation.org/circular-consumer-electronics-an-initial-exploration

Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why We Buy What We Buy: A Theory of Consumption Values (Vol. 22).

Statista. (2022). U.S. population: Usage of electric and battery shavers from 2011 to 2024. https://www.statista.com/statistics/285898/usage-of-electric-and-battery-shavers-in-the-us-trend/

FINAL COMMENTS

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

Statista. (2023). Global E-Waste - Statistics & Facts. https://www.statista.com/topics/3409/electronic-waste-worldwide/#topicOverview

van den Berge, R., Magnier, L., & Mugge, R. (2021). Too good to go? Consumers' replacement behaviour and potential strategies for stimulating product retention. In Current Opinion in Psychology (Vol. 39, pp. 66–71). Elsevier B.V. https://doi.org/10.1016/j.copsyc.2020.07.014

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If you are reading this and you are not from Philips

then you are breaking confidentiality, you madman