Viktor Rydal

Designing a smartphone stabilizer

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NTNU
Norwegian University of
Science and Technology

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At the time of writing this, the future of FlowMotion remains uncertain. Regardless of what happens next, I am forever grateful to have been a part of this incredible journey and this passionate and hard-working team.

We have given it our everything for the past three years, and I am proud of what we have accomplished in this time.

A million thanks to my colleagues and friends, and everyone who believed in us and supported us along the way.

I dedicate this project to you.

Abstract

Context

The smartphone has become the preferred device for capturing and sharing videos. It features an exceptional camera, but lacks proper image stabilization, resulting in shaky footage. The solution for this is a smartphone stabilizer. In today's market, the category is characterized by a war on price, and most smartphone stabilizers are made to be as cheap as possible. Ultimately, this compromises the user experience.

Goal

The goal of this project is to design a premium smartphone stabilizer, that will provide a better user experience and be a high-quality alternative to current products. The project is a collaboration with FlowMotion.

Method

To accomplish this, a user-driven approach is applied. User and market research has been conducted to discover needs and further define relevant value propositions. In particular, user interviews, physical prototyping, and user testing have been essential to the process. In total, five iterations of concept development and testing have been conducted, resulting in more than 70 parts and prototypes. Findings from this process give insight into meaningful product interactions and requirements.

Results

The prototypes and insights constitute the raw results of the project and form a story of how the product came to be. Further, a final design proposal for the new stabilizer is presented, effectively concluding the findings. In short, this includes a better interface, new mounts for the phone and the grip, an improved grip design, and ease of use.

Sammendrag

Kontekst

Smarttelefonen har utviklet seg til å bli det foretrukne redskapet for opptak og deling av videoer. Den byr på et utmerket kamera, men mangler profesjonell bildestabilisering, noe som resulterer i opptak preget av risting. Løsningen på dette er en smarttelefonstabilisator. Dagens marked er preget av priskrig, og de fleste stabilisatorer er laget for å være så billige som mulig. Dette går på bekostning av brukeropplevelsen.

Mål

Målet med dette prosjektet er å designe en premium smarttelefonstabilisator, som skal gi en bedre brukeropplevelse og være et høykvalitetsalternativ til eksisterende produkter. Prosjektet er utført i samarbeid med FlowMotion.

Metode

En brukerdrevet tilnærming er brukt for å oppnå dette. Kartlegging av brukerbehov og en konkurrentanalyse har blitt gjennomført for å utvikle aktuelle verdiforslag. Videre har brukerintervju, fysisk prototyping og brukertesting vært særlig viktig i denne prosessen. Totalt fem iterasjoner med konseptutvikling og testing har blitt utført, som har resultert i mer enn 70 komponenter og prototyper. Funnene fra denne prosessen belyser meningsfull interaksjon med produktet og krav til produktet.

Resultat

Prototypene og funnene utgjør det direkte resultatet av prosjektet, og danner en historie om utviklingen av produktet. Videre presenteres et forslag til endelig design av produktet. I korte trekk innebærer dette et bedre grensesnitt, ny innfesting for telefon og håndtak, samt forbedret ergonomi og brukervennlighet. Det endelige designet kan oppfattes som en konklusjon av opparbeidet innsikt.

Delivery

The main delivery of this master's thesis is the report you are currently reading. In addition to this, a great number of physical prototypes of a smartphone stabilizer has been produced as an essential part of the design process. These are well documented in photos throughout the report.

Acknowledgements

Designing a smartphone stabilizer

BY VIKTOR RYDAL

Contents

01   INTRO
Setting the stage

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Part one describes the background of the project and presents the official project brief. I further explain why I chose this assignment and introduce FlowMotion, who initiated the project.

NTNU

Fakultet for arkitektur og design
Institutt for design

Master's Thesis for Student Viktor Rydal

Designing a Smartphone Stabilizer
Design av smarttelefonstabilisator

The best camera is the one that is with you. For most people, this translates to a smartphone. Although the phone is a powerful camera, it is designed to fit in a pocket and is difficult to hold steady while recording videos. A smartphone stabilizer solves this problem, enabling people to capture smooth, shake-free moments.

Today, market leaders primarily focus on producing low-cost smartphone stabilizers. In contrast, recent smartphones are trending towards luxurious designs and sophisticated build quality, with a focus on enjoyable user experiences. A subcategory of premium smartphone stabilizers remains unexplored.

FlowMotion is a Norwegian startup creating easy-to-use tools for capturing better videos on your phone. Their main product category is smartphone stabilizers. The goal of this project is to develop a new smartphone stabilizer in collaboration with FlowMotion. This is meant to target the premium market. The thesis will be conducted as a design project with an emphasis on physical results, originating from a user-driven approach.

The project may non-exclusively include:
- Gathering of information
- Identifying user needs
- Idea and concept development
- Iterative prototyping and testing

The thesis is conducted according to "Guidelines for Master's Theses in Industrial Design".

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Business contact: Eirik Husby Dyrseth, FlowMotion Technologies AS

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Trondheim, NTNU, 11 January 2019

Trond Are Øritsland
Associate Professor

Ole Andreas Alsos
Head of Department

Project brief and mission

The project brief is attached to the left. It was developed in collaboration with the FlowMotion team.

The objective of the project is clear and specific: design a smartphone stabilizer for the premium market. Instead of working with a problem where I first need to figure out what to make, the solution scope is already defined from the very start.

As explained below, there is a big market for the product, and the project was started with the intention to produce and launch the smartphone stabilizer. Thus, this report does not speculate whether it is needed or the right product. However, what it attempts to address is what the best version of such a product might be.

In other words, the task is to design the most lovable smartphone stabilizer in cooperation with FlowMotion.

Background

Market interest

The future of content is mobile. Both amateurs and professionals use smartphones for capturing, editing, and sharing videos and photos. By 2022, video streaming will account for more than eighty-two percent of the global consumer internet traffic, where forty-four percent is generated by smartphones (Barnett Jr., 2018).

With social media as a key driver, there is a high demand for quality content and the necessary gear to produce it. According to KBV Research, the premium category make up thirty percent of all smartphone accessories (n.d., 2017). Adding this to FlowMotion's calculations makes the potential market for smartphone camera equipment valued at several billion USD.

Motivation

This project was initiated by FlowMotion following the success of their first smartphone stabilizer, launched on Kickstarter November 2016. Six months prior to that, I joined the FlowMotion team. Since then, I have been designing most aspects of the brand, such as logo, website, and packaging. But I have had little to do with the physical design of the stabilizer, apart from refining and "styling" what was already there.

In the spring of 2018, I did a pre-project for a new FlowMotion stabilizer. The pre-project was part of my studies and consisted of a theoretical and a practical component. A literature review and research article focused on designing products for the premium segment made up the former, while the latter resulted in a conceptual design for the stabilizer. It is important to note that there was no user testing or prototyping taking place at that time, and no progress was made in the time between the pre-project and the master's thesis.

Personally, I wanted to do this project because it was a big opportunity to gain more experience with user testing and involving users in design processes, as well as learning more about prototyping physical products. The product seemed to have a challenging but appropriate level of complexity, and the commercial potential also appealed to me. Although it was not a determining factor, it also felt good to continue and finish the work I had started a year before.

Throughout the project, I have had the pleasure to work with Trond Are Øritsland from NTNU and Eirik Husby Dyrset from FlowMotion. The combination of Trond Are's insights in usability and interfaces and Eirik's background in mechanical engineering have been most valuable to the design process.

About FlowMotion

FlowMotion was founded in 2016 with the goal of becoming the preferred brand for mobile video gear — empowering anyone to create professional-looking videos with their phone.

The startup became an overnight sensation after launching their first product, the FlowMotion ONE smartphone stabilizer, on the crowdfunding platform Kickstarter. The project raised $1.3 million USD in just 50 days, selling more than 5.500 products. At the time of writing this, the project is still among the top 70 in consumer tech on Kickstarter.

FlowMotion focuses on making high-end products that are easy to use. It is a design-driven startup that takes pride in crafting great user experiences for a community that has now grown several thousand customers strong. With the FlowMotion ONE comes a companion app to get the most out of the stabilizer and your phone's camera. In addition, there are two accessories for the stabilizer: an extension pole and a travel case.

The following pages contain images and values that are important to the FlowMotion brand and products.
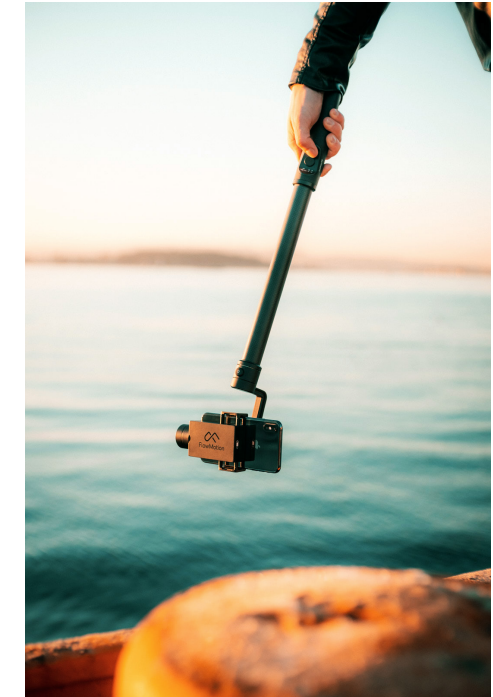
Scandinavian

Professional

Premium

Adventurous

Portable

Joy
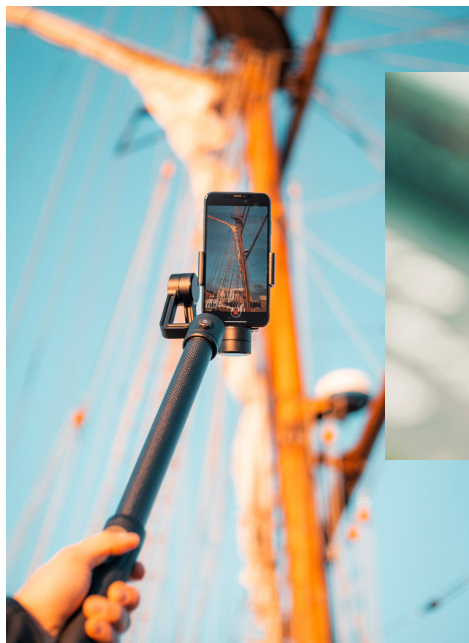
Easy to use

Versatile

A note on the structure of this report

What you have just read serves as the backdrop or canvas for the project. The next part presents the essential methods, or the paint and brushes if you will. Then, the four following parts contain the main body of work gone into this project, starting with market research and strategic decisions, before moving on to creating and testing solutions, and finally presenting the resulting design. The last part takes a step back to look at and reflect upon the project and process.

I have tried to strike a good balance between text and graphics. Topics I regard as more complex and in need of a closer look into my thought process naturally contain more text, whereas, with other sections, I intend the visuals to communicate and connect the dots. The amount of information in either of the four main parts — Discover, Define, Develop, and Deliver — reflects the divergent or convergent nature of the phase they represent in my design process.

02 APPROACH
Gearing up

—

Part two describes the chosen approach for working with this project and presents a relevant model for my design process. It also establishes an important framework used throughout the project.

Putting users first

The end user's satisfaction is the most critical factor determining the success of a product. Applying a user-centered approach is the key to develop products and experiences that people will love.

Empathy and understanding

To create exceptional user experiences, designers need to increase their empathy for the people they are designing for (Derome, 2015, Pede, 2018). Deepening our understanding of the target users and learning about their goals and pain points, is the way to go about this.

Lovable products

Although we can never completely understand our users, we can utilize qualitative research methods such as interviews and user testing to close the gap. Testing frequently is great for observing users' behavior and reactions over time as the design evolves. It creates a recurring arena to sit down with and listen to the users, which is essential to build lasting empathy. I decided to prioritize user interviews and testing in my project, believing that it will help me in designing a lovable product.

The process

There is a process driving every design project. Although the specific activities and contents of any two projects can vary greatly, designers generally work in a sequence of two divergent and convergent modules, known as the Double Diamond model. This model also describes my creative process. The Double Diamond model consists of four consecutive phases called Discover, Define, Develop, and Deliver. The first and third are characterized by a divergent mindset, while the second and fourth aim to converge the project into a specific direction and a refined solution, respectively (n.d., 2019a).

From the concept of this model, my process might appear very orderly and straightforward. In practice, the workflow has been more organic. As new development has been made, it has been natural and necessary to sometimes go back and revisit my previous research and work. Inherently, my design process has been iterative — constantly seeking to improve both the body of work and the means to produce that work.

Discover
Gaining foothold

Define
Finding direction

Develop
Think, make, test, repeat

Deliver
Putting everything together

Translate to strategic decisions

Market insights
User research
Desires and pain points
Opportunities

Personas
Design parameters
Positioning
Value propositions

Test

Empathize

Prototype

Generate and refine ideas into solutions

Ideate

Mechanical verification

Design

Project brief

Design goals

Concept exploration

Design proposal

The first phase is all about understanding the design challenge and gathering other relevant insights for the project. Because the project started with a specific objective of developing a smartphone stabilizer for the premium market, I have focused primarily on understanding the market and product category and learning about the user's wants and pain points.

In the second phase, insights are translated into strategic decisions about the product, market positioning and value propositions. The goal here is to specify a focus and direction for the design challenge.

The third phase is an iterative one where possible solutions to the design challenge are generated, evaluated,
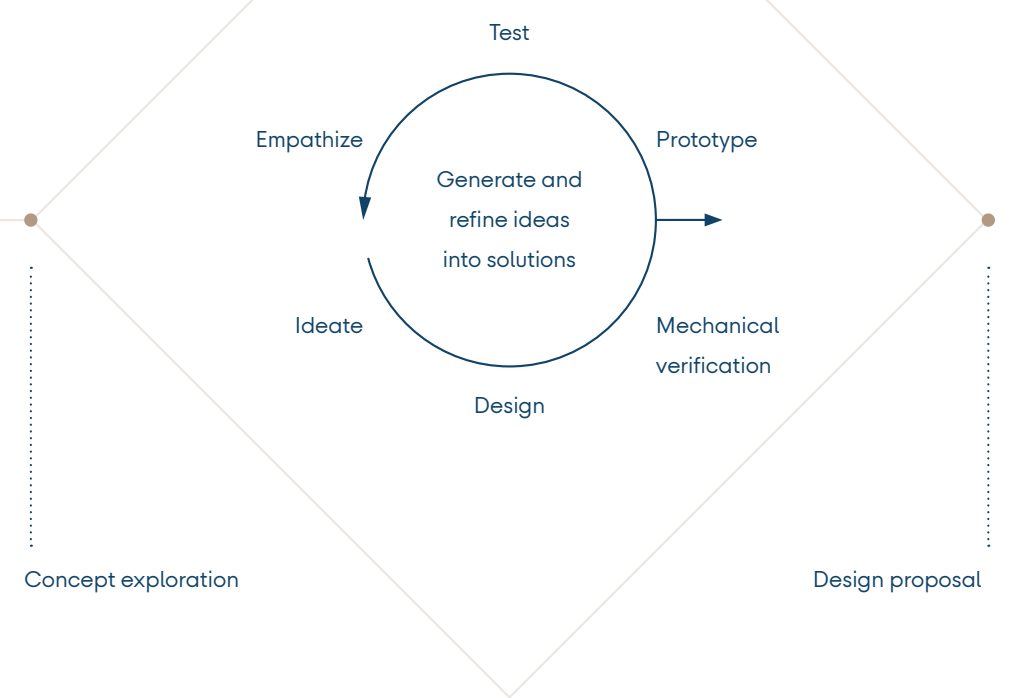
and improved. Because I intentionally focused on physical results and user testing, there is an emphasis on the development phase in this project.

Due to the complexity of the design challenge, my strategy for creating solutions has been to break down the product into smaller parts, working out those before forming larger components —

much like the concept of atomic design systems by Brad Frost (Frost, 2013).

In the fourth and final phase, the product is finalized based on the working concepts and solutions from the Develop phase.

A user testing framework

The user testing has been the backbone of the design process and the main source of user involvement. During this project, I have conducted more than thirty hours of user interviews and tests. Around seventy prototypes and parts have been made and evaluated over the course of five design iterations. For the user testing to run smoothly and maintain a consistent quality, I needed to establish a robust framework for it. This is presented below, and has been essential throughout the entire development phase.

The framework is based on Google Ventures' approach to user testing and has been further adapted to suit this project (Knapp, 2016b, Michel, 2016, Zeratsky, 2012).

The purpose

Fail fast

+

Involve users

The core purpose of the user testing is to collaborate closely with users on the design, making sure the product is aligned with their needs and wants. It is an invaluable tool for the designer and the development team for making informed and better decisions. Having a fresh pair of eyes to look at your product will lead to new insights on how to improve the design. Simply put, user testing is an efficient way to validate whether your ideas work or fail.

Key ideas

Five is the
magic number

↓

Reveals 85% of
the problems

For every round of user testing, the goal has been to test with five users. The big patterns tend to emerge after five interviews (Nielsen, 2000, Hanington, 2012). Then, potential problems are addressed and improved prototypes are made before another round of testing is conducted. This makes the development more efficient as you early on deal with the critical challenges and spend less time working out minor flaws. Naturally, as more iterations are done, the focus shifts from the big concepts to details.
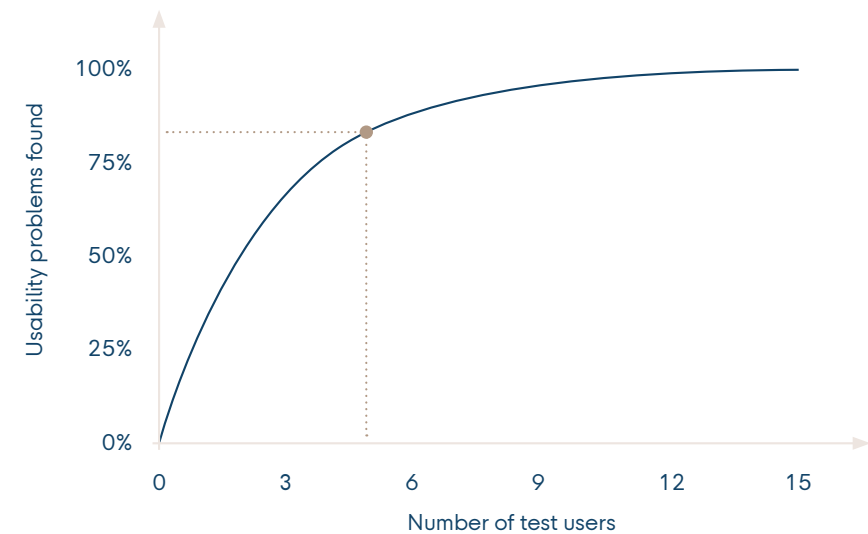
The research lab

All tests have been conducted in the workshop room at the FlowMotion office in Oslo. Every time, the set-up has been roughly the same.

- One interview subject
- Me, the interviewer, conducting the sessions
- Eirik, the assistant, helping with notes and preparations
- Printouts of the research plan and the interview guide
- Prototypes and models
- One computer for taking notes
- Pens and paper for additional notes and/or sketching
- Water, coffee, tea, fruits, and nuts
- Door sign to prevent interruptions
- Gift card for the participant
- A clock to keep the time

Recruiting users

For recruiting users, I have made use of the combined network of the FlowMotion team, using various channels to reach out and recruit. Ahead of the first user test, I made a user recruiting screener with criteria for the participants, which can be found in the Appendix. When recruiting users, they first got an open invitation with brief information about the test and suggestions for time and date. After receiving a positive reply, they would get a confirmation containing particulars such as date, time, directions, and compensation.

The interviews

The user interviews were conducted according to the *Five-Act Interview*, which is a structured one-on-one format by Google Ventures (Knapp, 2016a).

1. Friendly welcome: Welcome the user and make him/her feel comfortable. Explain that I want honest and straightforward feedback.
2. Context questions: Begin the session with small talk and simple background questions, then shift the focus towards the topics of the test.
3. Introduce the prototype(s): Make clear that I am not testing the user but the prototypes, and that some of them might not fully work. Ask the user to think out loud as they perform the tasks.
4. Tasks and nudges: Present the task without revealing how to do it, then watch the user work out the prototypes by himself/herself. Give small nudges if they are stuck. Ask follow-up questions to encourage the user to talk out loud.
5. Debrief: Ask final questions to have the user summarize his or her experience. Then thank the participant, hand over the gift card, and show him/her out.

While interviewing participants, my focus has been on asking open-ended questions, such as what, how, and why, to get the most informative answers. Sometimes I would continue to ask "Why?" to reveal underlying motives or emotions, similar to a root cause analysis (Norman, 2013). I also used broken questions to create silences that prompt participants to speak without any bias.

In contrast to the Five-Act Interview, I decided to have an assistant with me in the room responsible for taking notes of the participant's thoughts, reactions, and comments, as well as chipping in if I forgot an important question. This enabled me to be fully present with the participant, empathize, and show my curiosity towards what he or she had to say.

Before a new round of user testing, I always conducted a pretest with Eirik and one other member of the FlowMotion team. This was done to prepare ourselves for the real deal and to fix potential issues, ensuring the tests went as smooth as possible. For each round of user testing, I created a research plan outlining the purpose of the test and the key questions. I also made detailed interview guides specific to each round. The guides can be found in the Appendix. Research plans and findings from the tests are effectively covered in part three Develop.

After I completed a round of user testing, Eirik and I would gather all the notes from each session to summarize the results. Here, we looked for big patterns and other issues that required attention and discussed next actions based on our findings.

Theory follows practice

As this has been a practical project driven by qualitative and user-centered methods, working with research papers, and other secondary sources have not been paramount to the process. However, throughout the report, I incorporate relevant theory where I see it as a natural and valuable part of the discussion.

03   **DISCOVER**

Gaining foothold

—

Part three explains the product category and analyses the current products on the market. Then, I present user research and findings regarding smartphone stabilizers.

What is a smartphone stabilizer?

The best camera is the one that is always with you. For most people, that is a smartphone. Modern phones have incredible cameras but they were never made to replace traditional cameras — they were made to slide nicely into your pocket and be your second brain. The phone is difficult to hold steady and operate while recording videos or snapping photos, especially when you are running or doing other intense activities. This results in shaky videos and blurry photos — which is not how you want to look back at the moment.

A smartphone stabilizer solves this problem, enabling anyone to capture smooth, shake-free moments. The technology responsible for this is called a gimbal. They come in various shapes and configurations but the most common type consists of three motors, working together to keep your phone balanced and level — no matter how you move. Three motors

Not suited for activities

Poor grip and operation

Shaky videos/ blurry photos

mean we are working with three axes; yaw, roll, and pitch. The yaw motor, located in the yaw frame, handles rotation about the vertical axis, i.e. panning of the phone. The roll motor keeps the phone level with the horizon. The pitch motor controls the tilt of the phone. The phone is usually mounted in the pitch frame with a clamp-like mechanism.

In addition to the gimbal, smartphone stabilizers also have a grip. On the grip, there is usually an interface for controlling various features of the stabilizer or the phone's camera, such as power, video recording, and gimbal movement to name a few. Most smartphone stabilizers let the user toggle between different methods for balancing the phone, so-called follow modes. For instance, a lock mode will keep the phone stable and static in all directions, while in pan–tilt mode the gimbal will follow the user's movement about the yaw and pitch axes.

The above describes the typical workings of a powered stabi-lizer. There are also unpowered devices for keeping a camera or a phone stable, these are usually referred to as Steadicams. Although Steadicams keep your phone stabilized, they do not offer the same level of control and lack essential features compared to powered stabilizers. Other alternative solutions include digital and optical image stabilization. Both do a pretty good job but are currently not able to handle the same level of movement as powered stabilizers. Digital image stabiliza-tion will also degrade the footage by cropping it or introduc-ing artifacts.

Reviewing existing solutions

To understand stabilizers and learn their ins and outs, I have studied a handful of products. I have selected these based on market popularity and diversity, within the limitation of what I could get my hands on. In reviewing the stabilizers, I have focused on three main topics: 1) ergonomics, 2) usability of interfaces, and 3) aesthetics. Since my project revolves around the physical design of a stabilizer, companion apps have not been examined. I believe my analysis to be fair and balanced, despite my connection to FlowMotion.

On the next pages, you will find key takeaways about each product and a summary at the end. For the full review of all the stabilizers, see the Appendix.

Reviewing existing solutions
FlowMotion ONE

The FlowMotion ONE is the first product from FlowMotion. The start-up focuses on creating high-quality gear for smartphone videography. In a market primarily occupied by large companies, FlowMotion certainly sticks out. Priced at 249 USD, the FlowMotion ONE break into the high-end segment of smartphone stabilizers. With its sleek black silhouette and uncluttered design, it is marketed as a premium product and targets people of any skill level.

Pros

- Comfortable grip, very ergonomic shape
- User interface is simple and easy to understand
- The detachable grip is a unique and useful feature
- System feedback is clear and on-time
- Feels well made and robust
- Looks premium and minimal
- Gimbal has aluminum body
- Optional extension pole adds unique value

Cons

- Not the best price–value ratio
- Product feels very heavy to hold
- The interface offers few features
- Record and mode buttons are too small
- The grip mount feels unprecise and cheap
- Hard to discover portrait mode
- Takes time to balance gimbal
- No integrated tripod mount

Reviewing existing solutions
## DJI Osmo Mobile 2

The Osmo Mobile 2 from DJI is perhaps the most popular smartphone stabilizer on the market. DJI is a Chinese brand primarily focusing on drones and aerial footage for consumers and industry professionals. The Osmo Mobile 2 comes with a price tag of 125 USD making it a tough competitor on price and overall value. The price positions the product in the low-end mass market while targeting consumers with little to no previous experience with stabilizers. At first glance, the product seems like it is well-built and easy to use despite looking a bit clunky and dull.

Pros

- Good value for the price
- Interface offers zooming and photo capture
- Gimbal balance is set once
- Metal hardware increases the quality
- Offers phone charging
- Solid and rugged construction
- Plastic material feels high-quality
- Integrated tripod mount

Cons

- The grip is large and bulky but ergonomic
- Portrait mode is slow to use
- Interface is not the most comfortable to use
- System feedback is poor
- Appearance is not very attractive
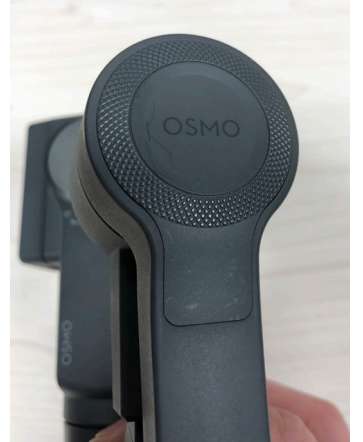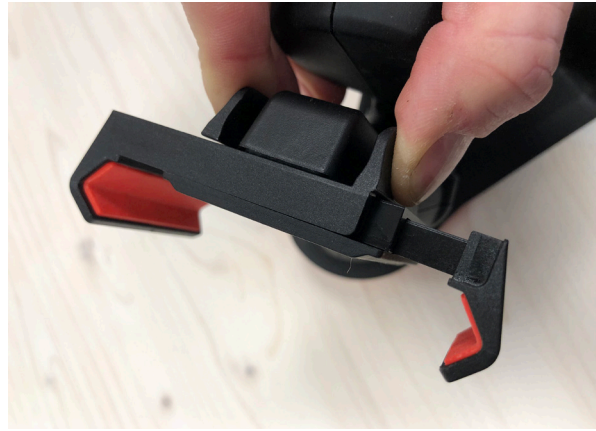
Reviewing existing solutions
Freefly Movi

In terms of design, the Freefly Movi is the odd one out among the stabilizers I have reviewed. Freefly is an American company renowned for producing high-end drone and camera systems for industry professionals and big screen productions. The Movi is marketed as a professional cinema robot rather than a stabi-lizer, and targets mobile cinematographers but also everyone else who wants to up their video game. The premium price of 299 USD reflects this differentiation. The product seems to hold a high build quality and its appearance strikes me as some-what industrial.

Pros

- Extremely well-built product
- Phone clamp is easy to use
- Stow lock and sleep function is useful
- Offers exposure control and camera toggle from the grip
- Integrated tripod mount
- Self-supporting design

Cons

- Steep price for what you get
- Grip is optimized for right-handed userss
- No buttons for moving gimbal or changing follow mode
- Buttons feel very mushy when pressed
- Hard to discover portrait mode
- Takes time to balance gimbal
- Grip requires two-handed operation
- Very industrial appearance

Reviewing existing solutions
Zhiyun Smooth 4

The Zhiyun Smooth 4 is one of the most advanced smartphone stabilizers on the market today. Zhiyun is another Chinese brand producing stabilizers for digital single-lens reflex (DSLR) cameras, smartphones, and action cameras. Although the product is targeted at the more demanding consumers and prosumers, the price sits at a relatively affordable level of 139 USD. My initial impression of this product is that it would require some extra effort to understand how to operate all the functions. The product seems have good build quality. The appearance is not the most attractive.

Pros

- Interface offers a lot of functions
- Gimbal balance is set once
- Has a stow lock
- Knob for zooming and pull-focus
- Offers phone charging
- Integrated tripod mount

Cons

- Grip is not ergonomic
- Very busy interface
- The buttons are confusing
- Ambiguous use of labels and symbols
- Portrait mode is slow to use
- Feels heavy
- Large footprint

Reviewing existing solutions
DOBOT Rigiet

The DOBOT Rigiet is perhaps one of the lesser known stabilizers out there but that does not imply it is a less interesting product. The Chinese company DOBOT primarily develop robotic arms for industrial and educational applications. Rigiet retails for 199 USD putting it more or less in the middle on the price ladder. The product presents itself as well-built and uncomplicated, and is targeted at less price-sensitive consumers.

Pros

- Interface offers more than basic features
- The product has a small footprint
- Gimbal balance is set once
- Good button tactility
- Offers phone charging
- Great build-quality
- Replaceable battery
- Integrated tripod mount
- Premium materials and elegant finish

Cons

- Phone clamp is slow to use and feels unsafe
- The grip size is too small
- The grip attracts dust and debris
- Interface is not straightforward
- Ball joystick feels awkward to use
- Hard to discover portrait mode

Reviewing existing solutions
Feiyutech Vimble 2

The Vimble 2 from Feiyutech is one of the latest stabilizers on the market. Similar to Zhiyun, Feiyutech is yet another Chinese company producing stabilizers for smartphones and various types of cameras. Vimble 2 looks clean and packs the essential features with more. The build quality could have been better. Retailing at only 119 USD, this product is for the lower-end great masses, but it is, without doubt, a dangerous competitor to high-end stabilizers.

Pros

- Incredible value for the money
- Ergonomic grip design
- Interface offers more than basic features
- Gimbal balance is set once and has a unique design
- Built-in extension pole is unique and useful
- Offers phone charging
- Integrated tripod mount
- Attachment loop for wrist strap

Cons

- Improved portrait mode, but it is still not very quick
- Gimbal balance feature is imprecise and feels cheap
- Buttons are too multifunctional (i.e. triple clicks)
- Joystick rotates freely around its own axis
- System feedback feels awkward
- Elegant but dull design
- Poor part fitting and joints

Reviewing existing solutions
Summary and conclusions

On the two next pages, I summarize and compare some of the key qualities and features of the stabilizers I have reviewed. The best solutions are highlighted in beige. However, being the best solution does not necessarily mean it is a good solution — it is just better than the competition.

What strikes me after inspecting and testing all these products is that there are no true premium stabilizers on the market. None of the stabilizers shine at all criteria. Most of the stabilizers are made to be as cheap as possible. Those that excel in some areas are either lacking basic features or aesthetic appeal and fail to provide a consistently smooth user experience. For instance, FlowMotion ONE comes with many unique features, and it is easy to use. However, the weight distribution remains a serious issue, and, for the price, I would have

expected a richer interface. The Feiyutech Vimble 2 gives the most bang for your buck. Having said that, you also get what you pay for, and neither the build-quality nor user experience is that great. Everything considered I am hesitant to name a winner of the bunch.

Before making further conclusions about the products, I will turn to customers to gather more insights, and supply with reflections from my long-term experience with the FlowMotion ONE.

|	FlowMotion ONE	DJI Osmo Mobile 2	Freefly Movi		Zhiyun Smooth 4	DOBOT Rigiet	Feiyutech Vimble 2
Ergonomics	Great, but too tapered	Good, slightly large	OK, only right handed		Poor, too square, proportions are off	OK, way too small	Great, not as secure as ONE
Interface	Simple and straightforward	Simple and under-standable	OK but lacking core features		Complex and confusing	Simple but not intuitive	Simple but confusing
Phone mount	Clamp, hard to grip, stiff	Clamp, hard to grip, loose	Clamp, easy to use, good stiffness		Clamp, solid, OK stiffness	Clamp, slow to operate, flimsy	Clamp, hard to grip, flimsy
Balancing	Slow but intui-tive, per session	Slow, set it once	Slow, per session		Slow, set it once	Slow, set it once	Quick, but impre-cise, set it once
Portrait mode	Fast and easy but hidden	Slow but easy	Fast and easy but hidden		Slow but easy	Fast and easy but hidden	Simple but slow
Weight	Top-heavy	Medium, evenly distributed	Left-heavy		Slightly top-heavy	Light, but slightly top-heavy	Light, evenly distributed
Build-quality	Excellent	Good	Excellent		Good	Good	Acceptable
Appearance	Elegant but burly	Bulky but clean	Crude, noth-ing special		Bulky and cluttered	Decent but inconsistent	Elegant but dull
Other features	Extension pole, detachable grip	Tripod mount, phone charging	Tripod mount, self-supporting		Tripod mount, phone charging	Tripod mount, phone charging	Tripod mount, phone charging, wrist strap
Price	249 USD (high)	125 USD (low)	299 USD (high)		139 USD (low)	199 USD (medium)	119 USD (low)

Real-world testing with the FlowMotion ONE

During my time in FlowMotion I have had several opportunities to get hands-on with their stabilizer. I have hiked up mountain tops and walked across the Uranos glacier in Norway, ventured into sandy deserts on camels in India, and gone sailing in the Mediterranean Sea — it is safe to say the FlowMotion ONE has undergone extensive testing under demanding and real conditions. Naturally, this has led to reflections about the user experience and the product design. Below, the focus is on problems and potential improvements.

One of the biggest issues I had with the product itself is the lack of an attachment point for a wrist strap. Often I would find myself in situations where the chances of losing the stabilizer and my phone with it were uncomfortably high, such as leaping over cracks while crossing the Uranos glacier. To drop and break your devices is one thing, but to lose the phone entirely — with all the videos and photos of precious
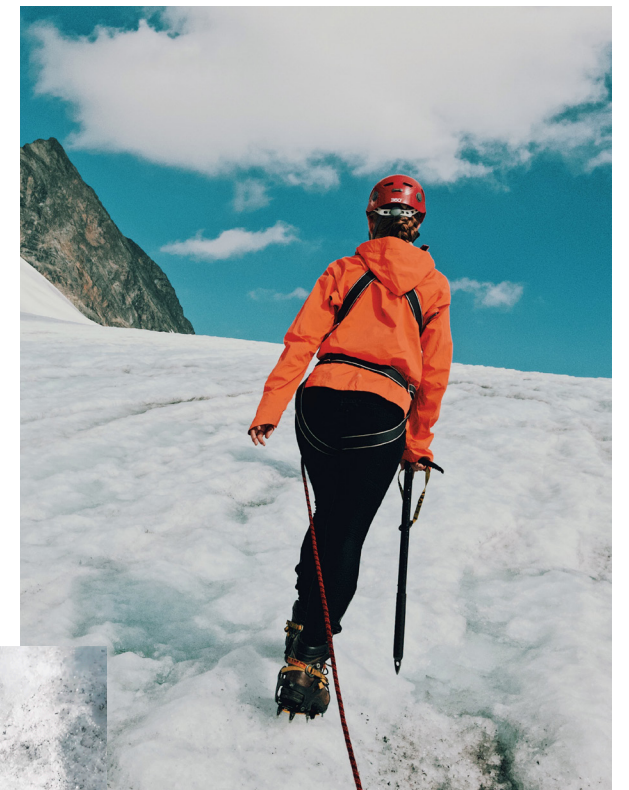
moments stored on it — is something else. A wrist strap would have been a simple yet effective way to address this pain point. Not to mention the utility of having a strap when you are out and about.

In between recording videos on trips, I rarely found myself taking the time to put the stabilizer back into its travel case, which I had in my backpack. I wanted to be ready with the gear in my hand in case something exciting happened. The problem is that there is no way to lock the product when it is powered off. Unless you hold it in a particular way, the gimbal

is constantly dangling when you carry it. Since the gimbal frames have rather sharp edges, it gets unpleasant to hold after a full day of action. I have experienced soreness in my hands on more than one occasion. As mentioned above, a few competitors have solved this with mechanical locks. In addition to a way of locking the gimbal, the product could have benefitted from having an optional backpack or belt clip for convenient carry and quick access during activities.

In terms of build quality and robustness, the product holds up well. Despite rough handling on several adventures, nothing is broken or damaged in a way that would render the product useless. However, the matte plastic on the grip gets scratches quickly and the paint on the aluminium parts easily gets scuffed off. Personally, I do not mind the weathered look – I think

it gives the product character. But this is probably not the case for all customers, especially considering it is supposed to be a premium product. For the next generation, we should investigate more durable materials and surface treatments.

My only complaint regarding the grip interface, besides my previous remarks, is about the joystick. Although the joystick feels great in comparison to others I have tested, I am not fond of the idea of having a joystick to control the movement. Usually, I only need to go straight from left to right and down–up, or vice versa. And for that, the joystick is too granular. It is difficult to be precise using it, and my shots do not turn out as smooth as I want them to be.
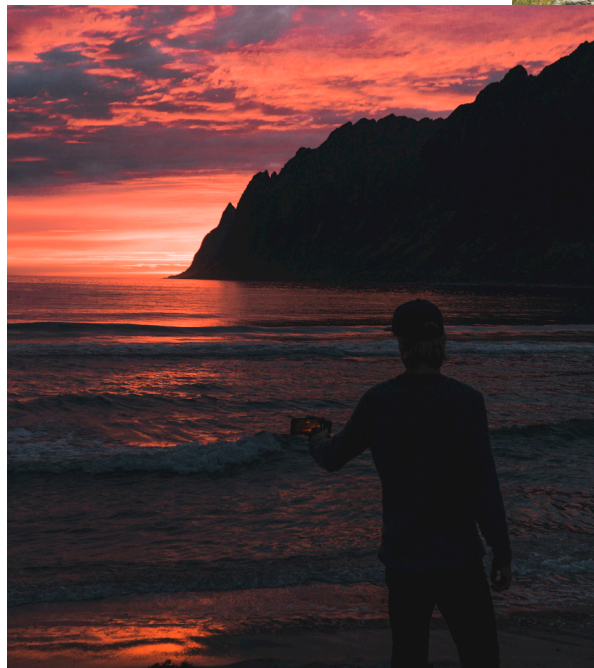
The battery life is superb. In general, I have gotten a full day of shooting out of one battery. Unfortunately, most phones are unable to match the battery life of the stabilizer. On trips I have brought with me a large powerbank to charge my phone during breaks from shooting. It would have been nice to be able to charge the phone with the stabilizer — preferably without cables. Having said that, I also know that phones consume a lot more power than stabilizers, meaning the battery of the stabilizer needs to have a high capacity to power both devices.
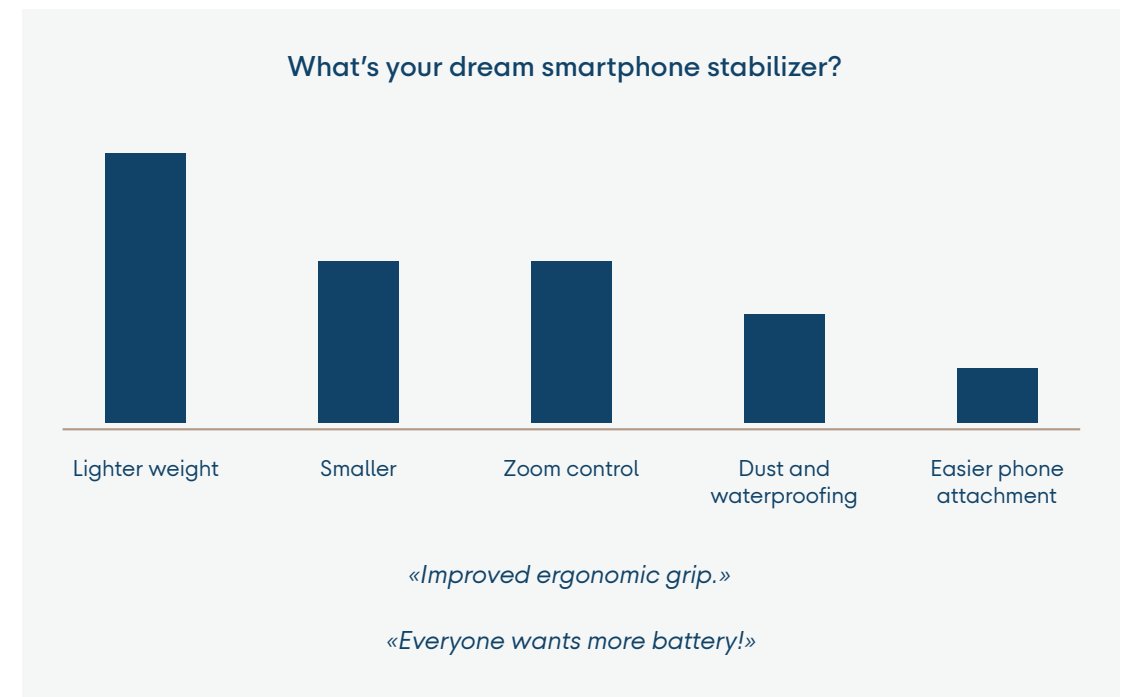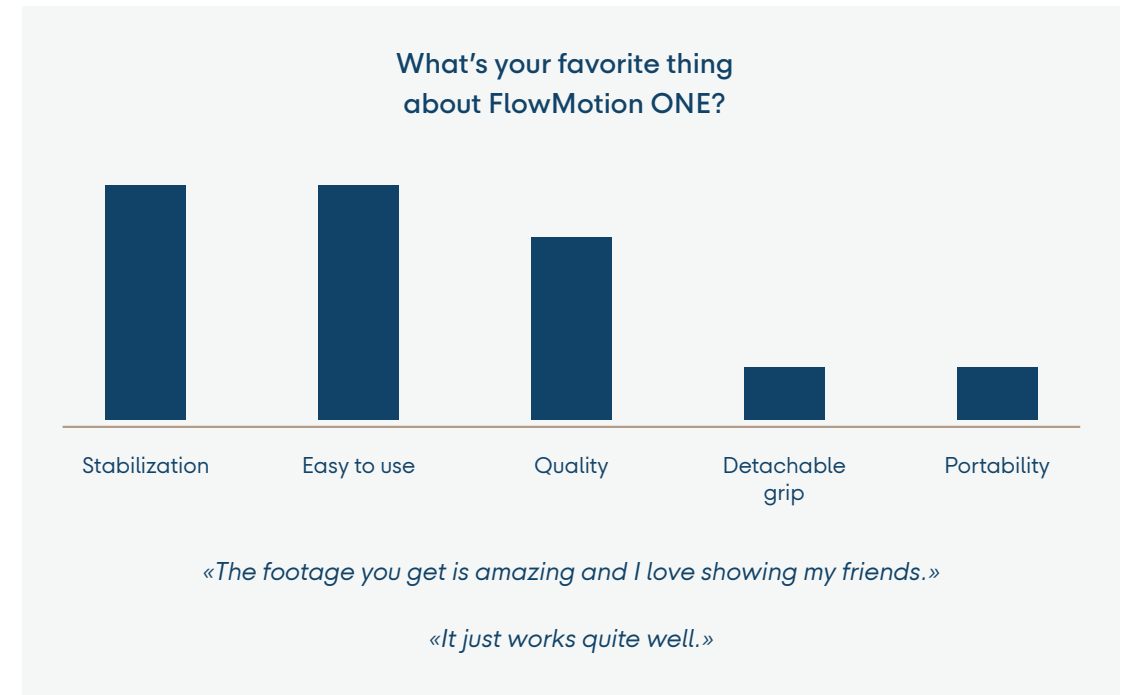
As stated, the focus is on the stabilizer and not the app. However, there is one issue I need to address. Using the stabilizer outdoors usually means you have to deal with changing lighting conditions. To ensure that the footage does not become over or under exposed, you can adjust and lock the exposure in the app. This is a very handy feature. However, I have found it difficult to perform the necessary touch gestures on-screen while I am running around with the product, focused on recording the moment. This also goes for other interactions such as changing camera mode. Bringing core camera settings to the grip and physically closer to the user could improve the user experience.

What do customers say?

FlowMotion's success is largely due to all the customers — especially the early adopters in the Kickstarter community who helped bring the project to life. To learn what the Kickstarter backers think about the FlowMotion ONE, I sent out an online survey.

I got 42 responses, which is a good deal but still relatively few compared to the total number of FlowMotion customers. Although the answers are in line with the feedback I have previously heard, I would have needed a higher response rate to consider the results as general.

What's your favorite thing about FlowMotion ONE?

Stabilization · Easy to use · Quality · Detachable grip · Portability

«The footage you get is amazing and I love showing my friends.»

«It just works quite well.»

What's your least favorite thing about FlowMotion ONE?

The joystick · Too heavy · No zoom control · Too big · No tripod mount

«Supersensitive joystick.»

«Too heavy.»

What's your dream smartphone stabilizer?

Lighter weight · Smaller · Zoom control · Dust and waterproofing · Easier phone attachment

«Improved ergonomic grip.»

«Everyone wants more battery!»

What's your dream smartphone stabilizer?

«Unlimited battery life, ability to charge phone while recording, better grip on phone, ability to zoom, and pre-program a set of movements.»

«A phone case that turns into a stabilizer would be cool. Always ready for action!»

«Be able to attach, and adjust phone in stabilizer with one handed motion, and not need to use two hands, and jam the handle between your legs to keep the stabilizer steady while attaching phone.»

«More compact and much less heavier than FlowMotion ONE, with GoPro compatibility and rain proof so I can wear it on my chest mount while biking.»

«It would've been awesome if you could just snap the phone in place.»

Digging deeper

To get a better and more nuanced perspective of the current market and user needs, I have analyzed online reviews and comparisons of stabilizers. For this, YouTube has been the primary source because video reviews convey more information about the user and the context than written reviews. The reviews stem from both professional filmmakers, regular consumers and technology reporters.

To convey the findings, I have selected eight direct quotes for each of the six stabilizers involved in this analysis. I chose this format as I think it better communicates the experience of the user — especially on an emotional level — which helps in building empathy. I have tried to make a balanced selection of quotes that reflect not only the general opinion of the products but also capture key differences.

Digging deeper
FlowMotion ONE

«The ergonomics of all the controls is really well laid out.»

«Build quality is also very good, and I'm not afraid it will break while using it in extreme situations or big crowds.»

«It seems to work fine but takes forever to balance.»

«Please integrate the tripod mount into the bottom of the handle — it's a neat feature that you can separate the handle from the stabilizer, but the need to do this every single time I want to mount it on a tripod and carry the extra piece with me which I first have to screw on is a bit... Meh.»

«The FlowMotion ONE feels like it's made from a company with at least 100 years of experience making user friendly products.»

«Different compared to other gimbals; premium packaging, premium feel, premium quality and easy to use.»

«The extension pole is the main selling point for me.»

«It feels quite top-heavy.»

Digging deeper
DJI Osmo Mobile 2

«There is one problem that I have with this portrait mode. The clamp only rotates in a certain fashion so that you have to remove the phone in order to change the orientation, and then of course when you change the orientation you have to reset your adjustments in order for it to be balanced.»

«This clamp is now spring loaded which is a little bit of a pain to use sometimes because you really have to wedge your phone in there.»

«Yay. Look at this tripod mount. I can actually put it on a tripod if I want to do any kind of selfies or anything like that. That is such a big deal for me.»

«This thing does a good job of just keeping it stable. It's super simple, build quality does feel a little bit cheaper but that's why the price is less.»

«It's super simple. The record button to start and stop the footage and the joystick made it really easy to tilt up and down and pan left and right. Where it was difficult is when you're filming changing settings is really difficult, and even setting up your shot you need to touch the screen to basically do anything.»

«I feel like you could slot this easier into your backpack. That being said it also feels the most flimsy.»

«You have a button that can make up to five, six, seven different functions which is a confusion. It confuses me.»

«The grip, it's just a bit too bulky for me personally.»

Digging deeper
Freefly Movi

«This thing is like super heavy-duty.»

«If money's not an option and you want the best smartphone stabilizer on the market, hands down, it has to be the Movi cinema robot. If you're a content creator, if you're getting paid for your work, if you do it for a job like me, the reliability and the durability of the Movi knowing that just about every shot is gonna work out and it's as gonna be as stable as possible.»

«To mount your phone you simply squeeze the back and it opens the jaws. It's very easy to do to, I like that.»

«One thing I love about the Movi is how quickly you can switch to portrait mode. For my job in social media switching between vertical and horizontal like that, that easy, is a game changer. That almost sells me on the Movi alone that feature.»

«Of all the smartphone gimbals I've used this one feels and behaves the most like a traditional gimbal you would have for a mirrorless camera or a DSLR.»

«I felt like with the Movi I had a smaller range of motion. I would hit the motors and the gimbals sometimes a lot easier.»

«I don't like how the Movi can't really do low to the ground. It's not that intuitive for any other shots besides upright.»

«This one's not gonna fit in your pocket but it also is super small and you can kind of put it with the rest of your gear in your bag.»

Digging deeper
Zhiyun Smooth 4

«On top of the Smooth 4 there is a locking compartment that locks the top of the gimbal so it's a lot easier to pack as well as it doesn't move around when you're walking around.»

«The build quality is solid even though it's predominantly plastic.»

«Using it, there is a bit of a learning curve as there are a lot of buttons and features that you can use on the gimbal.»

«It's a lot easier to change your settings while you're filming because everything you need is on the panel. So you don't have to fiddle around with the phone as much.»

«The grip is a little bit big and awkward. It's a little bit of a weird shape.»

«The fact that you have this whole control section on the gimbal is amazing. You basically don't have to touch your phone to operate your gimbal and I think that's a big plus.»

«I don't really care about the zoom wheel. I thought that that would be a cool feature but I don't think it works that great and I probably wouldn't realistically use it that much.»

«The big feature of this one is this zoom control that you have on the side. It allows you to do some cool smooth zooming.»

Digging deeper
DOBOT Rigiet

«It's fairly smooth. The only thing I don't like it's a little sensitive as far as I barely turn you see a little bit of motion here.»

«The handle is a little small for my size of hands.»

«I just wish that the handle was a little bit thicker so that I could grip it more easily.»

«The fit and finish is premium and it feels very solid the hand.»

«It's got these markings here. Super fantastic as far as, you know, getting it balanced.»

«One downside is I accidentally sometimes while shooting I flicked between modes so you have to be little bit careful not to touch it accidentally.»

«You can connect it to a tripod but the mount sits on the back the back of the handle. There isn't one on the bottom which, you know for me, I really enjoyed so I can put it on a tripod and set it down.»

«This gimbal is a lot smaller than all my other gimbals.»

«One thing I liked about this gimbal you know it's typical like all the other gimbals, it has all the modes, but there's a switch instead of a button on this one to change in between modes.»

«The tripod mount is to the side and not to the bottom. I'm not a fan of that as having the tripod mount at the bottom easily lets me extend the grip.»

Digging deeper
Feiyutech Vimble 2

«I personally like the simplicity of this. There's only a couple of buttons on here. I like it, very simple design. It's not overwhelming, there's not a ton that you have to remember about how to use it.»

«This is made from plastic but it does feel relatively well made considering it's plastic.»

«The extension pole is actually the key selling point of this gimbal as I could take shots that I could not take before with other gimbals. Really awesome feature.»

«The motors here do actually feel a bit loose compared to all the other gimbals that I've tried. They feel like they're a little bit more prone to some vibrations, especially when your walking heavily and awkwardly.»

«There are actually no adjustment knobs. I actually like that there's nothing to really interact with. It's very straightforward. So you just simply flip it and it kind of clicks in place. I find this very, very useful.»

«Sometime when you're switching phones or switching orientation you have to kind of like get it out, unwind it, put it. So on the grand scheme of things it consumes a little bit of time.»

«The control system on this gimbal is one of the best I've seen in this price range. My favourite is the trigger button on the back.»

«This little zoom trigger button being on the right side it's kind of complicated when you're filming or running to get with your thumb and to this button.»

A SWOT matrix
Strengths and weaknesses

To sum up and extract key findings from the previous research, I have chosen to do a SWOT analysis. The analysis compares the FlowMotion ONE with the competition mentioned above. I have regarded the competing products as one with a combined benchmark, which I believe is more practical for further work instead of a product-by-product analysis.

Strengths of FlowMotion ONE

- Ergonomically designed grip and console
- Detachable design makes it easier to carry in a bag
- Battery location makes it suitable for filming sports
- Premium design and high build-quality
- Stabilization is consistent and performs great
- Aluminum makes the product more robust
- System feedback is clear and timely
- Interface is simple and easy to use
- Orientation of phone can be changed seamlessly
- Gimbal has wide range of motion
- Easy to get low-angle shots
- Extension pole makes product more useful
- There is a button for temporar- ily locking the gimbal position
- Buttons are raised and have good tactility
- Battery is interchangeable

Weaknesses of FlowMotion ONE

- Product is top-heavy and tiring to use over time
- It is difficult to mount phone in clamp
- Portrait orientation is hidden
- User have to rely on touch screen for essential features
- Gimbal cannot be locked while powered off
- Instantly goes limp when powering off, which can damage the phone
- Aluminum makes the product heavier
- Attaching grip to gimbal is slow
- Takes time to balance gimbal and it has to be done every time
- Size is not really pocket friendly
- Paint and finish come off easily
- Extension pole is not integrated
- Joystick is too sensitive and hard to operate
- Function of mode button is not intuitive
- Cannot be directly mounted on a tripod or stand directly on the ground
- Cannot charge the phone
- Not possible to attach a wrist strap
- No zoom controls

A SWOT matrix
Opportunities and threats

Opportunities for new product

- Make it easier to capture content other than videos
- Make product lighter with plastic as main material
- Relocate battery to grip for better weight balance
- Design a new quick release mount for the grip and gimbal
- Make the portrait function visible
- Program the gimbal to fold slowly when powering off
- Design a stow lock for the gimbal
- Improve the clamp design or design a new phone mount
- Make balancing the gimbal a one-time procedure
- Reduce the need to use the touch screen while filming
- Add a separate trigger button for locking gimbal position temporarily
- Add locking as a new follow mode (in addition to temporary)
- Make sustainable production a uniqueness
- Design integrated extension pole
- Make it smaller and more portable
- Improve the battery life
- Develop wireless charging
- Add zoom control on grip
- Make a weatherproof design
- Improve durability of surface finish

Threats to new product

- War on price may result in compromises on quality
- Better cameras on phones may drive up expectations from the product
- Plastic can reduce perceived quality and robustness
- Increased portability might reduce ergonomics
- More functions can make the interface complex and confusing
- Innovative features increase development time, cost and risk
- Relocation of battery reduce the product uniqueness
- Lack of uniqueness might result in an unsuccessful product
- Wireless charging can drain the battery of the stabilizer
- Integrated extension pole increase size, and not everyone wants it
- Premium features not worth the cost in the eye of the customer
- Lack of sustainability might harm the market interest

Preliminary requirements

Together with the FlowMotion team, I formed a list of minimum requirements for the new stabilizer. The requirements outline a rough idea of the design — mainly from a production perspective — and is by no means a recipe for a successful product, but a baseline.

The gimbal

- Foldable frames
- Three-axis design
- Phone mount, preferably a clamp design to lower costs
- Adjustable roll frame length for balancing gimbal, preferably a set screw design to lower development risk
- Design must accommodate easy assembly of wires and motors
- Plastic as main material

The grip

- Detachable from gimbal
- Attachment point for wrist straps
- Universal 1/4-inch mount for tripods
- USB-C port for charging
- Internal space for one or two 18650 batteries
- Design must accommodate easy assembly of electronics
- Plastic as main material
- System status LED(s)
- Controls for: Powering product ON/OFF, entering Bluetooth pairing, resetting product, adjusting gimbal position, resetting gimbal position, changing gimbal modes

What should the product become?

The new stabilizer needs to bring uniqueness and innovation to succeed in a competitive market, especially when targeting the premium segment. With premium quality follows premium pricing, and although the product will not directly engage in the ongoing price war between low-end alternatives, it will certainly be affected by it. Mainly, I think it has made users more sensitive to high pricing, as with the Freefly Movi. However, that does not mean there is no market for high-end devices, but I believe it will be harder to find the sweet spot between what is viable to business and what people value — and for the right price, especially as a startup company.

At the time of launching of FlowMotion ONE, smartphone stabilizers were a fairly new product category, which has since evolved and is now almost commonplace. However, the fundamental technology of a stabilizer — the components and software responsible for keeping the smartphone balanced — has reached a point where few advances are made. Couple that with the fact that the quality of smartphone cameras are increasing with the release of every new flagship device, and we have a challenging task ahead of us. It is very unlikely that digital and optical image stabilization in smartphones will ever be as good as stabilizers, but over time, it will become *good enough* for many people.

My point is not to paint a dark picture of the future of smartphone stabilizers, for the interest exists. For stabilizers to stay relevant, I think they have to trancend their primary purpose. They have to attain a new and expanded meaning. Stabilization should not be the only pillar of the category. The product should embody all aspects of capturing moments and what that means to the user — no longer just a tool, a means to an end, but something that evokes inspiration and delight. This brings me back to the heart of the project and why I chose a user-centered approach; the conversation is not about the minimum viable product — it is about the *most lovable* product.

Kano analysis

With the most lovable product in mind, I have chosen to organize potential features for the stabilizer within the framework of a Kano model (Hanington, 2012). The resulting model is based on my insights from the preceding product testing and user research. It also concludes the Discover phase of the design process.

Required features form the baseline of a product and must be included. They may not increase customer satisfaction but will reduce it if left out.

Desired features have a linear relation to customer satisfaction. They should be included as they will increase the perceived value of the product.

Attractive features are sources of delight and surprise to customers and increase the level of satisfaction. As they are not expected, they will usually not disappoint the customer if left out. Attractive features are also useful for identifying potential ways to differentiate a product.

Neutral features are attributes the user does not care about. Because of this, they will not have an impact on customer satisfaction, included or not.

Anti-features can impact customer satisfaction in negative direction if included, and people will sometimes want to pay more to not have them in the product.

Required features

- Smooth, consistent stabilization
- Fits in a daypack
- Gimbal balance — set it and forget it
- Long-lasting battery
- Foldable gimbal
- Standard clamp mount for phone
- Supports portrait orientation
- Clear and timely system feedback
- Tripod mount at bottom of grip
- Attachment point for wrist strap
- Ability to lock gimbal position
- Simple and easy-to-use interface: Power on/off, record video, move gimbal, gimbal modes

Desired features

- Fits inside a pocket
- Knob-free adjustment of gimbal balance
- High-quality plastic body
- Manual stow lock
- Detachable grip
- Compatible with extension pole
- Improved clamp design (similar to Freefly Movi)
- Seamless and discoverable portrait mode
- Haptic feedback (vibration)
- Premium design
- Solid build-quality
- Lightweight
- Wide range of motion
- Durable surface finish
- Controlled movement when powering off
- Dedicated trigger button for locking gimbal position
- Wired phone charging
- Weather-resistant
- Shock-resistant
- Interchangeable battery
- Interface that requires less use of touch screen: Camera modes, capture photos, camera settings

Attractive features

- Quick-release phone mount
- Quick-release mount for grip and gimbal
- Magnesium alloy body
- Automatic balancing of gimbal
- Automatic stow lock
- Wireless phone charging
- Weatherproof
- Shockproof
- Voice control

Neutral features

- Integrated extension pole
- Zoom control
- Ability to stand on the ground

Anti-features

- Poor system feedback
- Shorter battery life than the phone
- Plastic body
- Unevenly distributed weight
- Too many buttons
- Flimsy construction

04   DEFINE
Finding direction

—

It is the designer's role to imagine how people want to use a product both today, tomorrow and in five years time. For technology, five years is a lifetime. Our concept of phones and content sharing may change entirely within that span. But, for this project and strategic scope, I presume that phones and stabilizers still have their place and use.

Building on the insights from the previous chapter, part four describes the target user and relates that to value propositions and strategic decisions for the design and positioning of the product.

Who is the user?
The typical customer

Understanding the audience you are designing for is perhaps the first step, and a crucial one, in gaining focus for any project. Knowing their goals and wants and the context in which they will use the product can make it easier to decide which features to prioritize.

Looking at the existing customers of FlowMotion is a good starting point. To get a better picture of who they are, I gathered information from previous customer surveys and sales data. In short, the typical customer is a young adventurous individual with a curious mind. He or she — most likely a he — is keen to travel the world and wants to enjoy the benefits from the latest technology. His goal is to capture amazing videos to share with friends and family. Sometimes he will post the content to his favorite social platform; Instagram, YouTube, or Facebook. Furthermore, the typical customer:

...has a college degree or higher
...has a relatively high income
...is married or in a relationship
...wants a great result with minimum effort
...values build quality, design and simplicity
...enjoys technology and gadgets
...and captures:

Vacations
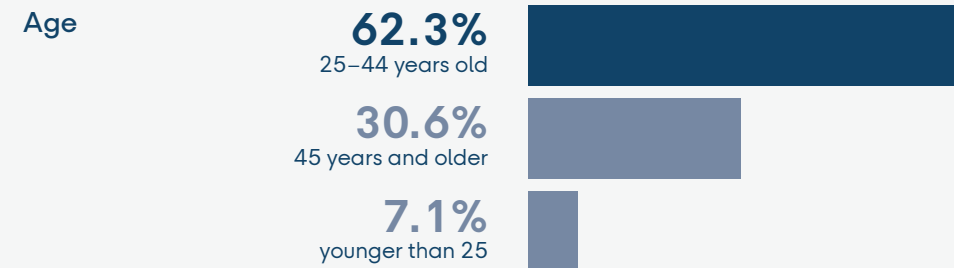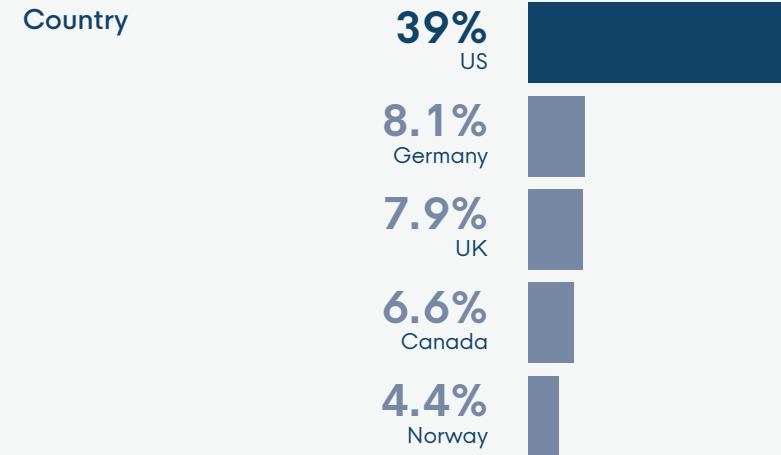
Projects at work

Loved ones

Country

39%
US

8.1%
Germany

7.9%
UK

6.6%
Canada

4.4%
Norway

Age

62.3%
25–44 years old

30.6%
45 years and older

7.1%
younger than 25

Gender

85.2%
men

14.8%
women

Device OS

70.4%
Apple users

29.6%
Android users
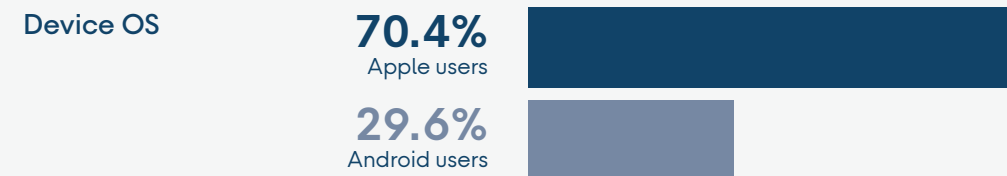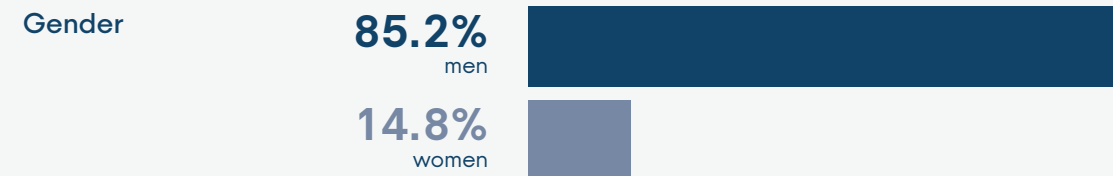
Who is the user?
User workshop

To further explore our audience and customer characteristics, I invited the FlowMotion team to do a workshop on the topic. My thinking was that everyone on the team knows something about our audience that the previous data do not tell. My plan was to gather more information I could use for creating personas and to discover other factors that I might need to address when designing the stabilizer.

In the first part, I made the team write down as many different customers they could think of. Next, we clustered similar users together and created twenty-four different categories of people. I then had the team do the same with customer traits. This resulted in twelve general traits, which are presented below.

General customer traits

- Technology: Open to new technology — early adopter
- Video and photo: Wants to make videos and take photos

- Social media: Interested in sharing content and promote oneself
- Has something to capture: Has a hobby or interesting lifestyle to show
- Simplicity: Seeking to simplify the video making process
- Good economy: Ability to spend and has a high-end smartphone
- Conspicuous consumption: Wants to identify with product and brand
- Quality oriented: Appreciates design and build quality
- Perfectionist: Wants to get professional-looking videos
- Sporty: Plays a sport or is active outdoors (hiking etc.)
- Travel: Curious and wants to explore new places
- Self-improvement: Aspire to attain a certain lifestyle

I wanted us to go more in-depth on the different kinds of customers but with twenty-four categories, we first had to reduce and prioritize. While individually voting, I encouraged the team to start thinking about the pros and cons of

the different categories. After this step, we were left with four categories, which were bloggers, journalists, athletes, and young women. Next, I challenged the team to come up with short and simple stories about fictive users to each of the categories.

We then wrapped up the workshop by discussing what these characters might want and their pain points, in the context of smartphone stabilizers. For instance, athletes will demand higher

performance from the product, especially concerning robustness, durability and weatherproofing. They are also more dependent on the ability to mount it to other gear they use. And for journalists, we would have to think of new solutions to deliver better audio quality in addition to smooth videos. As the categories vary in how wide they are, there were some overlaps when discussing needs and challenges.

Who is the user?
Two personas

Based on the customer data above and the results from the workshop, I have created two personas for the product. Both personas are intended to represent lead users that other people look up to or aspire to be like. It is crucial that they portray something attainable to catch interest and continue to be interesting — always one step ahead but never out of reach. My idea is that you should be designing for how people want to use your product tomorrow, and not today or yesterday. I believe this type of thinking can help to push boundaries when developing a product. And pushing boundaries and innovating is especially relevant for premium products.

The first persona is the closest match with the typical customer, whereas the second one represents a segment where we want to expand our reach. Since the first persona belongs to Flow-Motion's largest customer segment, this character will have priority over the second persona.

Riley Burkard

35 years old
Stunt coordinator
Engaged
Los Angeles

Riley is a stunt coordinator working in the movie industry. He never turns down an opportunity to travel, that be for work or vacation. He feels the most alive cruising along the scenic coast on his Triumph bike, stopping only to snap photos with his beloved Leica camera. He also has a drone to get aerial videos of the exotic destinations he and his partner visits. Riley is looking for an efficient way to get the same smooth footage as his drone can do but down on the ground. He uploads once or twice a week to Instagram and on a monthly basis to YouTube. Riley values high build-quality and has a keen eye for timeless design. He appreciates simplicity in technology but not at the cost of performance.

Social channels

Favorite brands
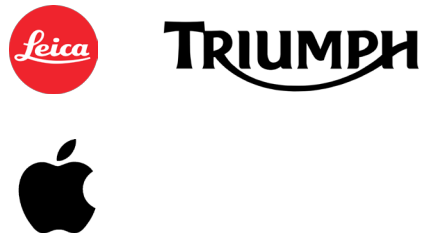
Goals

- Capture behind-the-scenes videos of the action at work but without the camera shake
- Share stunning and professional-looking travel videos to YouTube

Needs

- Gear that lets him record videos one-handedly
- Ability to control essential camera settings on the fly
- Something that can handle slightly rough use
- The option to live stream videos using his phone

Pain points

- Does not have the time to set up a DSLR camera and gimbal to capture behind-the-scenes content at work
- His Leica is great for photos, but it is manual and difficult to use for video capture
- Does not want to bring full-sized gimbal for his Leica when travelling

DEFINE

Hannah Gartner

27 years old
Yoga instructor
Single
Wien

Hannah leads an energetic and urban life. She does yoga classes and retreats for a living and is using Instagram and Facebook to build her own business. Her work gives her the freedom and opportunity to travel all over Europe. Do not be surprised if you catch her commuting on her electric skateboard. Hannah is looking to improve the videos she shares, hoping it will help to grow her business and social following. She uploads more or less daily, focusing on crafting raw and short stories from her everyday life. Hannah values products that are easy to use and from a known brand. She wants her tech and other essential gear to complement each other visually.

Social channels

Favorite brands

lululemon

Goals

- Build an inclusive online community around yoga, healthy food and urban living
- Share inspiring and educational videos of her yoga prac- tice, recipes and weekend getaways in Europe

Needs

- Ability to share photos and videos on the fly from her phone
- A better way to make vertical videos for her Instagram stories
- Seamlessly switch between filming herself and the surroundings
- A compact setup that fits in her gym bag

Pain points

- Do not want to spend a lot of money on camera gear
- Cameras have a lot of advanced features she does not need
- She uses her phone a lot for work, which drains the battery

DEFINE

Strategy workshop
Values and features

To get everyone aligned and create a clear direction for the new stabilizer, I organized another workshop with the FlowMotion team. This time the workshop primarily focused on which value propositions we wanted to make with the product, and various features the team associated with these values. We also brainstormed names for the new product.

As the workshop facilitator, I guided the team through structured sequences consisting of individual ideation, presentation of ideas, prioritizing ideas, group discussion, and decision making.

The workshop resulted in nine value propositions, which were then weighed against each other. The order in which they appear below reflects how they were prioritized, from most to least significant. Although the outcome of this work is of use and importance, I will be careful to not let it tower above more substantial feedback from the users.

Uniqueness

- Features that enable you to do things you could not without, e.g. automated barrel rolls
- Gimbal folds and locks automatically when powered off
- Detachable grip
- Family of accessories (product ecosystem)
- Quick-release phone mount
- Phone recognition and automatic balancing
- Human-like abilities (haptic feedback, LED "breathing" pattern etc.)

Seamless experience

- App integration with social media
- Automatic launch of app when powered on
- One handed control; less physical interaction with phone
- No bugs or errors
- Everything that can be pushed to background is pushed to background (FW updates etc.)
- Tracking without using touch screen

Performance

- Longest-lasting battery life
- Best performing stabilization
- Foolproof system/firmware
- Smooth, natural panning (not robotic)

Portability

- Compact size
- Low weight
- Foldable and easy to pack
- Easy to carry (wrist strap, belt clip etc.)

Premium design

- Scandinavian
- Proportional structure
- Contrasting finish, e.g. matte vs. shiny
- Smooth surfaces and highlights

Versatility

- Mountable
- Extendable
- Accessories

Personalization

- Colorways
- Configurable (battery life, add-ons etc.)

Excellent build quality

- High-quality materials
- No visible welds
- Precise part fitting
- No loose parts, i.e. it feels solid

Robustness

- Materials do not scratch easily
- Dust and water-resistant
- Can take a fall

Strategy workshop
Product name

After a series of short brainstorming sessions, we voted on our favorite ideas and discussed the pros and cons of the best-performing ones. The voting resulted in a close race, and we did not manage to conclude with a clear winning name. I present the top three candidates below.

The reason I wanted to work on the name at this stage was that it gives character and personality to a product, which could be useful to further define the design.

TWO (5 votes)

Pros

- Clearly makes it the successor of Flow-Motion ONE
- Naming style is already incorporated in the brand
- Short and simple

Cons

- Non-descriptive
- Will it work in a product ecosystem?
- Neither remark-able nor distinctive

X (4 votes)

Pros

- Sounds intriguing
- Short and easy to remember
- Creates associations to iPhones

Cons

- How would the name evolve with new generations?
- Non-descriptive and not unique
- Will it work in the context of naming a product family?

The Stabilizer (5 votes)

Pros

- Descriptive and straightforward
- Easy naming pattern for a product family
- Sounds significant

Cons

- Not the shortest
- Might cause confusion with past and future generations
- Only focused on stabilization

Design parameters

Nostalgic ——————————●——————————→ Novel

Minimal ——————●————————————→ Technical

Instrumental ————————————●————→ Ornamental

Here, I establish three useful parameters for informing the form and function of the product. The aim of this exercise was to translate the strategic values above into more practical terms to guide my work.

P1 refers to the interplay between modernity in function and modernity in expression. For instance, with many cameras today there is high-performing innovative technology inside, but the outside has a familiar look that honor iconic predecessors. With the new stabilizer, I want the product to feel novel, as it is, but at the same time make a nostalgic connection back to traditional cameras.

P2 primarily describes the desired shape and layout of the product. Although a stabilizer can have many complex and moving parts, I aim to create a clean and uncomplicated exterior. However, the user experience should also be rooted in the same idea.

P3 hints at the symbolic value of the product and is a continuation of the discussion about the future of stabilizers towards the end of the Discover phase. The idea is that the product should evoke confidence in the user. The person should feel proud to own and use the stabilizer, in contrast to it being just a tool. To illustrate this, I have selected two very different types of watches that also would represent two very different meanings to the wearer.

Positioning in market

High perceived quality

New stabilizer

Low cultural value

High cultural value

Low perceived quality
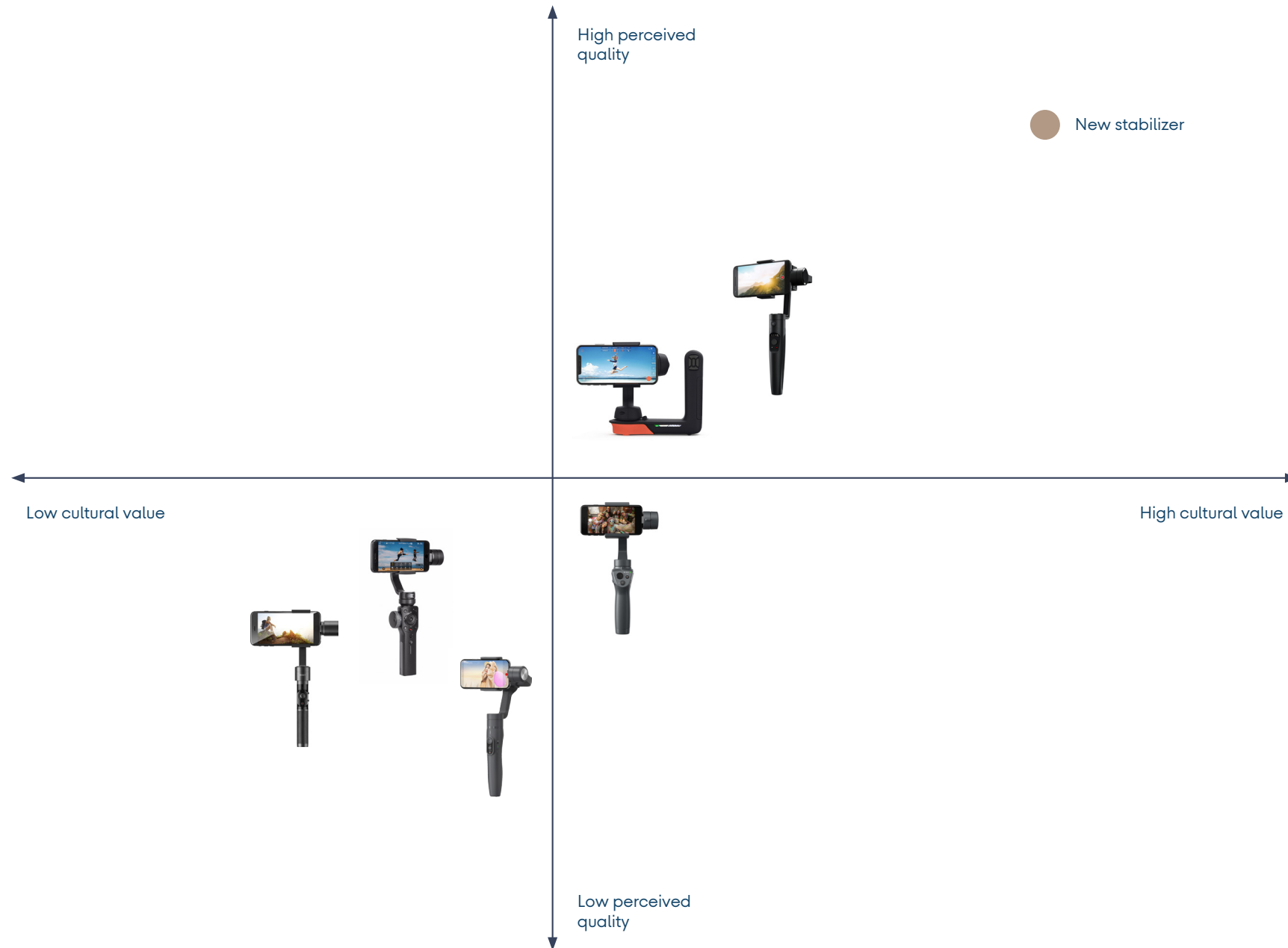
There are several relevant parameters to choose from for communicating how to position the product. To illustrate the fact that there are currently very few stabilizers in the premium segment, I have decided to keep it simple and let the vertical axis represent perceived quality. The perceived quality of a product is determined by many different factors — both intrinsic and extrinsic — craftsmanship, sophistication, and brand awareness to name a few (Rydal, 2018). Since this parameter takes into account most of what I focus on designing the product, a second parameter is perhaps superfluous. However, to reiterate myself and manifest how I think the product category should evolve, I let the horizontal axis represent cultural value. Here, a high cultural value does not mean the product has a low functional value and vice versa. With a premium product, high utility and performance are expected. The cultural value comes on top. Using these two parameters, I hope to strike a unique and interesting note in the market.

For more information about the factors affecting perceived quality, please refer to my 2018 literature review on designing premium products.

A MoSCoW diagram

In light of the personas, value propositions, and other strategic choices discussed above, I have made a MoSCoW diagram of features for the new stabilizer. Similar to a Kano analysis, the MoSCoW diagram is another tool for prioritizing and defining a design challenge. MoSCoW is an acronym for Must, Should, Could and Won't (n.d., 2015).

Must haves are the most vital features of the product. If left out, the product will fail.

Should haves are important but not critical features. If possible, they should be included in the product.

Could haves are features that provide a better user experience. They will be included if time and resources allow it.

Won't haves are features that either requires too many resources to implement or provide little value for the effort.

The diagram below builds on the Kano analysis in part three of the report and attempts to further narrow down the scope of the project. It is also meant to be a rough guide for how to proceed with the development phase.

Must

- Have smooth stabilization
- Fit inside a daypack
- Have a foldable gimbal
- Have a detachable grip with quick-release mount
- Be lightweight with evenly distributed weight
- Have an intuitive and discoverable portrait mode
- Have an ergonomic grip
- Have a tripod mount and wrist strap loop at bottom of grip
- Have an intuitive button interface
- Provide clear and timely feedback — with haptics
- Have ability to lock gimbal position
- Be made of high-quality plastic
- Have appealing aesthetics
- Have a solid build-quality
- Have a long-lasting battery

Should

- Have a quick-release phone mount
- Have a simple one-time adjustment of gimbal balance
- Shut down in a controlled motion
- Have an interface that requires less use of touch screen
- Have a wide range of motion
- Be compatible with an extension pole
- Have a manual stow lock
- Be dust-resistant

Could

- Be made of magnesium alloy
- Have an automatic stow lock
- Have a dedicated trigger for locking gimbal position
- Have zoom control
- Have wireless phone charging
- Be shock-resistant
- Be splash-resistant
- Have voice control

Won't

- Have interchangeable batteries
- Have integrated extension pole
- Have the ability to stand on the ground
- Have wired phone charging
- Have automatic gimbal balance

Sources of inspiration

To finish off the Define phase, I traversed the Inter-net collecting images that are in part meant to be a visual reflection of the strategic decisions so far and an inspirational toolbox for the Develop phase.
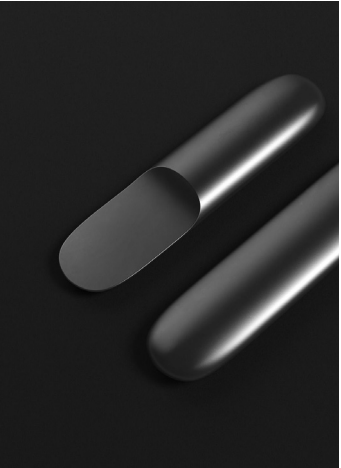
Materials
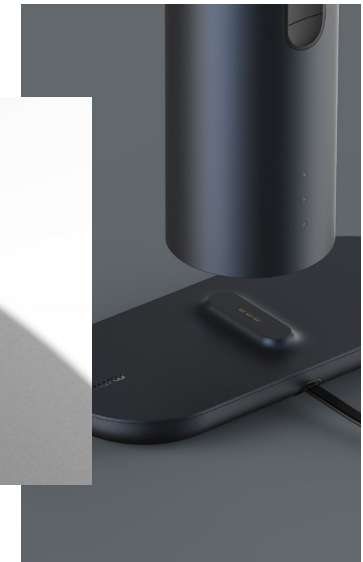
Communication

Silhouettes

05   DEVELOP
Think, make, test, repeat

—

Part five describes the iterative practice of creating possible concepts and solutions for the product. Further, it presents the findings from all five rounds of user testing driving this phase of the design process.

Iteration 1

A beginning

The first iteration kicks off the development phase by discussing what aspects of the product to attack first. Then, it continues by exploring grip shapes, quick-release mounts, and detachable grip concepts. Further, it briefly looks at the clamp and the roll frame design before wrapping up with the first user test.

Where to start?

A smartphone stabilizer is a complex product made up of many components. Choosing where to start can be a challenge. Considering the grip is what the user will interact with the most — and that it can make or break the product — I decided this was the right part to begin with. The grip design involves both ergonomics, a physical interface, and aesthetics — all aspects that require time and attention to detail. These aspects also have to be aligned with technical requirements of internal components.

In the first iteration, I also wanted to get going with new concepts for the detachable grip mount. The threaded solution in FlowMotion ONE caused a lot of production issues and is neither the most elegant nor user-friendly design. For instance, the threads caused misalignment between the grip and the gimbal, which delayed production three months and forced FlowMotion to scrap twenty-one of the involved metal parts. Another problem was that the threads are sharp and potentially dangerous if caution is not exercised when detaching and attaching the grip. Resolving this issue caused another few weeks of delay. Thus, I figured we could gain a lot from improving the detachable mechanism.
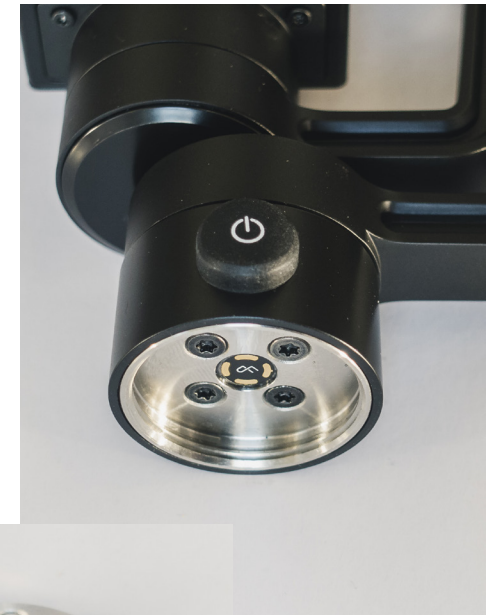
Rough grip shapes

In the workshop, I made nine different grip designs. For this, I used a soft type of foam which allowed me to evaluate and then easily modify the shapes to taste. The process was very hands-on. Some of the shapes I invented on the spot, while others were inspired by stabilizers, shavers, and game controllers among other things. The shapes with a cross-section similar to a squircle, a type of superellipse, were based on my research on hand ergonomics from the pre-project the year before.

Some quick-release mounts

A lot of solutions already exist for quick-release mounts, and many of them are very good. To get ideas for the stabilizer, I inspected a handful of products with different mount designs. Most of these products were from the camera industry. In addition, Trond Are kindly demonstrated the sturdy mount for the battery on his electrical bike.

What I focused on when inspecting the solutions

- Is the mount strong and durable?
- Is the connection tight and precise enough to allow electrical signals between grip and gimbal?
- Is it easy to understand and operate?
- Is it secure and foolproof?
- The grip is relatively small and there is little room for intricate mechanical designs — does the mount scale down well?

Detachable grip concepts
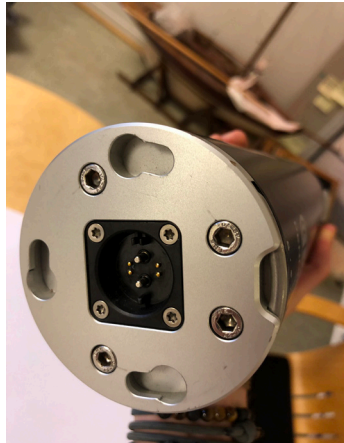
Next, a few concepts were made for the detachable grip. Among the designs, one resembled a bike seat clasp, while another one was a mock-up made using parts from my tripod. A third was a hybrid of a garden hose connector and the threaded one in FlowMotion ONE. The fourth and final was roughly based on a camera lens mount. The four solutions would be tested up against the FlowMotion ONE in the first user test, which is described later.
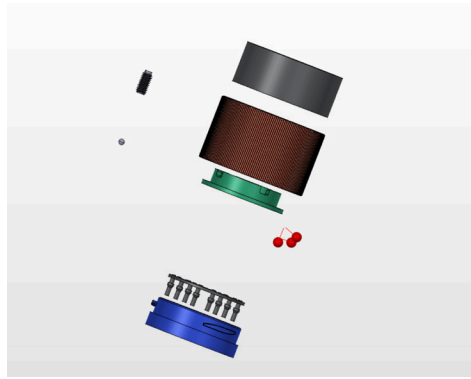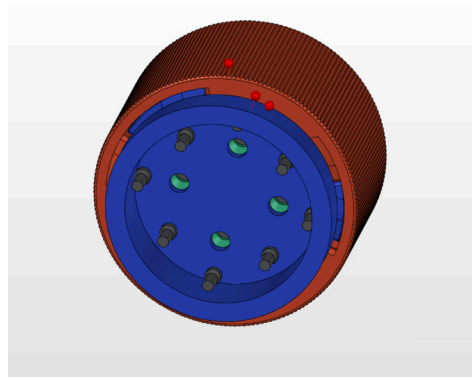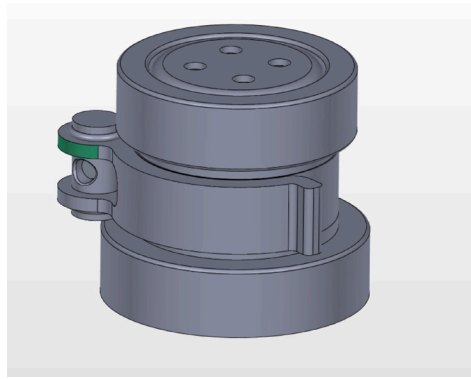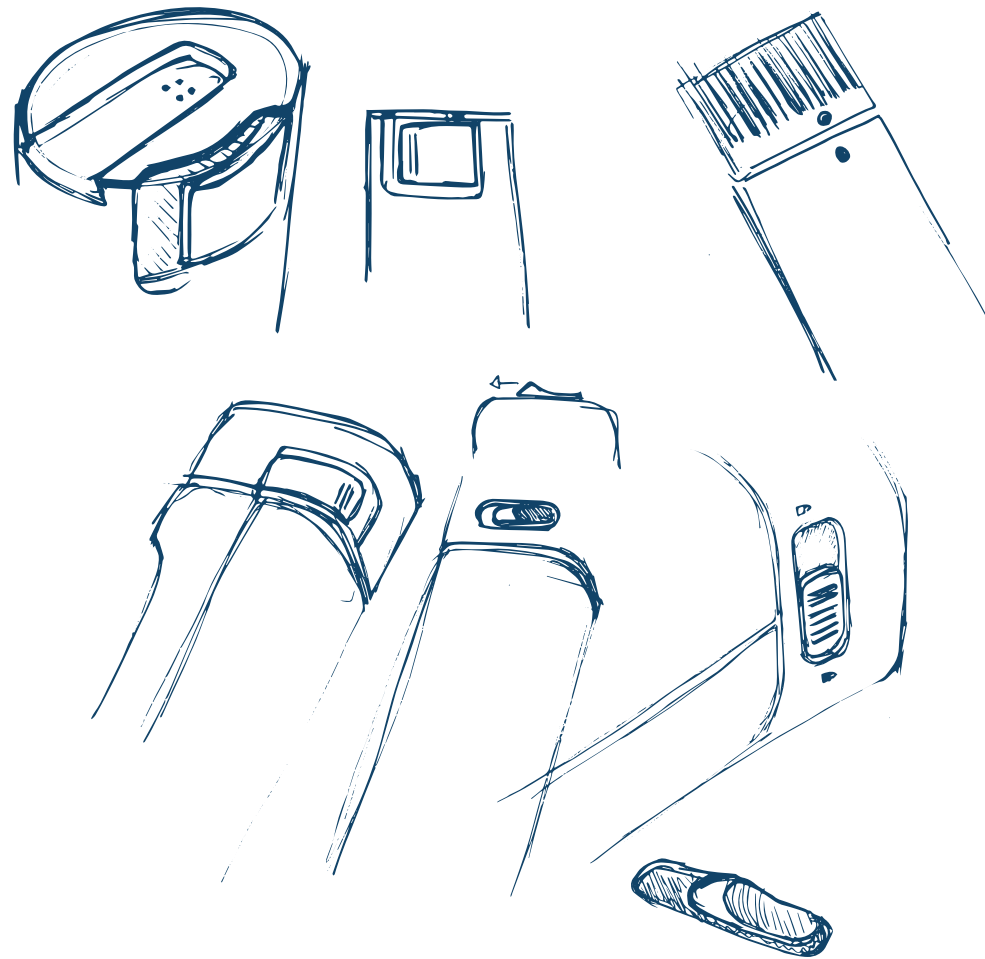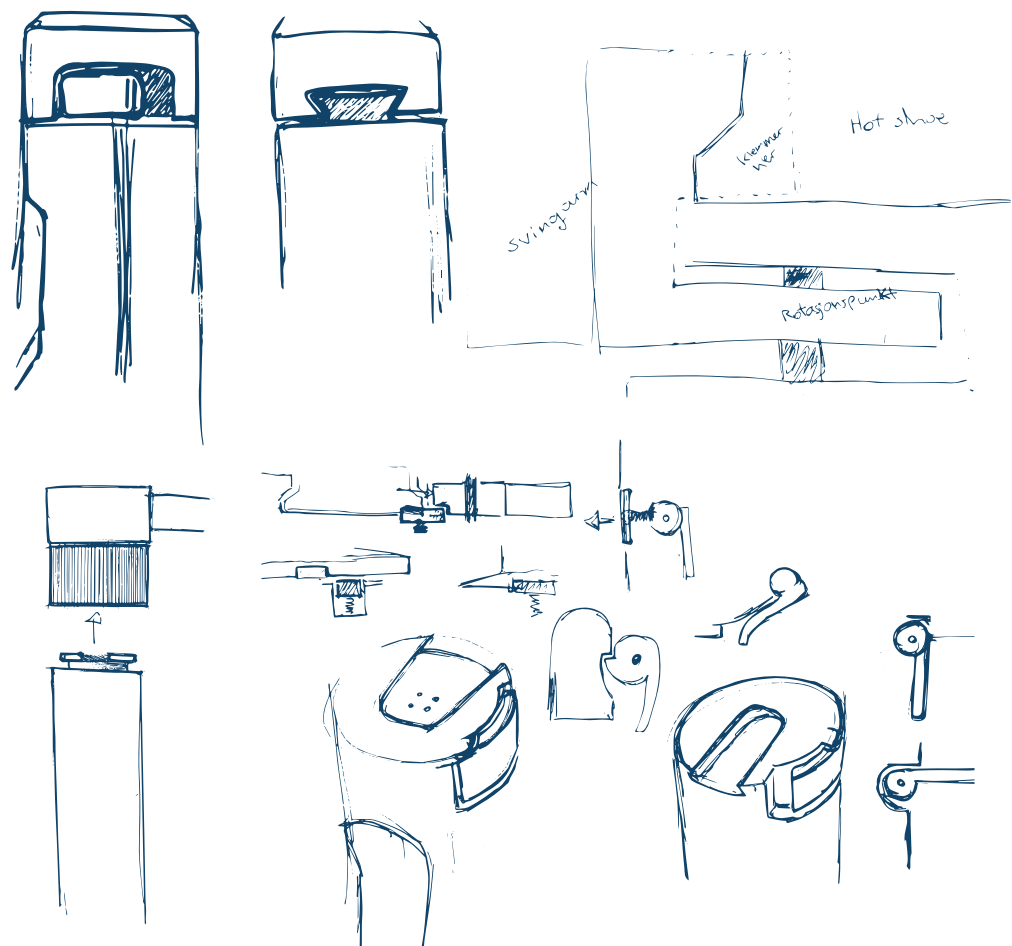
Phone clamp and gimbal balance

A roll frame with a set screw design for the gimbal balance was made in addition to a clamp design for the phone mount. These were primarily for mechanical verification purposes. A similar clamp to the one in Freefly Movi was also modeled, but it quickly occurred to us that it would increase the size of the pitch frame significantly, which would have reduced the stabilizer's portability.
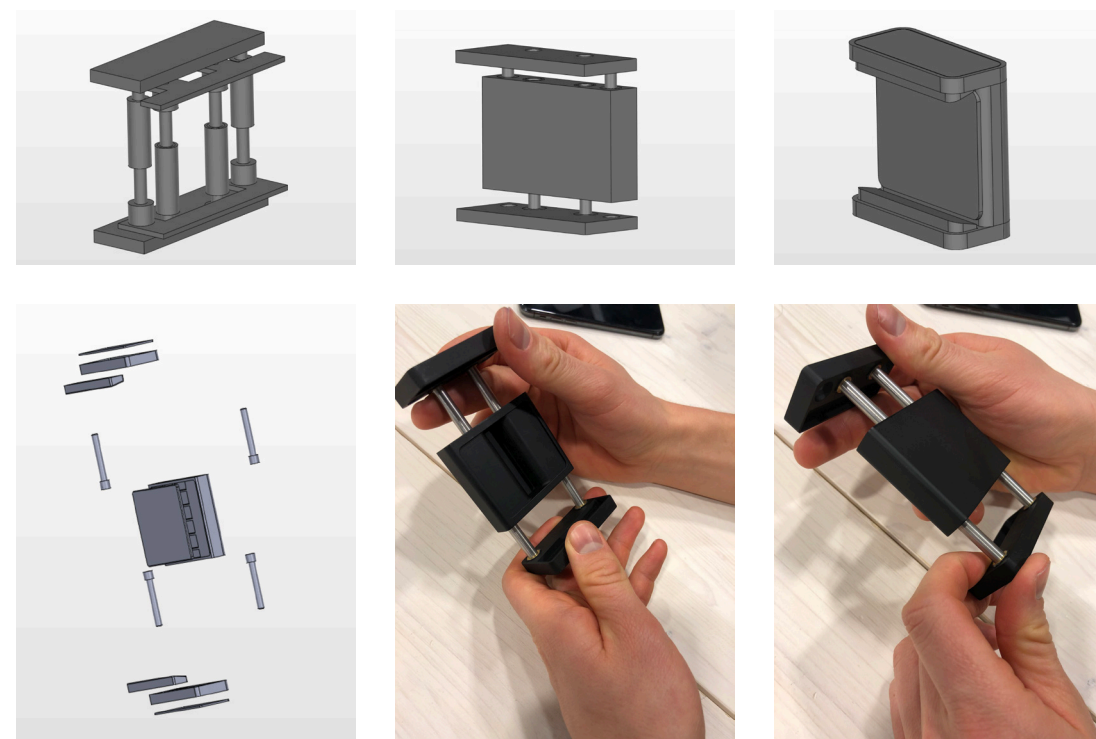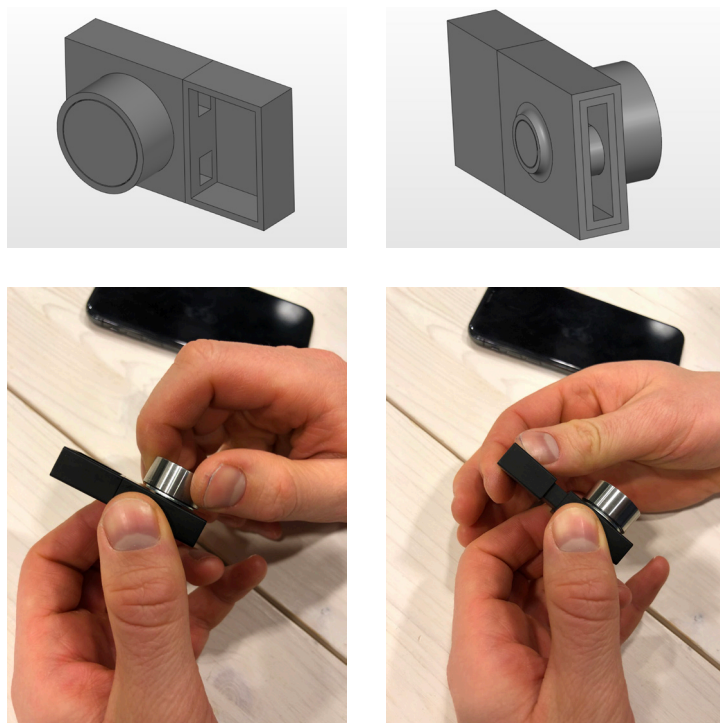
User test 1

The purpose of the first user test was to find a rough direction for the shape of the grip and evaluate various quick-release concepts for the grip. I also wanted to investigate how the portrait mode feature of FlowMotion ONE would compare to the one in DJI Osmo Mobile 2, and how to improve this feature.

Discovery questions

- Which detachable concept do users prefer?
- Which grip shape do users prefer?
- Which portrait solution do users prefer?
- What are the pros and cons of the different grips, mounts and portrait solutions?

Usability questions

- Can users discover the FlowMotion ONE portrait function?
- Do users understand this portrait function?
- Are users successfully able to detach the grips?
- Are the detachable concepts easy to use?
- Can users comfortably hold the various grip shapes?
- Is the size of the grips too small or large?

Tasks and prototypes

1. Pick up and feel twelve different grip shapes
   a. Nine foam models
   b. DJI Osmo Mobile
   c. Zhiyun Smooth Q
   d. FlowMotion ONE
2. Detach the grip from five different mount concepts
   a. Tripod mount
   b. Bike clamp
   c. Threaded hose
   d. Camera lens
   e. FlowMotion ONE
3. Set the gimbal to portrait orientation
   a. FlowMotion ONE
   b. DJI Osmo Mobile 2

ITERATION 1

User test 1
Findings

Grip shapes

The participants were presented with the grips lying in a row on the workshop table. I invited them to pick them up and tell me what they thought about them, what they thought they were for, and why. Although the users quickly realized we were dealing with some sort of grips, I intentionally left this out of the introduction to get more candid responses. A result of this was how some of the users would pick up the grips and hold them in ways we had not thought of or intended. This was a valuable lesson in how people read and interpret form.

We discovered that a consistent diameter of 38 mm or larger was too big. Participants preferred the grips that were tapered towards the bottom end. Of all the shapes, the 36 mm squircle and the FlowMotion ONE performed best. Users also liked the grips that featured a finger groove and cut-out for the console, although they felt the positioning was a bit off.

User test 1
Findings

Detachable concepts

For this task, people were only told that it was possible to detach the grip from the prototypes. The threaded hose came worst out of the five as no users were able to detach the grip at first try. The tripod mount was recognized by the participants and was easy to detach and attach. However, users did not feel safe using it and feared they might drop the gimbal and their phones. Operating the bike clamp was pretty straightforward, but users said it did not feel high-end. They also thought it was supposed to be rotated instead of pulled after releasing the lever arm. The FlowMotion ONE performed quite well, but users pointed out that the threads were sharp. This was expected. When attaching the grip, participants spent time trying to find the entry point of the threads. The camera lens concept was also easy to use, but participants felt that it popped out too easily and that there was too little friction and feedback when operating it. All users wanted a larger surface on the gimbal part to hold onto when detaching the grips. This was mentioned for all of the concepts.
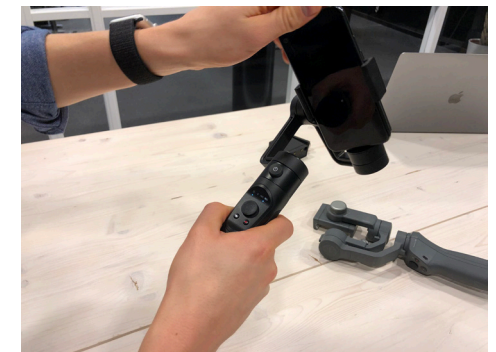
User test 1
Findings

Portrait mode

For the portrait mode, users spent a long time figuring out how to use both the FlowMotion ONE and the DJI Osmo Mobile 2. The main difference was that users thought the primer was easy to use after they had done it once. Participants thought the Osmo Mobile 2 was cumbersome and slow to operate even after knowing how to work it.

User test 1
Conclusions and next actions

Grip shapes

- Make new grips with tapered shape
- Diameter should be around 36 mm at the middle of the grip
- Cross-sections should range from almost circular to rounded square
- Make new models with and without the finger groove
- Adjust the position of console and groove

Detachable concepts

- Discontinue threaded hose and FlowMotion ONE
- Improve the camera lens concept
    - More feedback that it is secured or loosened
    - Make it possible to only insert the grip one way
    - Swap position of male part and female part
    - Add more friction when tightening
    - Add surface texture for better grip when rotating
    - Add an indicator for the rotation, e.g. a dot
- Make a new detachable concept based on the tripod mount and the bike clamp
    - Make the socket deeper to prevent gimbal from popping out
    - Make a slide-to-insert socket design

Portrait mode

- Discontinue knob or other mechanical concepts
- The FlowMotion ONE concept is not enough alone
- Test if people prefer to click a button to toggle portrait mode

Iteration 2

Slow but steady
wins the race

For the second iteration, I continued to
focus on improving the parts and features
I tested in the first user test. Because it
was still early in the development phase,
and the first prototypes were very rough,
I decided it was better to not add other
features and more complexity at this point.

Making more grips

Back in the workshop, I made six new grip shapes based on the feedback received during the first round of user testing. This time I used a slightly denser foam to allow more precision with the designs. The grips had cross-sections based on a squircle, with varying degree of roundedness. I used two variations of taper, one from 38–32 mm and one from 38–30 mm. Four of the grips had a groove for the index finger while two had not. To give them a uniform appearance and to have plastic-like texture, I covered the grips with a few layers of spray paint.
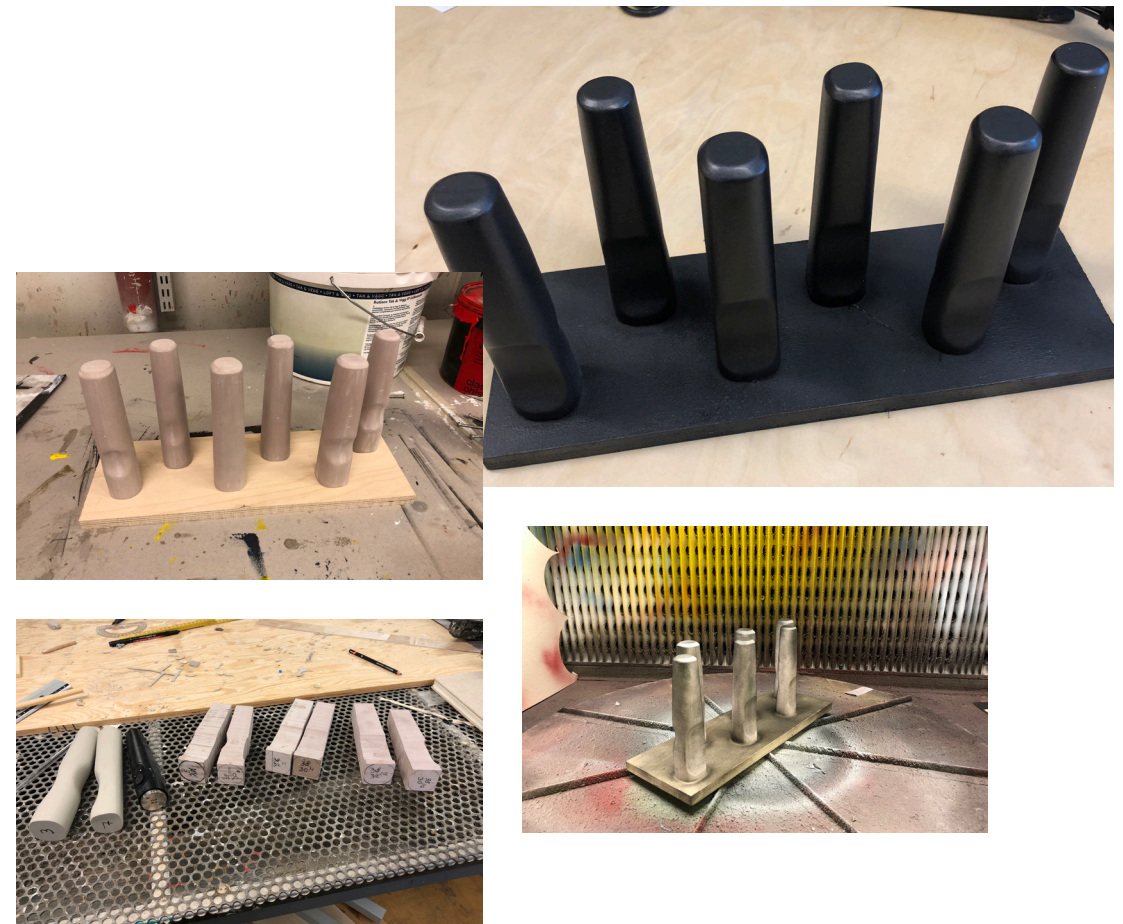
Improved detachable concepts

Improved versions of the camera lens concept and the tripod concept were made using SolidWorks, building on the previous models. In addition to the actions decided in user test 1, a ball pin was added for better audible feedback in the tripod mount v2, and the release lever was redesigned to be less protruding. Adding to the above-mentioned points for improvement, the camera lens v2 got two guide pins for easier attachment.
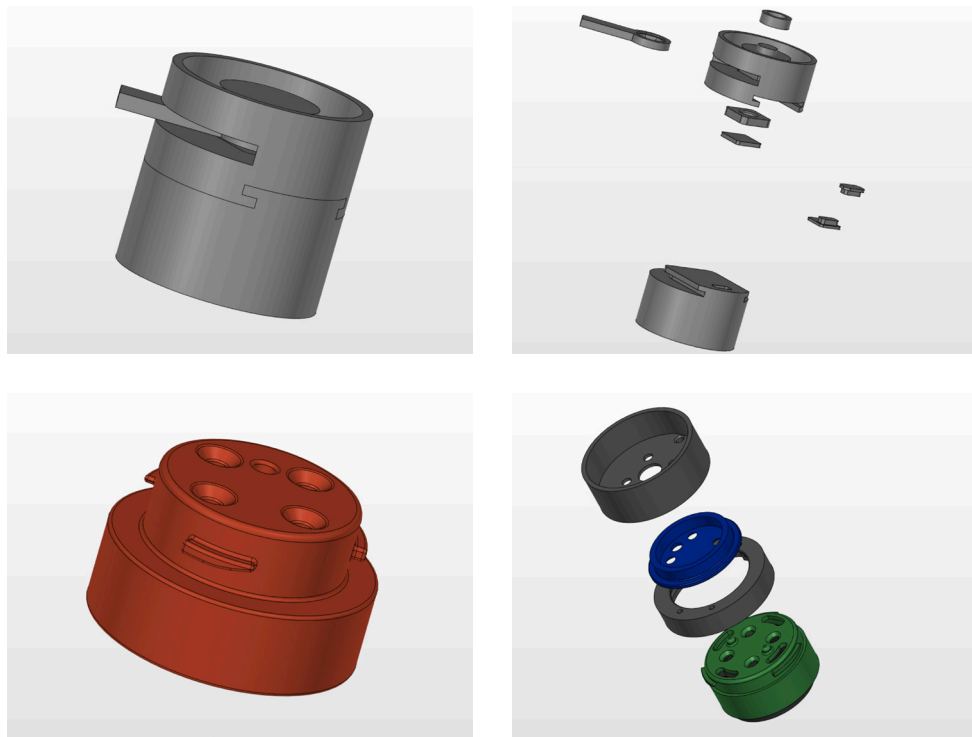

Bootstrap portrait button

The quickest way to get a working prototype with a portrait mode button was simply to rework a FlowMotion ONE stabilizer. I got Matias, FlowMotion's lead engineer, to reprogram a spare unit for me so that the record button was now controlling the phone's orientation. I also quickly brushed up on the appearance of the button to signify its function, adding a couple of arrows to indicate rotation.

Clamp v2 and balancing screw v2

We did another iteration on the clamp and the roll frame in SolidWorks. This time also, it was mainly for mechanical verification and testing in-house.

The claws of the clamp were a bit hard to grip and internal springs were too stiff. The knob on the roll frame was quite easy to turn. The 15 mm diameter felt comfortable to grab. For the next iteration, the knob should be placed on the outside of the frame to make it more accessible.
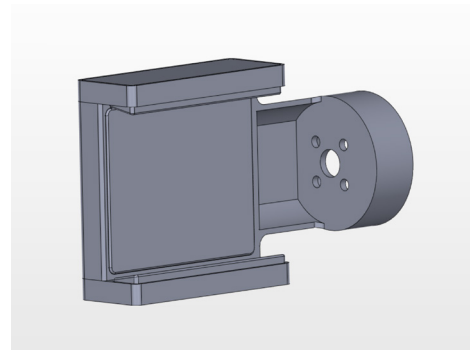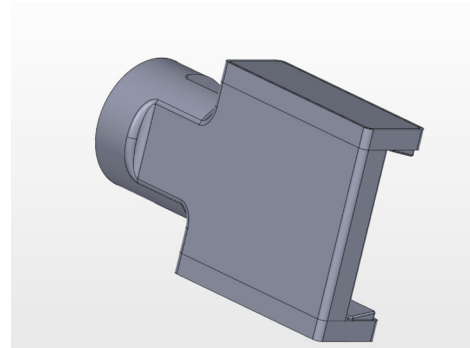
User test 2

6 participants

60 minutes each

The second test was all about evaluating the improved proto-types and solutions since the first iteration. I hoped to settle which detachable concept would be best to develop further and figure out if the new implementation of the portrait toggle was any good.

Discovery questions

- Which detachable concept do users prefer?
- Do users feel safe about using the concepts with their phones?
- Which grip shape do users prefer?
- How does the tapered form feel? And the finger groove?
- Can users discover the portrait button?
- Do users think the portrait button is supe-rior to the other solutions?

Usability questions

- Do users understand the portrait button and its symbol?
- Are users successfully able to detach the grips?
- Are the detachable concepts easy to use?
- Can users comfortably hold the various grip shapes?
- How is the size of the grips?

Tasks and prototypes

1. Pick up and feel six different grip shapes
2. Detach the grip from two different mount concepts
    a. Tripod mount v2
    b. Camera lens v2
3. Set the reprogrammed FlowMotion ONE to portrait orientation

User test 2
Findings

Grip shapes

The two grips without a finger groove performed worst consistently throughout the test. Among the four with grooves, participants thought the ones that were more rounded were more elegant and comfortable to hold. The slightly squarer ones felt more secure in the hand due to the flat sides of the grip. The 38–32 mm taper performed better than 38–30 mm. Participants preferred the finger grooves that were slightly deeper than the rest. The groove that had well-defined edges in the back and front and a seamless transition to the grip's cross-section on the sides was said to be more comfortable and secure. The length of the grips was too short, with the bottom end stopping just inside the users' palm, which cause discomfort to some.

«The ones with flat sides feel more secure in my hand»
— Marius O.

User test 2
Findings

Detachable concepts

Although system feedback was improved from the first iteration, both of the prototypes in the second test were still lacking in this area according to the users. The testers especially wanted more distinct tactile and audible feedback when the systems were locked or unlocked.

For the camera lens v2, users would like to have more clear indicators for aligning the grip and the gimbal when attaching the two. The camera lens v2 scored marginally better on safety, but it was mentioned that it should have had a release button. It was also said to be the more aesthetically appealing of the two.

The tripod mount v2 was more recognizable and seemed faster to operate, which was in part because of the clear lock symbols. However, several users expressed their concern about the protruding release lever, fearing that it might accidentally get unlocked.

User test 2
Findings

Portrait mode

This feature was more or less a breeze to test. All participants discovered and understood the concept fairly quick. They preferred using a button to toggle between landscape and portrait orientation, stating it felt more precise. That it can be done one-handedly was also a bonus. However, users would still like to be able to change the orientation by moving the gimbal by hand.

User test 2
Conclusions and next actions

Grip shapes

- Improve finger groove based on test results
    - Make the cut smoother and align it with the natural position of the index finger when wrapped around the grip
    - Make the groove narrower, measured from back to front
- Continue with a taper of 38–32 mm
- Cross-section should be a fairly rounded squircle
- Add about 5 mm to grip length

Detachable concepts

- Neither concept is a clear winner, and both will have to be improved for further testing
- Improve audible and tactile feedback
- Camera lens v2
    - Make insertion smoother — use chamfered mount threads?
    - Use clear symbols
    - Make one version with release button and one without
- Tripod mount v2
    - Make release lever more integrated, i.e. less exposed
    - Make the male connector tapered for easier operation

Portrait mode

- Include the portrait function in the new stabilizer's button interface
- Also include the current solution used in FlowMotion ONE

Iteration 3
Two steps forward,
one step back

In the third iteration, further work was done on the grip shape and the quick-release mounts for the grip. Good progress was made with the latter, but I also ran into some issues that brought the development to a halt. While the previous iterations of the clamp had a mechanical focus, this time, I started looking closer at the composition and aesthetics of the part.

Another iteration of grips

At this point the grip design was becoming so specific that we had to do it digitally in SolidWorks. Crafting it by hand in the workshop simply would not be precise enough.

Around this time, FlowMotion started a dialogue with various suppliers of gimbal motors for the new stabilizer. The discussions indicated that the grip would have to be about 40 mm wide in the top end to accommodate the motors. We were already going to make one design with a 38–32 mm taper. Based on this new information, I decided to make three additional variations; 40–32 mm, 40–31 mm, and 40–30 mm. All four grips had the same length, cross-section shape, console cut, and finger groove.

Based on the previous user feedback, I also worked on smoothening the transition of the finger groove, making it more gradual.
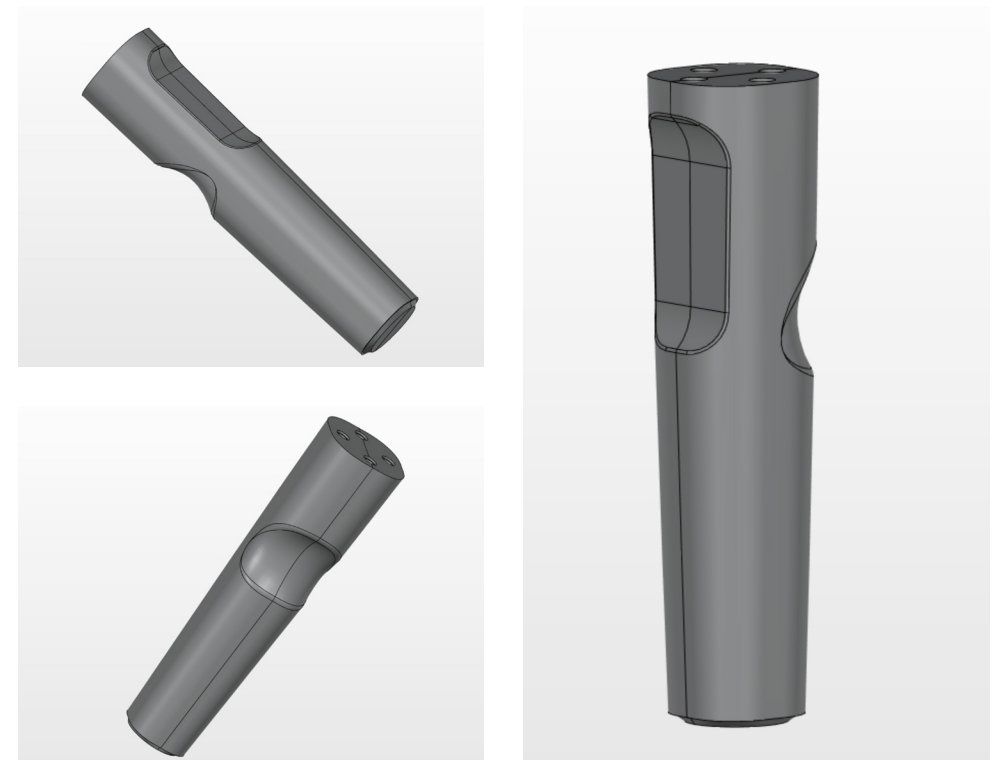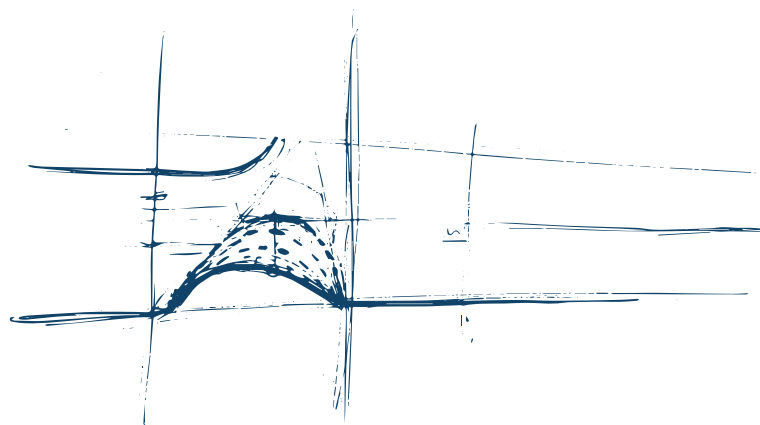
Clamp v3

Working on the clamp, I started with rough sketches to quickly evaluate ideas and design variations. The boundaries I had to work with was the pitch frame motor housing that would be about 38 mm in diameter and the actual clamp mechanism that would sit perpendicular to the motor housing.

The mechanics of the motor housing and the clamp require quite different geometry, which made the job of fusing together these parts an interesting challenge in composition. Portability was also a concern. The clamp had to be able to expand enough to hold plus-sized phones, but it should also be as compact as possible when collapsed.

First, I explored a few very compact concepts. Due required size of internal components, these were quickly deemed impossible to make by the FlowMotion team, and so I discarded them. After some more sketching, I selected one concept that seemed feasible, which was later modeled in SolidWorks and prototyped.

Initially, I intended to test the clamp in the third user test but decided not to because the prototype had too stiff springs and the clamp was too hard to open. Instead, I opted for reviewing just its appearance with the users. This was not really a major setback to me as the clamp is a fairly simple mechanism compared to the new detachable grip concepts, and FlowMotion had already experience with making clamps for the FlowMotion ONE. Besides, I had yet to start exploring other options for the phone mount.

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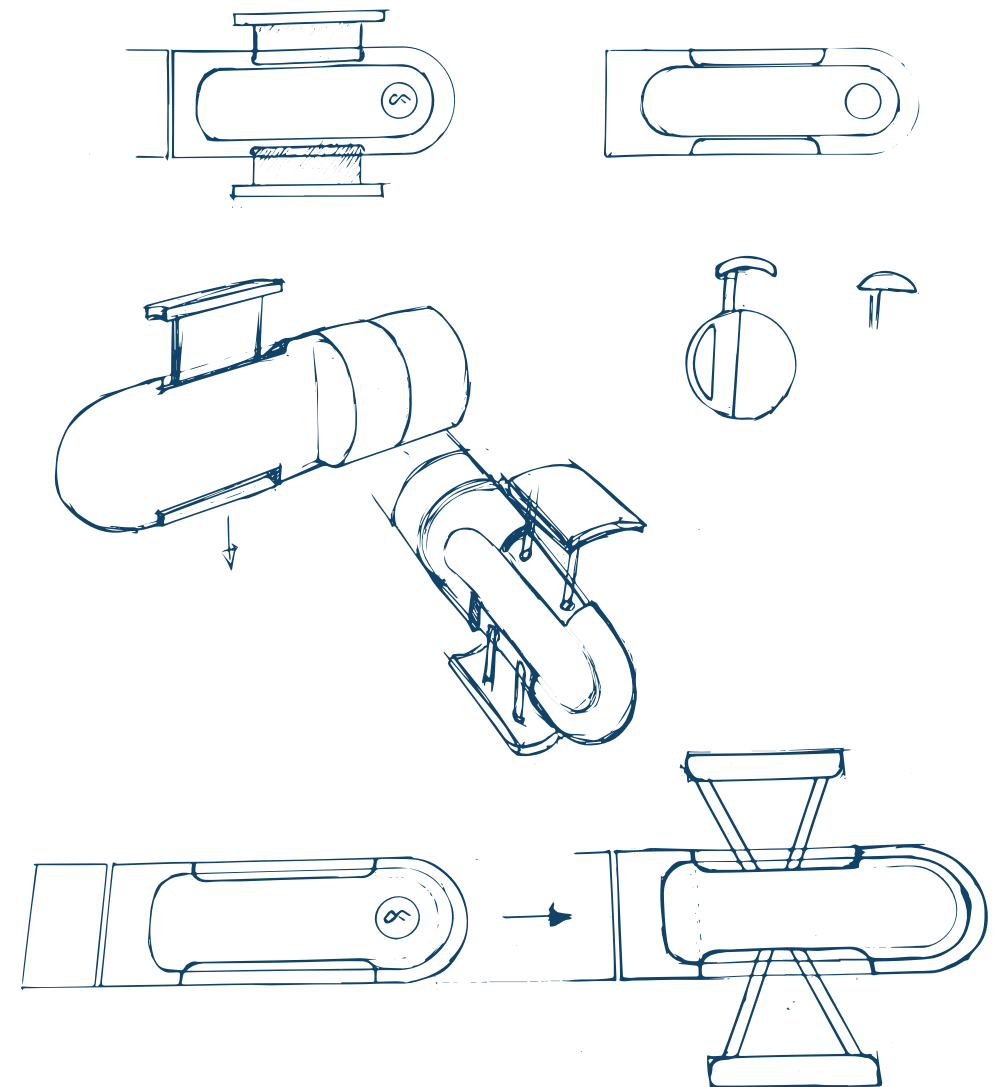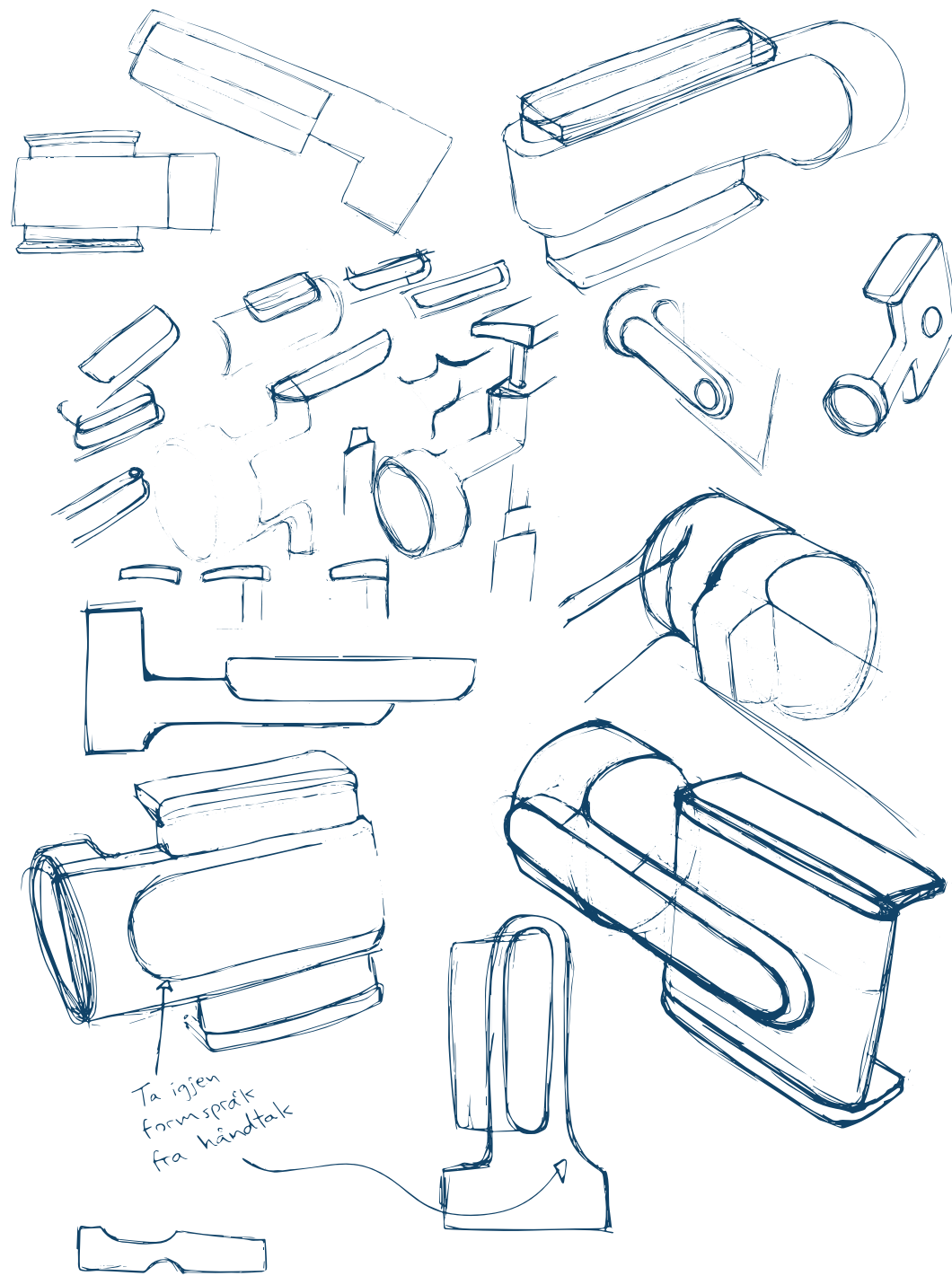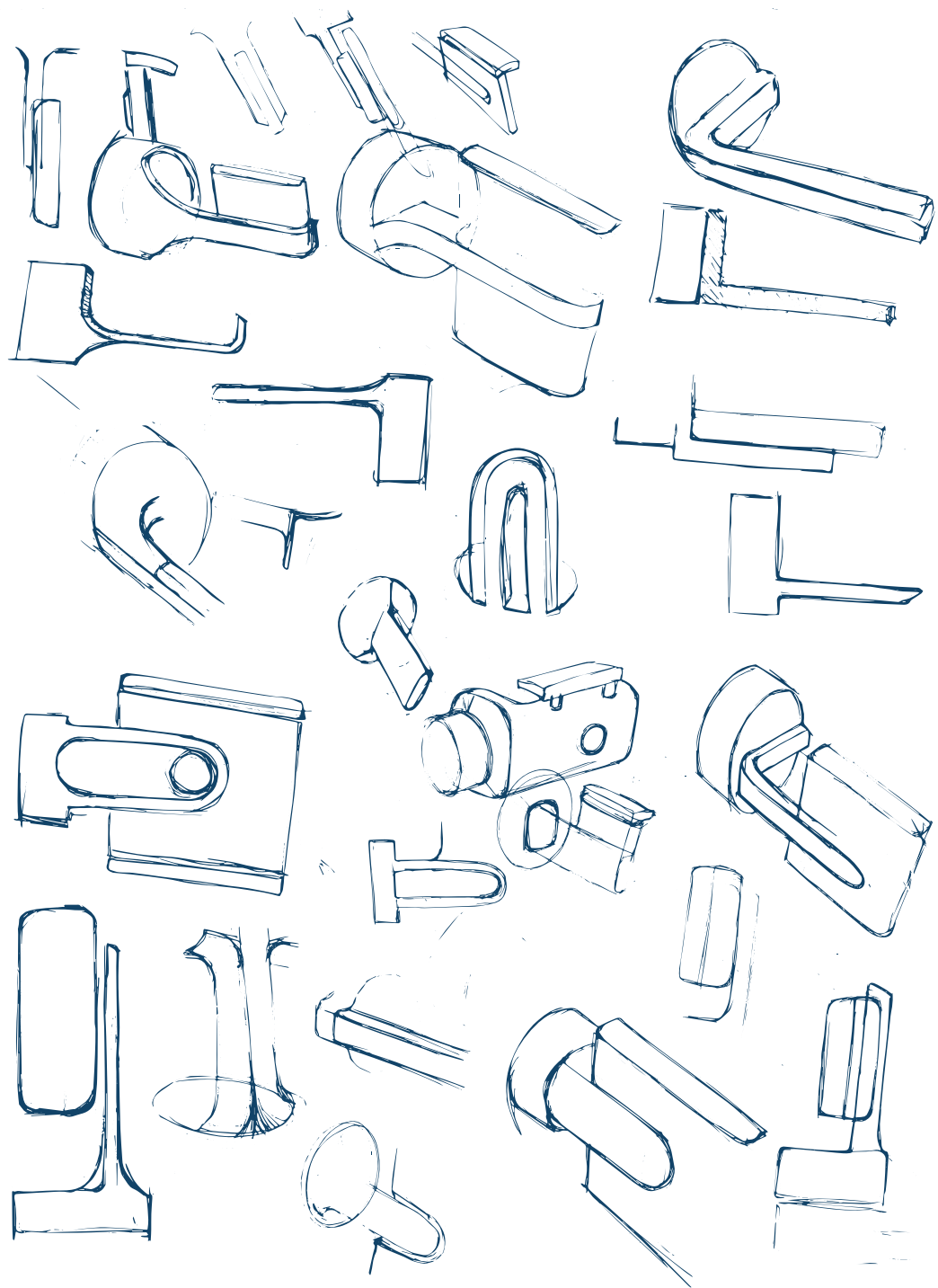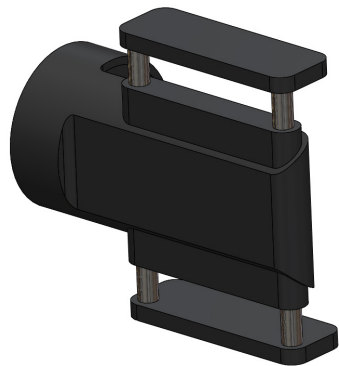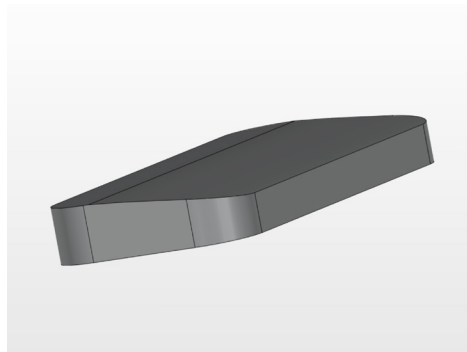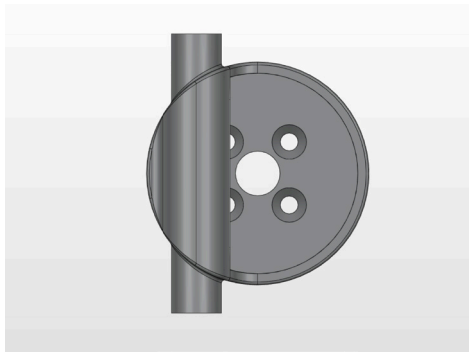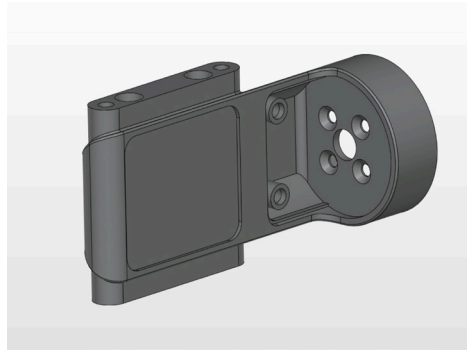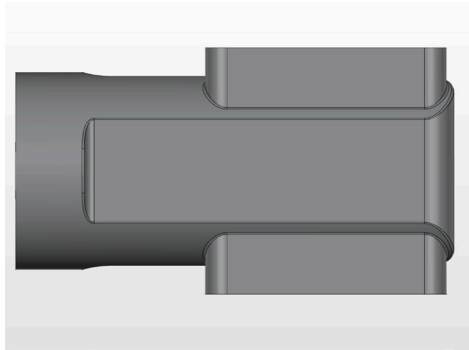
Frame design

The frames need to have a hollow cross-section that is large enough for the wires and sensors running through them. In the pre-project, various simulations were done to define the mechanical requirements for the frame design with regards to forces such as bending, torsion, and compression. Based on this foundation, I went ahead to sketch concepts that were in line with the requirements. From this, five variations were modeled in SolidWorks and prototyped to be evaluated in the upcoming user test.
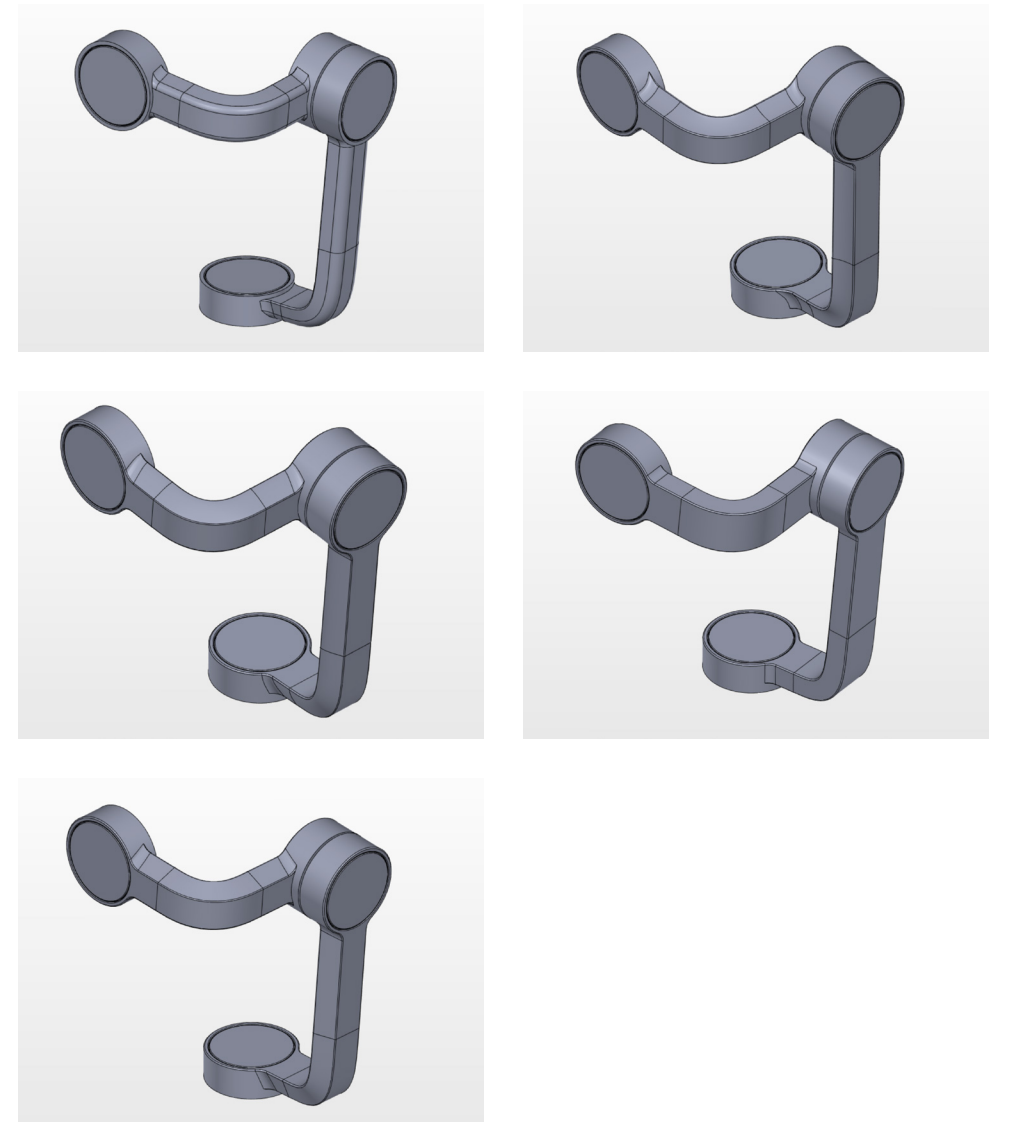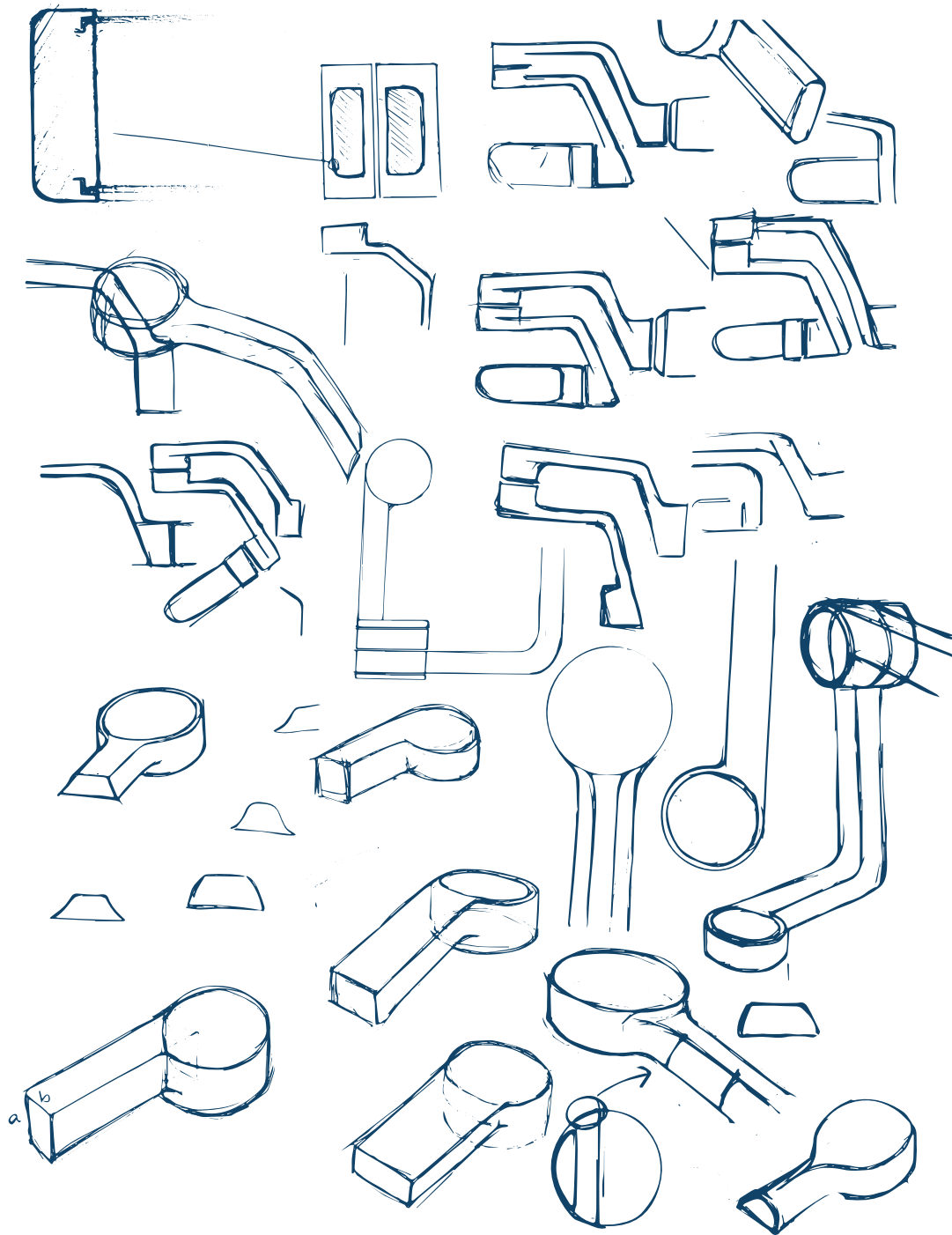
Balancing screw v3

Except relocating the knob to the outside of the frame, little was changed from the second iteration. It was now ready for user testing and evaluation.
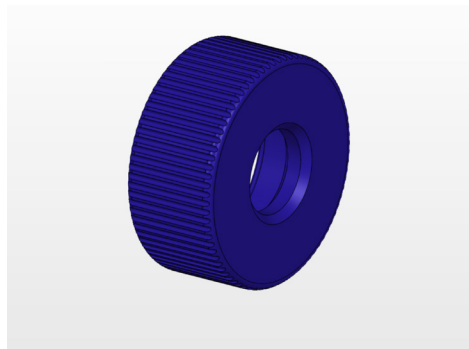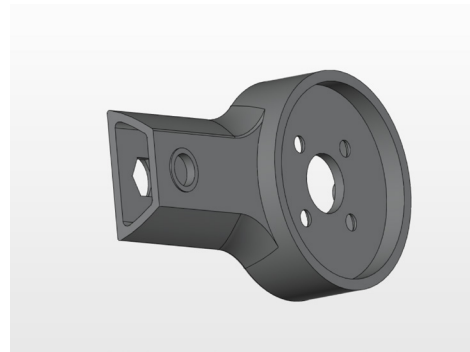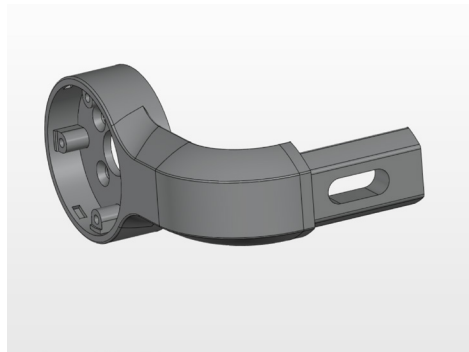
Failed detachable concepts

Although the results from the previous user test were not conclusive, I was confident that the third iteration would produce a winner. Substantial improvements were made to both of the concepts.

For the tripod mount v3, two mechanical variations were made. Externally, they were more or less the same, apart from the release levers. Internally, the way the mounts would tighten and lock was different. One had a fairly simple construction, with a lever rotating around a fastener joint. The other was slightly more complex, where the rotation of the lever would move a small wedge that was responsible for locking the mount. Both release levers were made more integrated to avoid unintended opening of the mounts.

In the camera lens v3, a spring-loaded brass pin and a release button were added to the design to make it more secure. The brass pin would also provide better tactile and audible feedback. The mount threads were slightly tapered to improve insertion and removal.
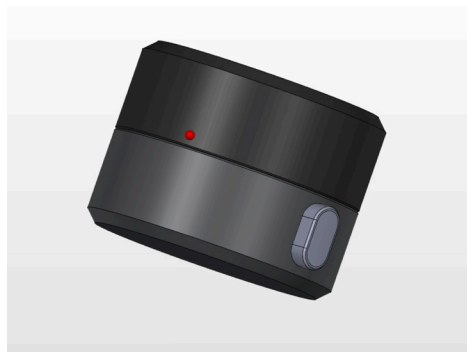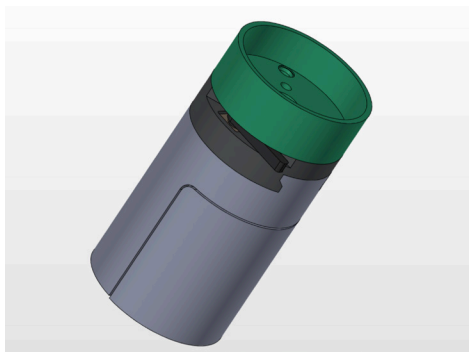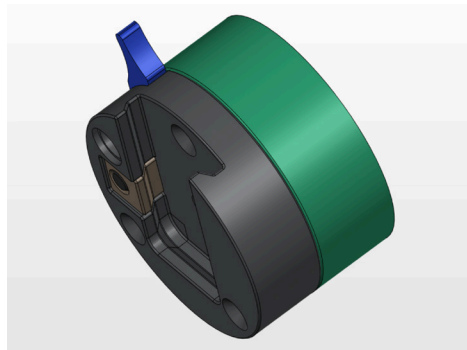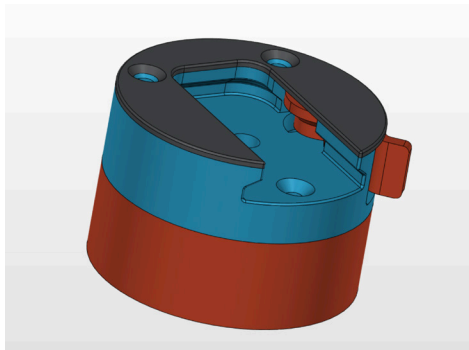
Unfortunately, upon assembling the new prototypes, the parts did not fit properly. Tolerances were too tight, and the plastic proved to be too brittle. As a result, the prototypes either broke or did not function. Since the third user test was just around the corner, and there was not enough time to produce new prototypes, the detachable concepts were omitted from the test.

For internal testing and review, a quick and dirty 3D print was made of the new camera lens solution. Although it was not good enough for testing with users, it was a proof of concept.

User test 3

Due to the above-mentioned issues with the prototypes, the third user test was not as comprehensive as planned, with the main setback being the improved detachable grip solutions. However, the test still proved useful, and I got valuable feedback on the prototypes and designs I presented to the users; grips, frames, clamp, and the balancing screw.

Discovery questions

• Which grip shape do users prefer?
• Which frame design do users prefer?
• What do users think about the clamp design?
• What do users think about the balancing screw?

Usability questions

• Can users comfortably hold the different grip sizes?
• How is the shape of the grips (cross-section)?
• Is the length of the grips sufficient?
• Is the new finger groove comfortable? What about placement?
• Are users able to adjust the roll frame length? Is it intuitive?

Tasks and prototypes

1. Pick up and feel four different grip shapes
2. Evaluate five different frame designs and the clamp
3. Adjust the length of the roll frame

User test 3
Findings

Gimbal balance

The set screw seemed to work fine for all participants, and they did not need much time to understand the solution. The users thought it to be a robust solution and felt that the size of the knob was good. One of the users commented that it should be this size or even bigger. However, the same participant also wanted the set screw to be more integrated into the roll frame because the feature is not used very often.

ITERATION 3

User test 3
Findings

Grip shapes

Of all the grips, the one with a 40–30 mm taper performed best, with the 40–31 taper coming second. This was perhaps a bit unexpected, but also a relieve considering the dimension of the new motors. The general shape of the grip and the length seemed to fit better with all users this time. Several stated the grips felt secure in their hand.

Users felt the finger groove could be shallower and more rounded. One user suggested having an asymmetric indent, but this would result in a design favoring either left-handed or right-handed people. It was also suggested that the finger groove, or the underside of the grip, had some kind of rubberized texture to it so it would be more grippy and secure. The placement of the groove seemed to be good. Further, one of the participants felt that the groove made it easier for him to alternate his grip, confirming the findings from the previous user test.

«The finger indent allows me to adjust my grip more easily»
— Klaus K.

User test 3
Findings

Frames and clamp appearance

First, the participants were presented with just the five different frame designs. All of the designs received fairly good feedback, except the rounded one and the concave, which were seen as cheap and tacky. The three other designs were frequently described as clean, simple, and elegant. No clear favorite appeared among these three, but the plain rectangular shape performed marginally better than the convex and the straight chamfered. Regardless of the frame design, participants said they would have preferred a smoother transition between the frame and the motor housing.

When comparing the frames together with the clamp and the grip, the convex frame design marked itself as the clear favorite among all of the users. The participants did not share that much when evaluating the clamp alone, but they all said it looked good. One user commented that he wanted it look more similar to the grip design.

For these prototypes, a PPS plastic was used. All the participants thought the material felt premium and durable. One participant thought the prototypes were all metal even and not plastic.

«This feels nice — is it made from metal?»
— Eirik S.

This was the most preferred design

User test 3
Conclusions and next actions

Grip shapes

- Continue with the 40–30 mm taper
- Make the finger groove more shallow
- Make lateral transition smoother
- Try different shapes for the finger groove
- Test with rubber in finger groove and on grip underside

Frames and clamp appearance

- Continue with the convex frame design
- Make the trasition from frame to motor housing smoother
- Try to make more visual connections between clamp and grip
- Users think the PPS plastic is high-quality

Gimbal balance

- Make knob more integrated
- Test with a smaller knob diameter to see how users respond
- If possible, lower the knob into the roll frame
- Make knob slimmer
- Improve the turning; make it smoother

Iteration 4

Back on track

In the fourth iteration, I begin exploring an alternative solution for the phone mount. The grip design is becoming more refined, and the detachable solutions are finally back on track. I also focus on the button interface for the grip.

Adding weight to the grip
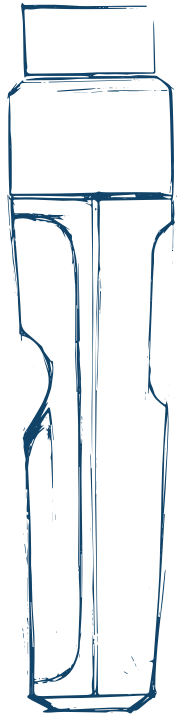
Continuing the dialogue with component suppliers, FlowMotion concluded that the grip would have to be 41 mm in the top end. Before implementing the change, I compared the difference in thickness around the middle of the grip with the 40–30 mm taper, which proved to be negligible.

The finger groove was made more shallow and smoother. Building on this, three variations of the groove shape was made. I later refer to these as slot, ellipse, and bean. For each groove design, a similar rubber pad was made. In addition, a grip with the entire underside covered in rubber was made.

By now the general design of the grip was more or less set. To fine-tune the geometry, I needed the grips to feel more realistic in the next test. Therefore, a weight was made for each grip. The weight was attached at the top end of the grip and simulated roughly the same moment as a gimbal with a phone mounted in it would.

As a little test to see if I still was on the right track with the new grip design, a grip similar to the DJI Osmo Mobile 2 was modeled and prototyped. This would be tested against the four other grips in the fourth user test.
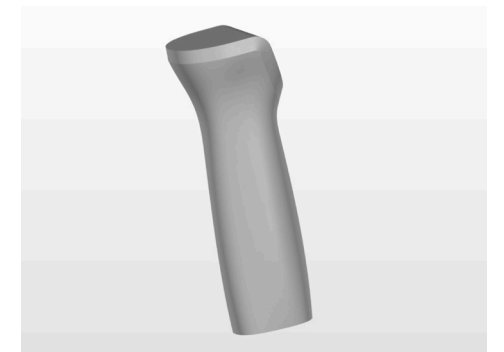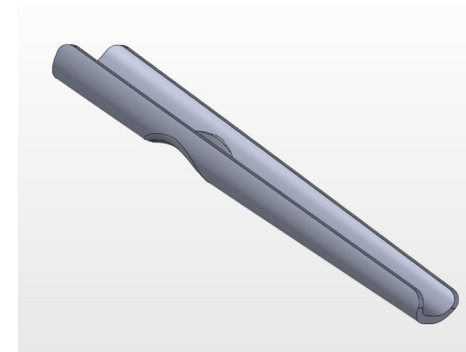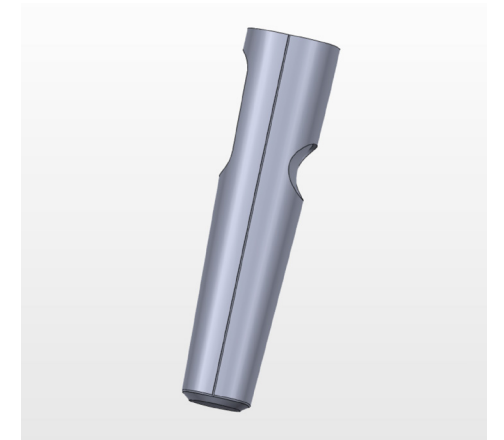
Redoing the detachable grips

Learning from the shortcomings of the previous iteration, new prototypes were modeled with better tolerances and made in a stronger plastic. Three solutions were made; tripod mount v4, camera lens v4, and camera lens v4.5. The two latter are fairly similar and are built on the same principles. The difference is that camera lens v4 does not have a release button while the v4.5 has.

The lever arm of the new tripod mount was now even better integrated compared to the previous versions. To indicate opening and closing of the mount, lock and unlock symbols were printed on each side of the lever. For the camera lens v4, I used a set of three white circles to indicate operation. A combination of an unlock symbol and colored dots were used for the camera lens mount with release button. The symbols are more visible in the photos of the fourth user test than in the CAD images here.
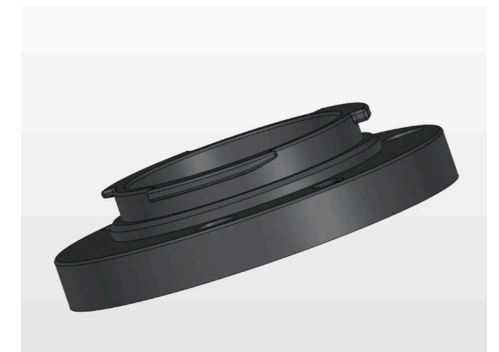
Improved frames

Continuing with the convex shape, the curvature between the frames and the motor housings was smoothened.

I also got the idea of adding a lip and groove between the pairs of motor housings. Instead of having a gap there, leaving the interior exposed, the lip would help keep dust and debris out. It might also make the product slightly more water-resistant.

Lip between motor housings to keep dust out
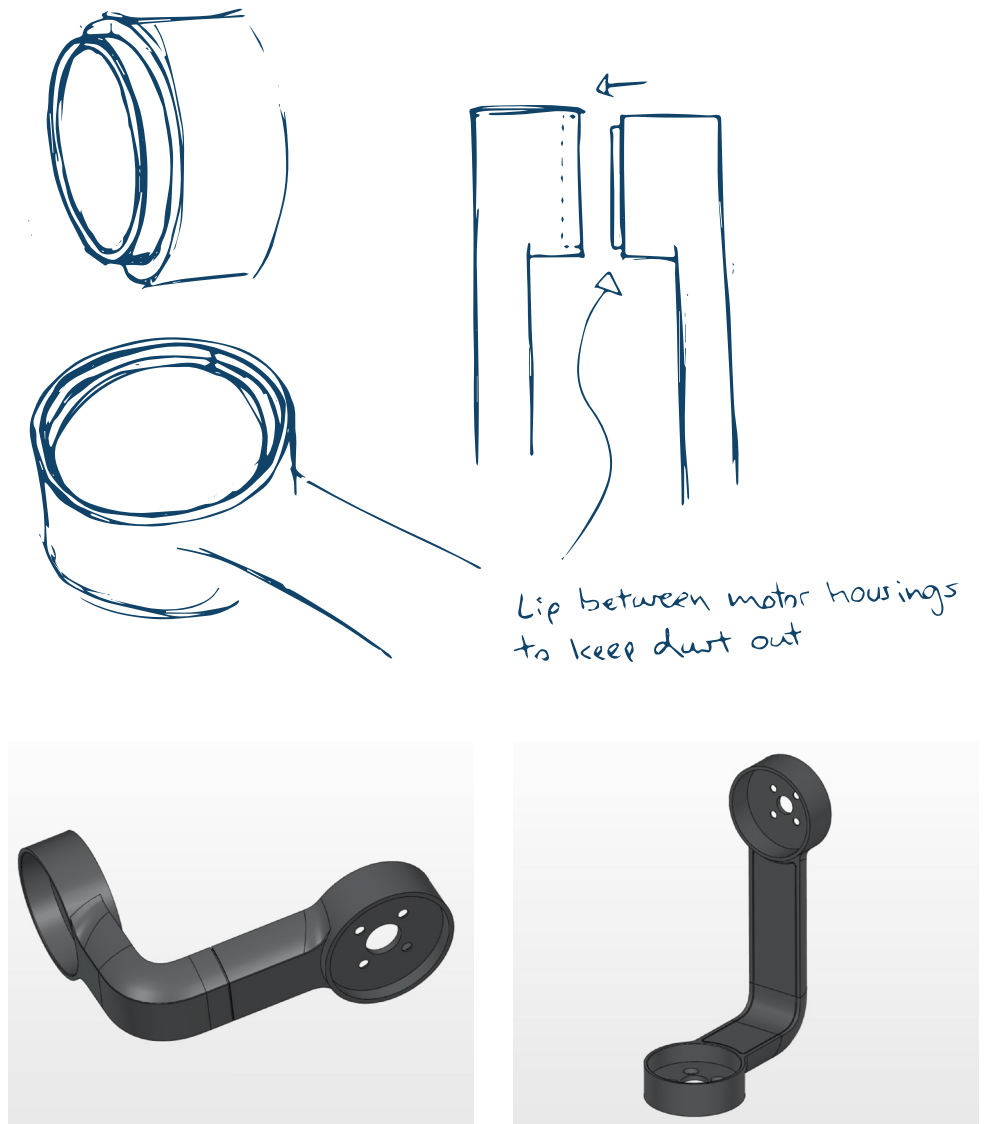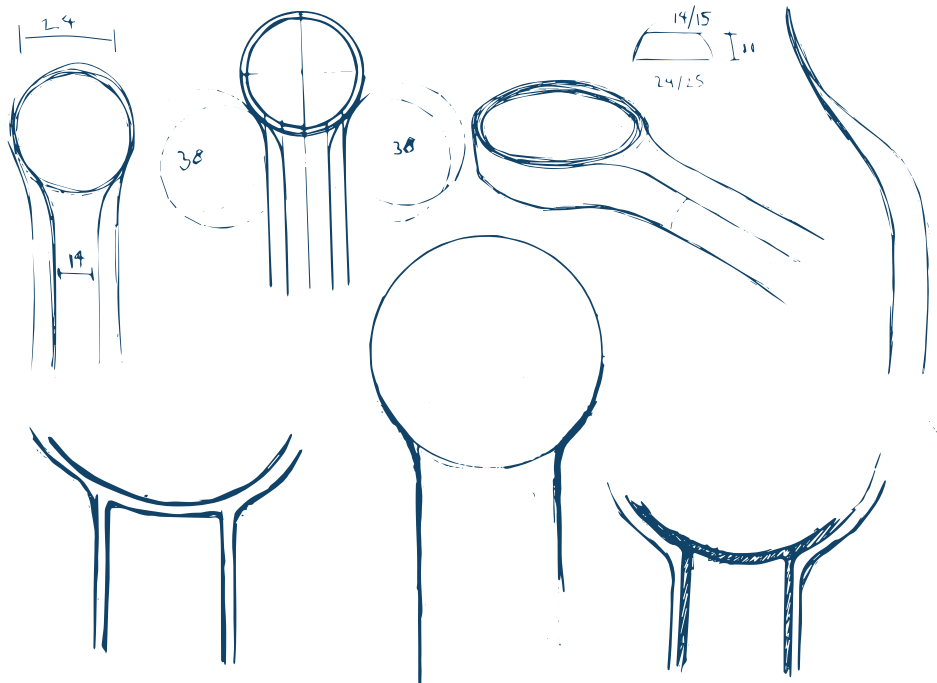
Smaller roll frame knob

The gimbal balance is not something users will need to adjust very often. On that premise, and from the last test's feedback, I wanted to reduce the size of the knob to see how it would fare. I reduced the diameter by 3 mm down to 12 mm, and a small deboss was made in the roll frame so that the knob would be more integrated and thereby less obtrusive.

Clamp mount v4

In the fourth version of the clamp, I added two indentations on the back to make it easier to pull the jaws of the clamp. I also made the jaws wider to keep the phone more secure as well as having more mass to grip and pull.

To make the clamp visually closer connected with the grip, I added more curvature to the jaws. I also thought the curvature and slightly closed shape visually reflected the function of the clamp. Playing with some detailing, I added a small logo decal on the back and tested a new variation of the rubber pad in front.

Once again, the springs turned out to be just a bit too stiff, and I decided to skip a full user test of it also this time. However, I would present it to users and let them evaluate it — just without inserting and removing a phone. Reviewing the clamp internally with the FlowMotion team proved the effectiveness of the indentations on the back.

A new phone mount
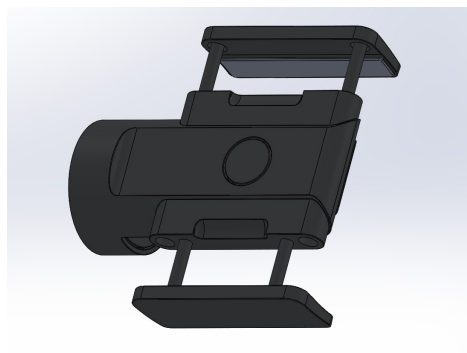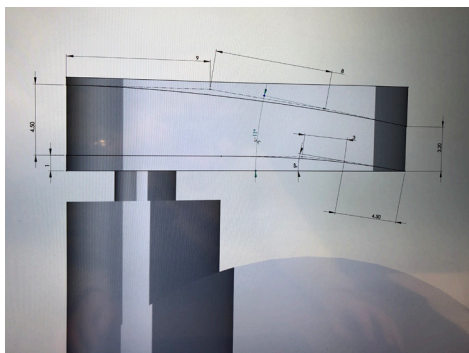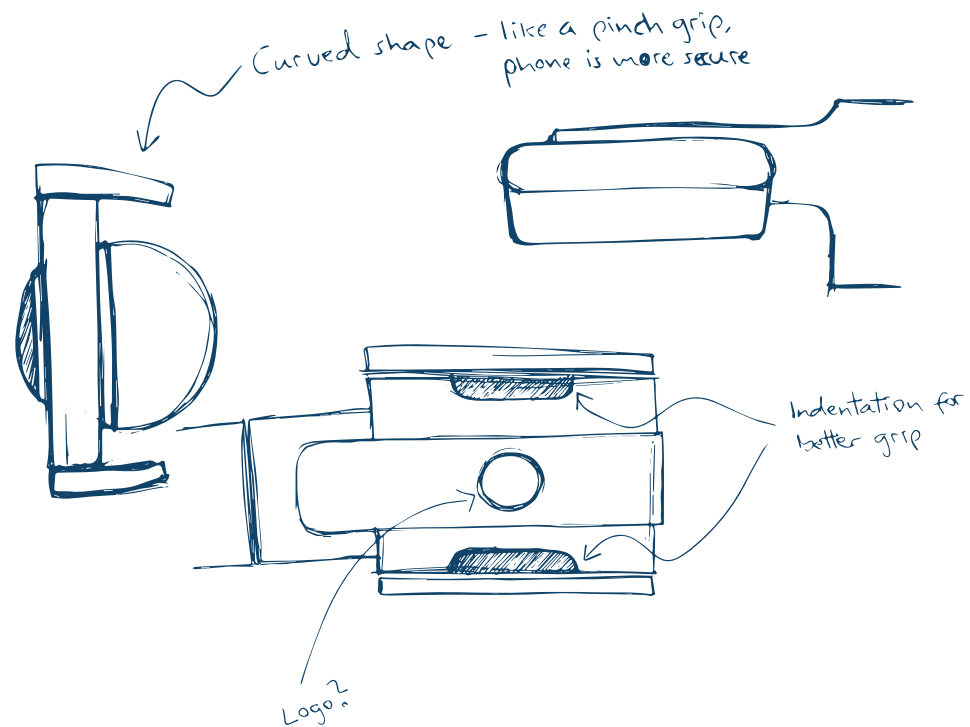
An alternative solution to a phone clamp is to design a phone case that would attach directly onto the pitch frame of the gimbal. I do not exactly remember whose idea it was or where it came from, but everyone in FlowMotion had been playing with the thought of it for a while at this point.

Starting off, I did some digging on phone cases. According to NPD, seventy-five percent of smartphone owners use a case. For iPhone users, the share is even higher at eighty-seven percent (n.d., 2013). I also sent out a short survey to the Kickstarter backers of FlowMotion ONE, asking them about smartphone accessories. As it turns out, seventy-one percent use a case for their phone. Now, this could be both good news and bad news. On one hand, it could mean users would not want to swap out their current case with a new one — unless it satisfies the same needs and more. On the other hand, it could also mean users are very likely to adopt this solution.

To better evaluate the idea, I gathered the FlowMotion team to discuss the pros and cons and compared it with the clamp solution. As it had not been prototyped yet, this discussion was based on educated guesses.

Next, I sketched out a few ideas and mechanical concepts for the case mount. Then, a couple more were quickly modeled in SolidWorks. Some of the concepts looked promising, but time was short before the fourth user test. The clamp still needed to be fixed, and I figured it made more sense to wait and test the case mount and the clamp mount together in a later user test.

Case mount

Pros

- Slimmer and lighter
- Unique and innovative feature
- Faster to use
- High-end engineering
- Better balancing
- Opens up for new accessories
- More secure

Cons

- Takes time to include new phones
- Cannot make it for all phones
- User is forced to use the case
- Users might not want to change their case, or want a case at all
- More expensive than clamp
- The case might have to be bulky for it to work

Clamp mount

Pros

- Proven solution that works
- Inexpensive to produce
- Requires less development time
- Fits any phone
- Easy to adjust balance
- Works without a case
- All-in-one solution

Cons

- Difficult to use
- Might not feel as secure as a case mount
- Not unique or innovative
- Low-tech impression
- Expensive to repair
- Can easily feel cheap
- More "loose" parts
- Less compact gimbal
- More weight
- Not very elegant

"Pull claws"

Direkte
overføring
av kraft

Pad

Tap my utløser-
mekanisme for
"pull claws"

↗ Trekker
innover

↓ Knapp for
å skyve
utover

knapp

T-spor

spenn

Utløser
knapp

T-spor

1 I-bok

or

2 I-looks

T-slot

slots

fjær

RubberLid? How to
keep out dust and
debris?

Reversed
claw   Tapp

↕ spenn
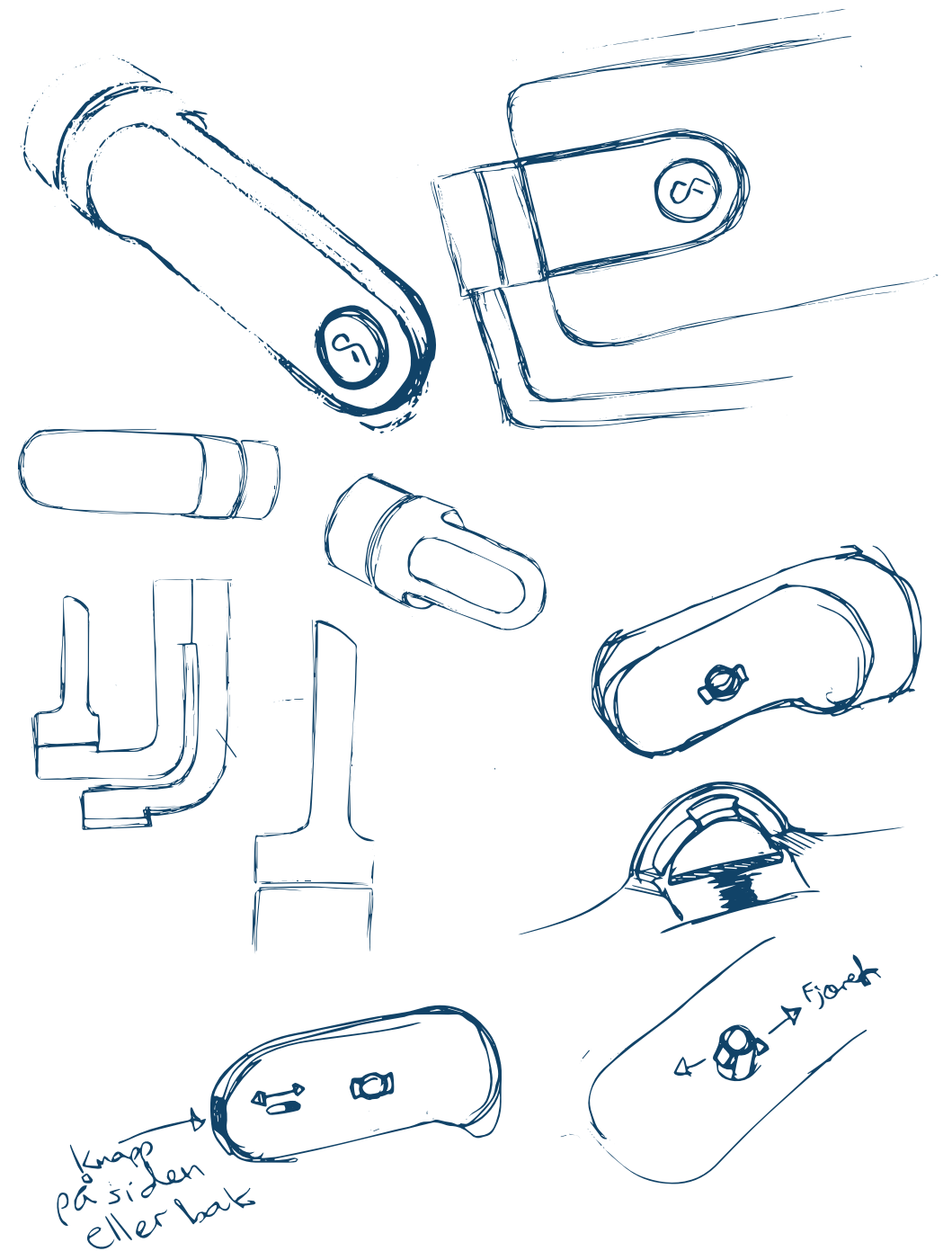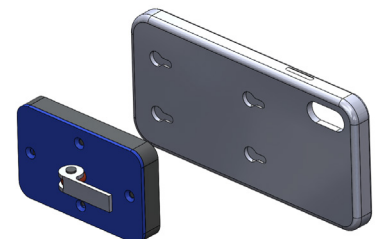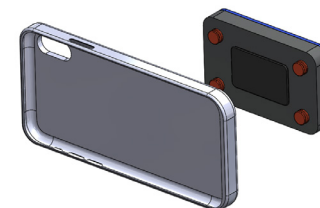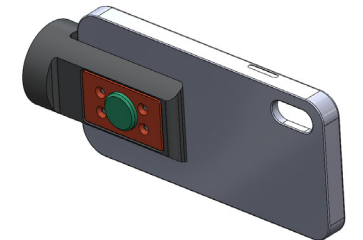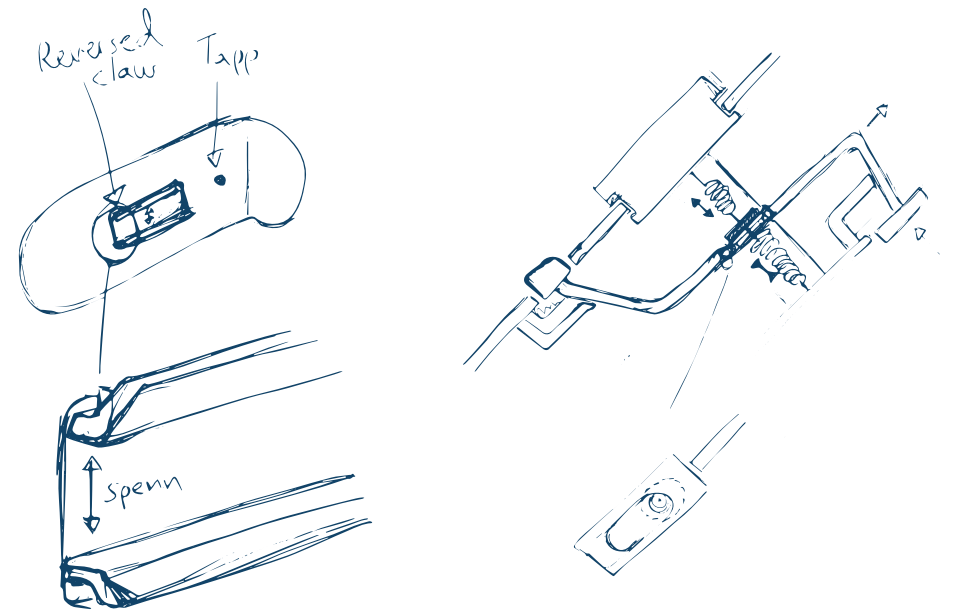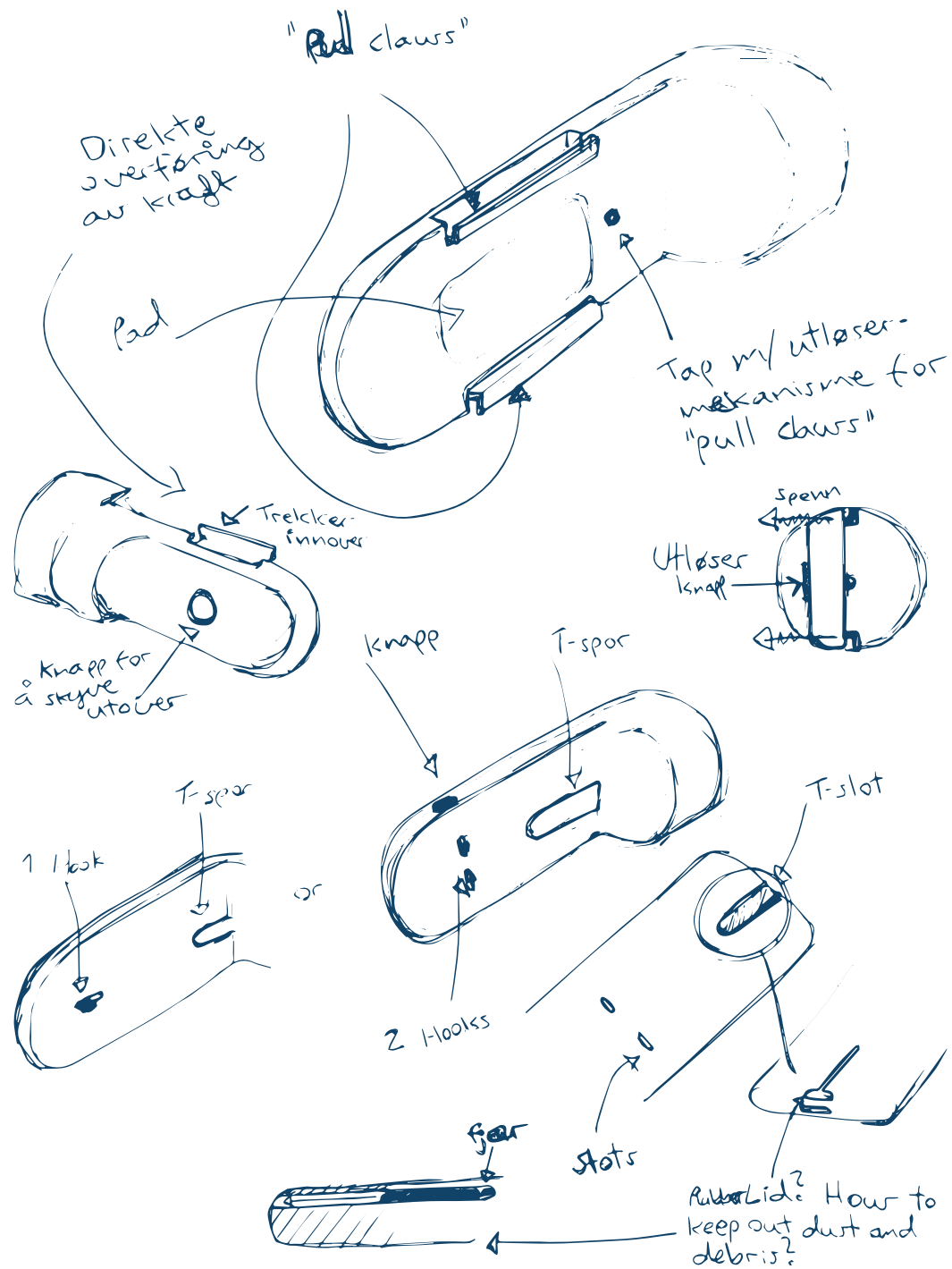
Interface workshop
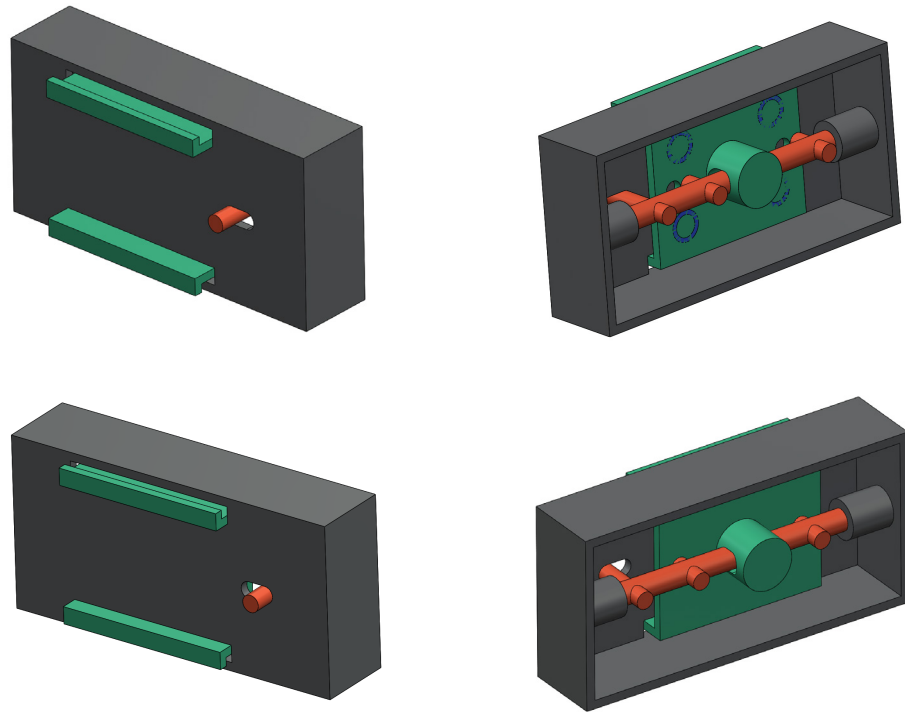
With the principal grip design in place, it was time to look closer at the interface going on the grip. Thus, I organized a workshop with the FlowMotion team where the goal was to explore possibilities regarding functions and buttons for the stabilizer.

Starting off, we did an individual ideation session covering both functions for the stabilizer alone and functions within the companion app one might control from the grip. Next, everyone presented their ideas — without judging as we were still wearing the Green Hat.

Before moving on to the next activity, I made clusters of similar ideas. I then asked the team members to rate the ideas as either must, should, could, or won't, using colored stickers. Next, everyone got a chance to explain their thinking and rating to the rest of the group. To wrap up, we had a group discussion about the functions in the context of who the users are and what they might want.

In short, the previous user research has told me that users want the stabilizer to be easy to use, and they appreciate functionality that reduces the need for using the touch screen. In the second user test, their desire for a button to toggle phone orientation was also readily documented. Apart from that, basic functions such as record video, power, and gimbal modes have also been discussed above. Using the results from the workshop and the previous research, I made a MoSCoW diagram for the grip interface.

Must

- As little as possible
- Power ON/OFF
- Adjust gimbal position
- Reset gimbal position
- Toggle follow modes

Should

- Record video
- Capture photo
- Toggle phone orientation
- Zoom
- Toggle cameras/lenses
- Enter Bluetooth pairing
- Hard reset stabilizer

Could

- Control focus and exposure
- Burst photos
- Select tracking target
- Control flash
- Set motion time-lapse targets
- Change camera mode
- Lock gimbal position
- User programmable button
- Change gimbal speed
  and responsiveness

Won't

- Navigate entire app UI
- Change video resolution
- Play last recorded clip
- Change frame rate
- Instant share video function
- Video/photo filters
- Aperture
- Brightness
- White balance
- Shutter speed
- Adjust mic gain
- Control accessories

Interface interviews

Following the previous workshop, I conducted three user interviews focusing on what actions users make, or want to make, before and while capturing content.

Warm-up questions

- Which smartphone do you own?
- What type of content do you capture?
- Which app(s) do you use for videos/photos? Why?
- Which stabilizers have you used? How was it to use those products?

Discovery questions

- What settings and actions do you make before capturing content on your smartphone?
- What about during recordings?
- What functions do you want to control from the grip? Why?
- Which controls do you use on stabilizer X? Why?
- Which controls do you not use on stabilizer X? Why?

Findings

All of the participants prefer the native camera app on their iPhones, adding that it is quick to launch and easy to use. They have used companion apps for various stabilizers, but dislike them for being difficult to use and having poor UIs, although sometimes they have to use them to get the extra functionality.

Before capturing videos, they mentioned adjusting frame rate, ISO, focus, and exposure. No one said they had used focus and exposure lock. However, one user said he had not been using it because he had not discovered it yet, but would love to use it now that he knew about it. As with the portrait feature in FlowMotion ONE, this shows how important discoverability is. Further, participants said they adjust the gimbal position. One user stated he only moves the gimbal along one axis at the time, explaining that it looks weird when adjusting multiple directions at the time.

While recording, they change the point of interest for focus, adjust tilt and pan, and change the follow mode of the gimbal. No one uses the zoom while recording.

When asked what functions and buttons they want on the grip, they answered recording, joystick or directional pad (d-pad), and focus and exposure control — with locking. One user wants a zoom button. Another wants the ability to change gimbal speed. They have no strong desire for toggling cameras but add that they definitely see it being useful in certain situations. It seems that they would like to keep it fairly simple, but they also want to control as much as possible from the grip to avoid touching the screen all the time.

«More than that will make it overcomplicated. Shutter and aperture control would be superfluous.»

— Alexander M.

To discover further needs and thoughts, I asked them what functions they remembered using on their stabilizers. Here, video recording and gimbal position were repeated, while capturing still photos and locking the gimbal position was added. One mentioned that he liked to have battery status LEDs. Another talked about a selfie-mode button, but complained about the triple click implementation, and added that it was faster to manually toggle the camera by touching the screen.

> *«Everything except the zoom button.»*
>
> *— Rory S.*

They all thought the products were quite easy to understand and had nothing particular to say about the layout and ergonomy.

User test 4

6 participants
60 minutes each

Although I did not test the clamp mechanism or any of the new phone mount concepts, the fourth user test was still a comprehensive one. Adding weight to the grips revealed critical information about the finger groove, and great progress was made with the detachable solutions. I also used the opportunity to interview the participants about the grip interface and functions. In addition, three acquaintances from EGGS Design came by to help, providing valuable industry feedback.

Discovery questions

- What do users think about the improved grip?
- Which groove shape do users prefer? Why?
- Which detachable solution do users prefer? Why?
- What settings and actions do you make before/while capturing videos?
- What functions do you want to control from the grip? Why?
- What do users think about the appearance?

User test 4
Findings

Usability questions

- Can users comfortably hold the grips?
- Which groove provides a more secure grip?
- How is the size of the grooves?
- How is the placement of the finger groove? Too high/low?
- Does the extra rubber padding provide better grip?
- Are users successfully able to detach the grips?
- Are the concepts easy to use and understand?
- Do users get enough feedback when detaching the grips?
- Are the mount indicators easy to understand?
- How does the camera lens release button feel?
- Are users able to adjust the roll frame length?
- How is the size of the new roll frame knob?

Tasks and prototypes

1. Hold and evaluate improved grip with different finger grooves, and compare with DJI lookalike
2. Test and compare friction and grip of padding in finger groove only vs. padding on entire underside of grip
3. Detach the grip from:
   a. Tripod mount v4
   b. Camera lens v4
   c. Camera lens v4.5
4. Adjust the length of the roll frame with smaller knob
5. Evaluate appearance of grip and gimbal

Gimbal balance

Reducing the size of the knob quickly proved to be a horrible idea. Participants felt it was difficult and uncomfortable to operate, and the surface did not provide enough grip. Users also wanted the actual turning to feel smoother. No big remarks, neither positive nor negative, were made about the appearance.
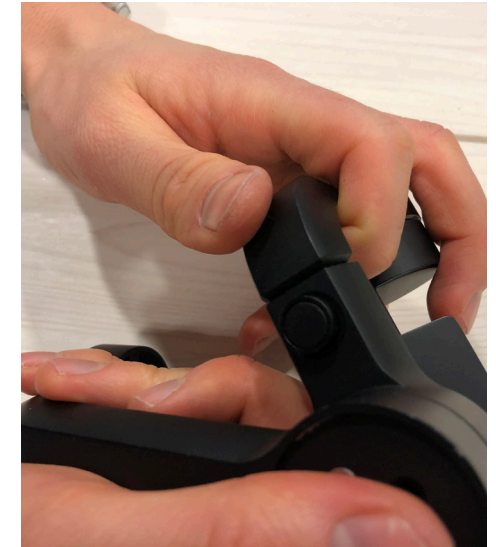
User test 4
Findings

Grips

The grip shape was well received. Participants said it felt good to hold, and it was not perceived as too big with the increased 41–30 mm taper. Testing with weight revealed that the weight distribution was off. Most of the participants placed their middle finger in the index finger groove to compensate for this, which is unwanted because then the console becomes difficult to reach. The DJI lookalike performed a lot better in terms of weight distribution, but the new grip design was for most participants superior in all other aspects.

The slot was the preferred groove shape. Several users felt this provided a more secure grip, while still making it easy to alternate the hand position. Participants felt the groove still needed to have a smoother lateral transition. Having the entire underside of the grip rubberized did not seem to provide significant advantages over using rubber in the groove only. Some users thought it might make a difference to have rubber on the upper half, but they also added that they did not see it as necessary.

Aesthetically, the grip got great feedback from both users and EGGS Design. It was seen as very sleek and Scandinavian. EGGS commented that the curvatures could be further improved to give smoother highlights and that the rubberized slot groove provided a sense of precision. However, making the slot groove more similar to the console outline would result in a more consistent design. The grip ending was also well received, but they suggested improving the curvature also here.

User test 4
Findings

Detachable concepts

All of the improved detachable solutions performed significantly better compared to the second iteration. The tripod mount v4 was seen as more secure than the others, but also bulky and unattractive. Users felt it was very straight forward, and the indicators worked well.

The camera lens v4 was the least secure, but also the most elegant solution. Detaching and attaching felt smooth, but the feedback still had a long way to go. Also here the indicators were easy to understand.

The camera lens v4.5 was perceived as the most high-end solution. Thanks to the release button, it felt more secure than v4. However, there were some flaws with the button. It was poorly attached, and the design was not the best, which lead to some confusion. Together with the indicators, this resulted in some users trying to rotate the button instead of sliding it. The button was also too small and not grippy enough. Upon attaching the grip, some users felt the insertion could have been smoother.

User test 4
Findings

Frame and clamp appearance

The frame shape got great feedback overall. The major thing to improve was the main curvature, or arch, of the yaw and the roll frame. The clamp was seen as better than the previous iteration, but it still had a way to go.

The designers from EGGS wanted the geometry to be more honest. The decal on the back looked too much like a button and made the design cluttered.

Interface

Users with more experience with DSLRs tend to want full manual control from the grip, while beginners and average users focus on the basics such as focus, record, and exposure. This is perhaps not a surprise. Further, the participants think that what you can do while recording is more important than what functions you would want to use before or after getting the shot. As before, they still want the interface to be simple.

> *«I just want a good result.»*
>
> *— Henning N.*

Before recording videos, participants said they would adjust focus, exposure, and zoom. During recordings, their needs were the same except for the addition of grabbing still frames of the video.

Rated from most to least important, these were the functions they said they wanted on the grip:

- Record button
- Zoom wheel
- Photo shutter
- Camera toggle
- Focus
- Exposure
- Flash
- Aperture
- Shutter speed
- Resolution
- Frame rate

User test 4
Conclusions and next actions

Grips

- Move the groove forward to improve weight distribution
- Improve curvature of grip; make it continuous/G3
- Make groove transition smoother
- Based on slot shape, make finger groove more similar to console cut
- Explore patterns and textures for the groove pad

Detachable concepts

- Discontinue tripod mount v4 and camera lens v4
- Further develop camera lens v4.5
- Smoother friction between male and female mount
- Introduce one-way rotation and entry
- Recess release button in a slot for more affordance and protection
- Make button wider and taller
- Add texture on button for more grip
- Use indicators similar to camera lens v4 or DSLR cameras
- Improve the audible and tactile feedback by making it more firm and substantial; make spring and pin more beefy

Gimbal balance

- Revert knob diameter to 15–16 mm
- Improve smoothness
- Make surface texture more coarse and grippy
- Experiment with click set screw for better feedback

Frame and clamp appearance

- Make clamp geometry more honest
- Improve curvature of jaws
- Try glossy finish on decals
- Make clamp pad size taller, i.e. same as cable cover
- Improve frame curvature

Detachable concepts

- Gather more feedback from users
- Explore layouts

Iteration 5

Tweaks and last-minute changes

In the fifth iteration, I move onto detailing of the grip and make small but important tweaks to the detachable solution. The case mount concept and grip interface is further explored and developed. Iteration five also includes the last round of proto- typing and user testing. Feedback from the tests results in important changes to the design moving forward.

Bootstrap case mount

To quickly be able to test the concept, one of the more promising ideas was simplified and adapted so that I could modify a FlowMotion ONE with the solution. The concept consisted of a male mount with four pegs and a female mounting plate that would slide and tighten on top of the pegs. I had an old phone case sitting on my desk gathering dust, which I glued the mounting plate on. It was a low-fidelity bootstrapped prototype, but it was sufficient to evaluate the concept.
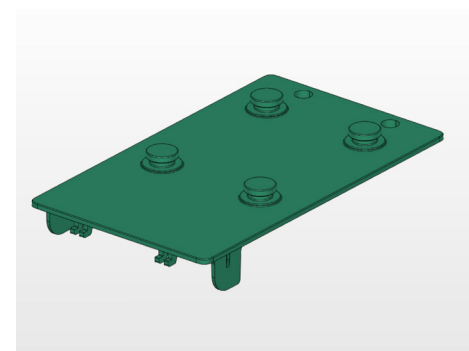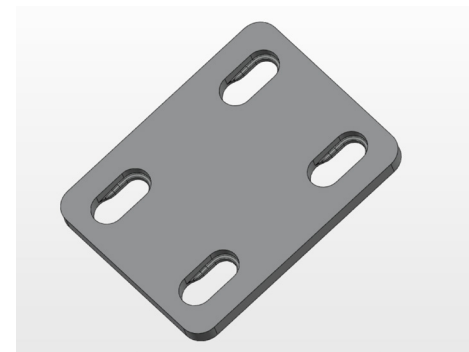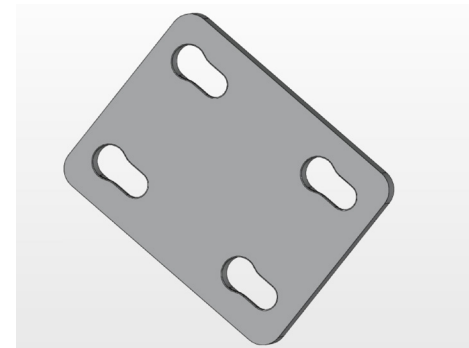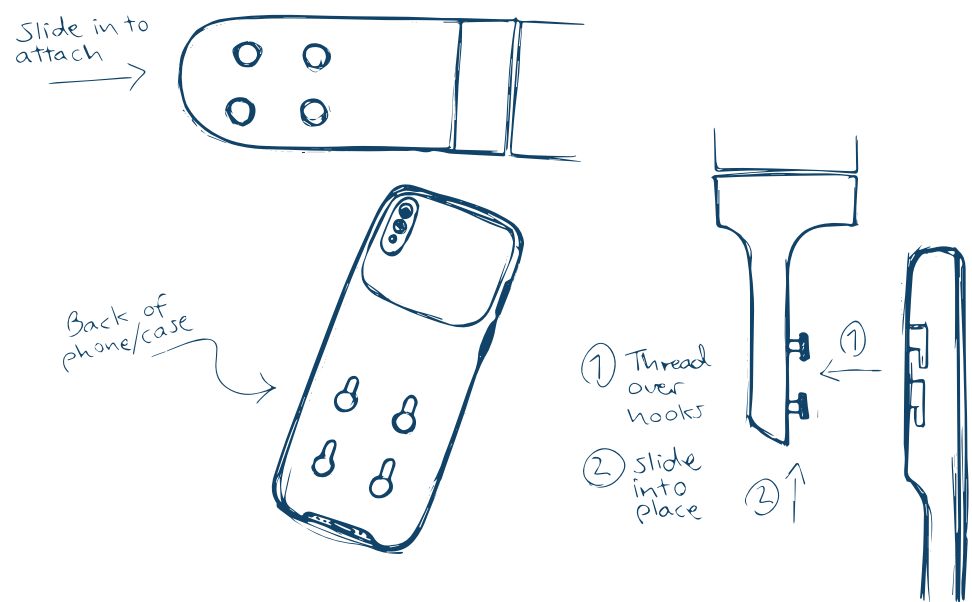
Clamp mount v5

Since I was going to test an alternative solution to the clamp, I did not want to spend too much time refining the clamp solution. The design was already quite developed at this point, and I also wanted to avoid any potential bias the refined solution might have against the bootstrapped case mount.

Trying to improve how the pitch frame motor and clamp were joined together, I was inspired by a hand holding a book. A few variations were tested in CAD before settling on a design. Two sets of clamps were made — with different spring stiffness.
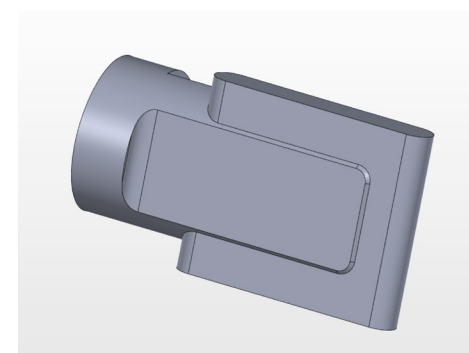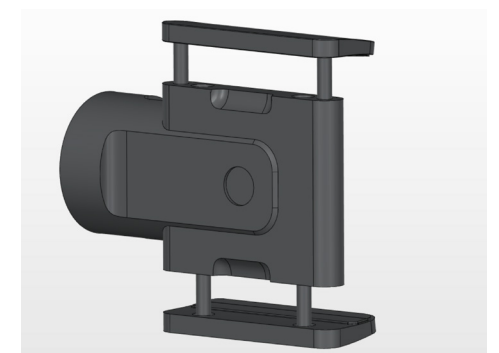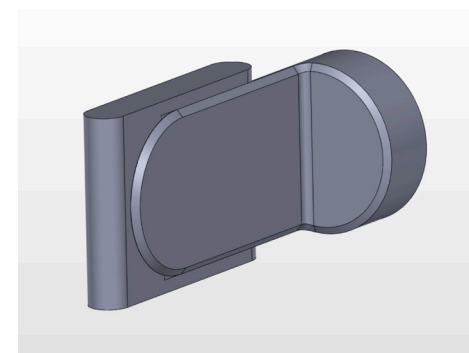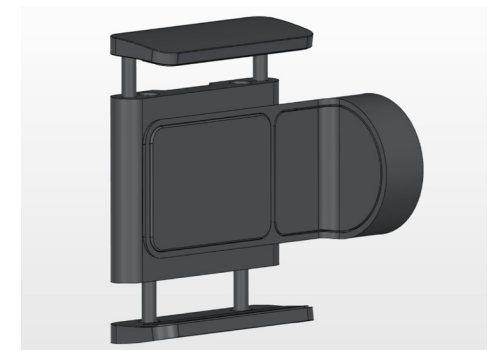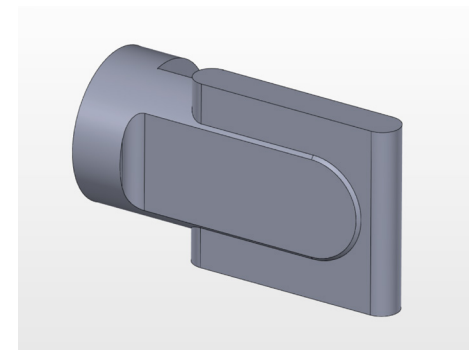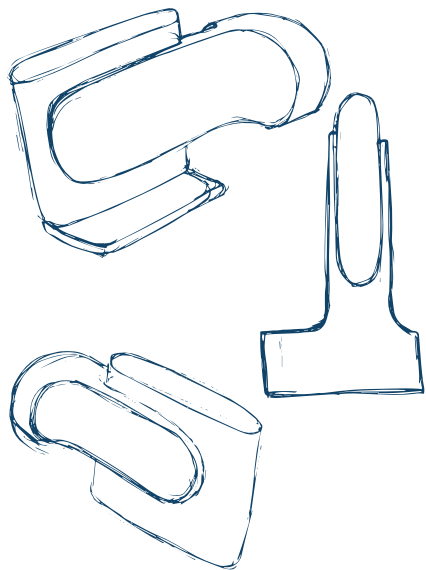
The charging port

Before developing the fifth iteration of the grip, I had to figure out where to place the USB-C charging port. After discussing the matter with FlowMotion and Trond Are, I decided to have it in the bottom of the grip next to the tripod mount.

The bottom felt like the most natural position for inserting a cable considering how you hold the grip, and it will enable accessories such as a charging stand. This disables charging while the stabilizer is mounted on a tripod, but since the battery of the stabilizer will last significantly longer than the phone, it is not really an issue. The other option was to have the port somewhere along one of the sides of the grip, but that will favor either left-handed or right-handed users, and the port might get in the way of the user's hand in some cases.

USB-C
placement
?

USB-C Bottom Placement

like on a phone

can't charge on a tripod

bottom USB-C placement enables accessories s.a. charging stands
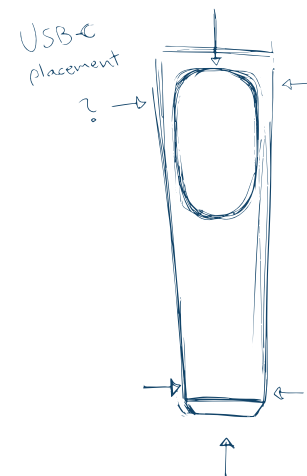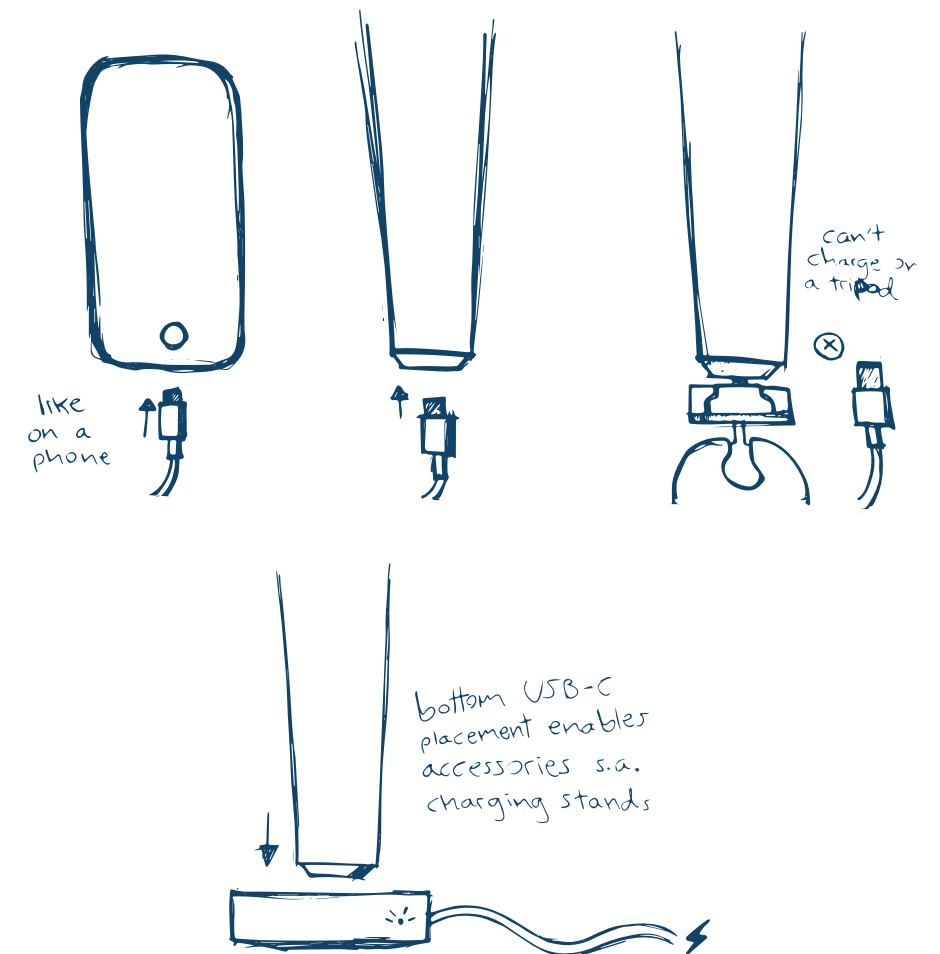
Small tweaks to the grip

By now, the work with the grip was mostly about detailing and refining the shape. The finger groove was improved based on the most recent feedback. For testing the weight distribution, I decided to try two different positions. This time the prototypes were made such that they could be mounted to the gimbal unit in order to test with an even more accurate moment.

I made the cross-sectional curvature completely continuous, using a so-called G3 curvature, which improved the highlights of the grip. The photo below comparing the new prototype with the previous one shows the difference.

A bottom plate with a tripod mount and a dummy charging port was also added to make the prototype more realistic.
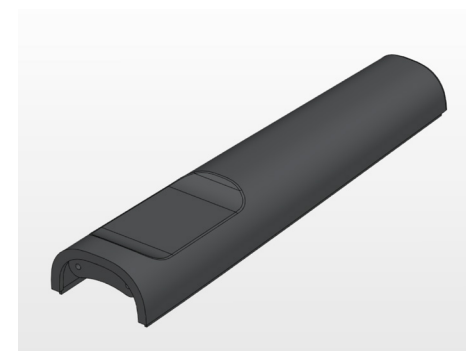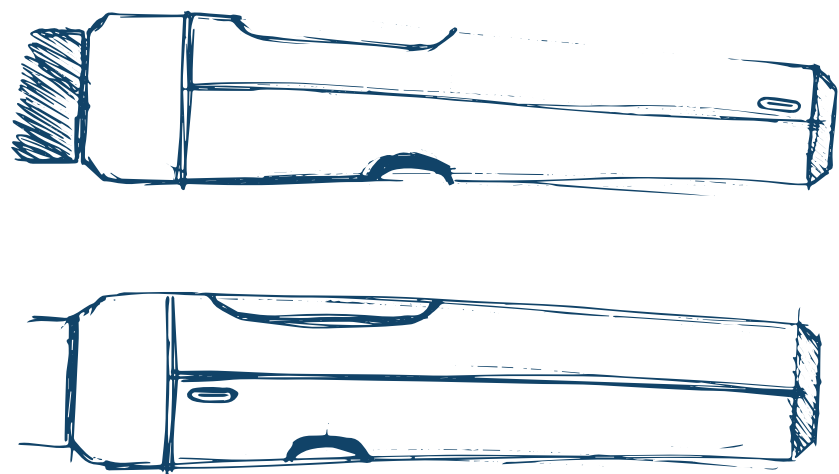
Textures and patterns

For the finger groove pad, I explored various textures and patterns as potential alternatives to plain rubberized or the leather imitation used for FlowMotion ONE. The process consisted of sketching, both digital and analog, and collecting images online. I focused on patterns clean geometric patterns that I thought communicated flow, precision, and technology. I also made a few concepts inspired by the FlowMotion logo. I ended up making four pads with different patterns that would be evaluated in the next user test. Upon receiving the pads, the textures provided less than friction than expected, but I decided to run with it all the same.
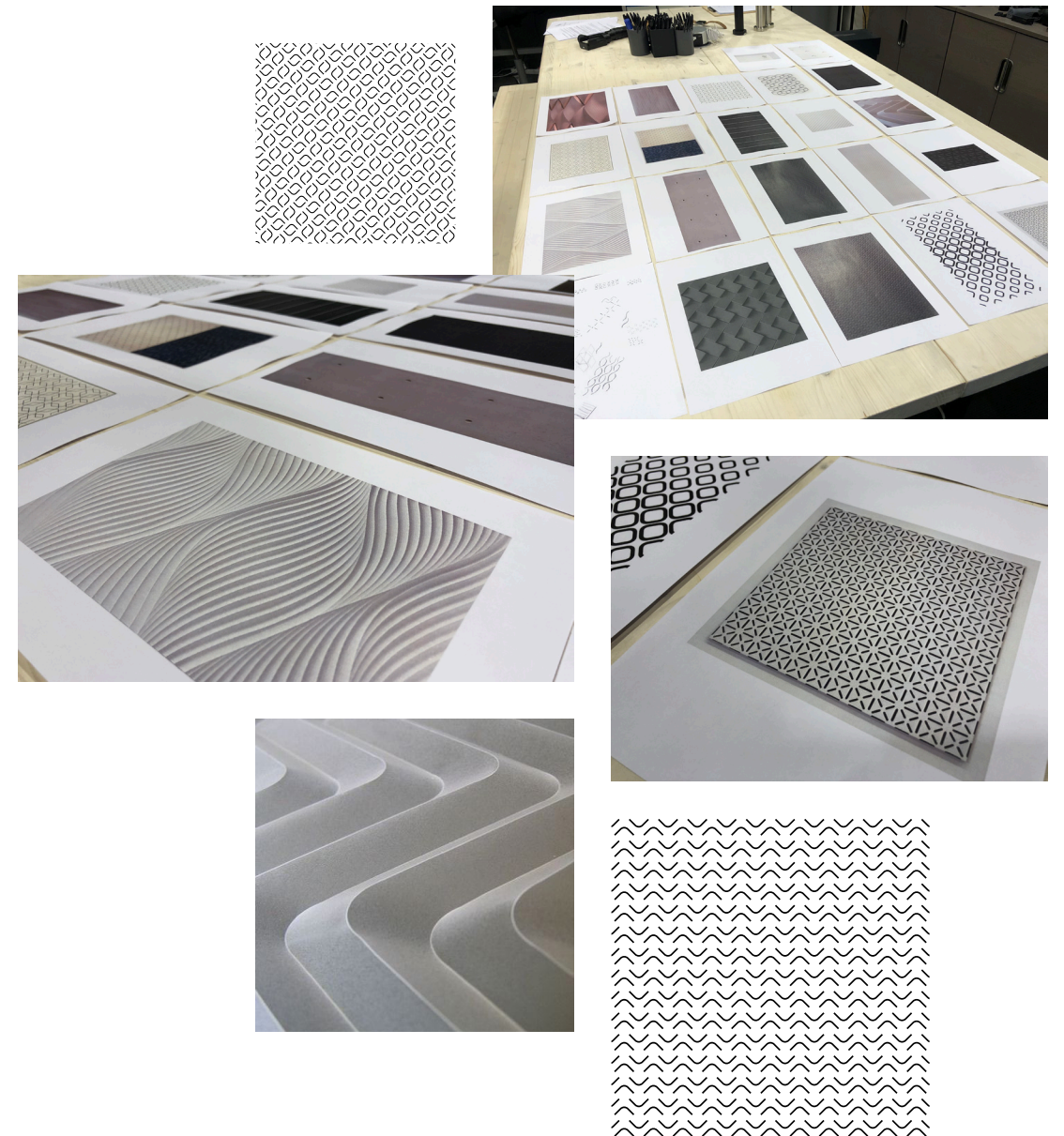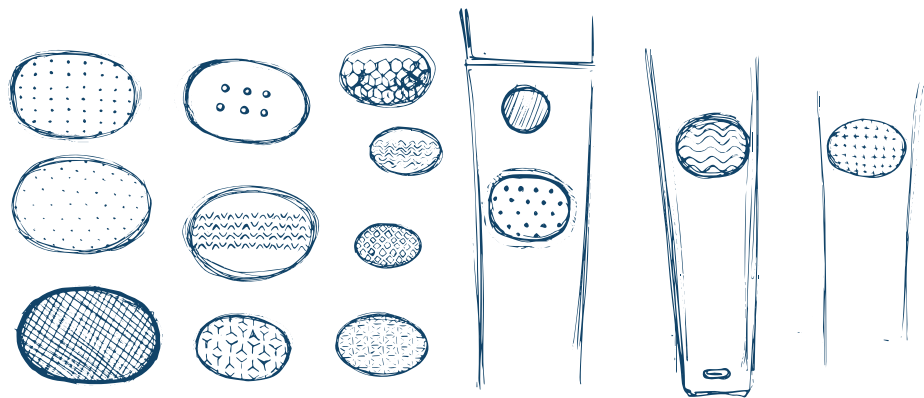
Interface co-creation

To further research user needs for the button console, I decided to go with a more hands-on approach. Based on the new grip prototypes, a perforated grip was modeled and 3D printed along with some basic button shapes. The dummy buttons were attached to pegs so that they could be mounted on the perforated grip — similar to LEGO bricks or an Arduino board. The idea was to co-create with the users in the upcoming user test, and that this would help people express what functions they wanted and where they would like to have them. In addition to the prototypes, I also made a simple template of the grip to print out and sketch layouts. This can be found in the Appendix.
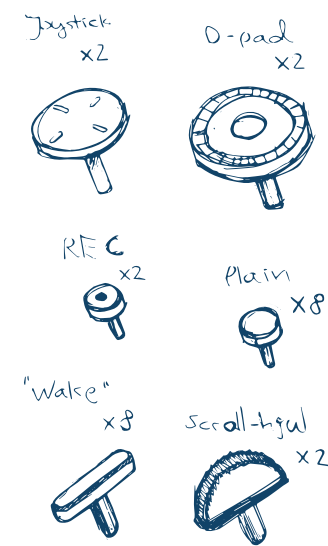
Camera lens v5

The feedback from the fourth user test enabled me to narrow down and continue refining just one of the solutions. Starting off, I did some quick sketches of the release button and the indicators, before moving on to modeling. Three variations were made of the release button: one slim and two larger ones with different surface texture for grip. The three buttons also had different spring stiffness. For the indicators, I went with something similar to what you find on DSLR cameras, thinking this might feel familiar and more understandable to the user.
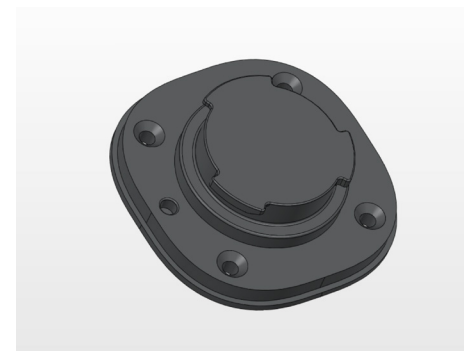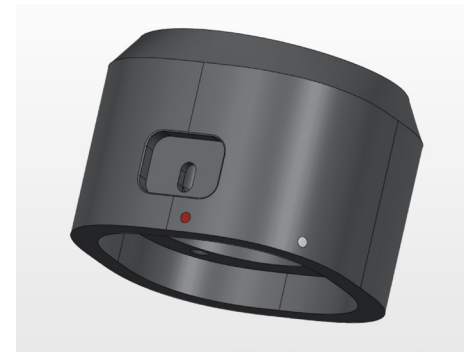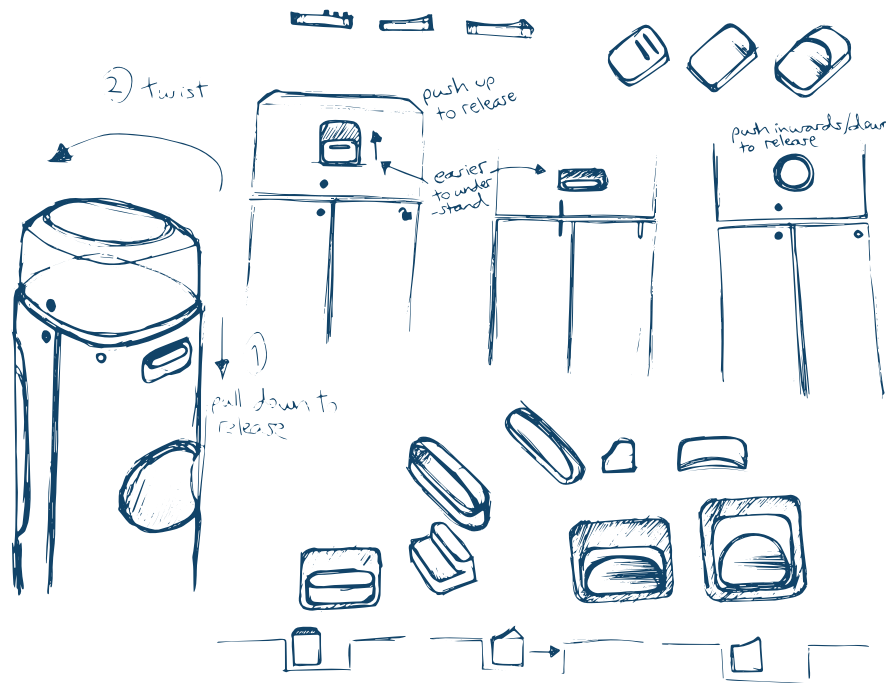
Frame shape

The main change I did to the frames was to improve the curvature of arch between each motor housing. The previous prototypes were somewhat inconsistent and angled. This iteration addressed that. I applied the same type of curvature to the frames as the grip.
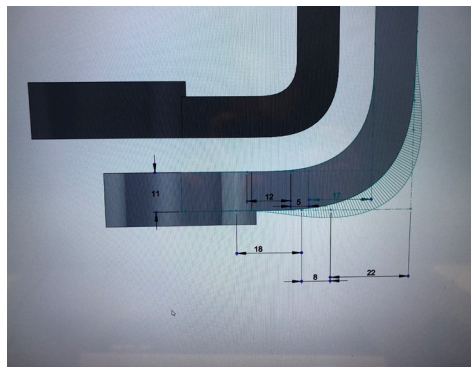
Knobs and watch crowns

To reduce the diameter of the roll frame knob was a mistake. Working to improve the knob, I brought the size back up to 16 mm while keeping a slim profile. To further improve the design and construction of the knob, I explored various watch crowns. Based on this, I sketched a few different concepts. Three of these were later prototyped. However, only one showed up in the shipment from FlowMotion's prototyping partner.

An early concept of a set screw mechanism, with click feedback, was also modeled and 3D printed. The prototype was not sufficient for testing with users, but it was evaluated internally.
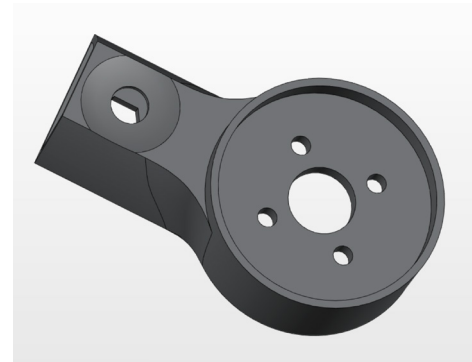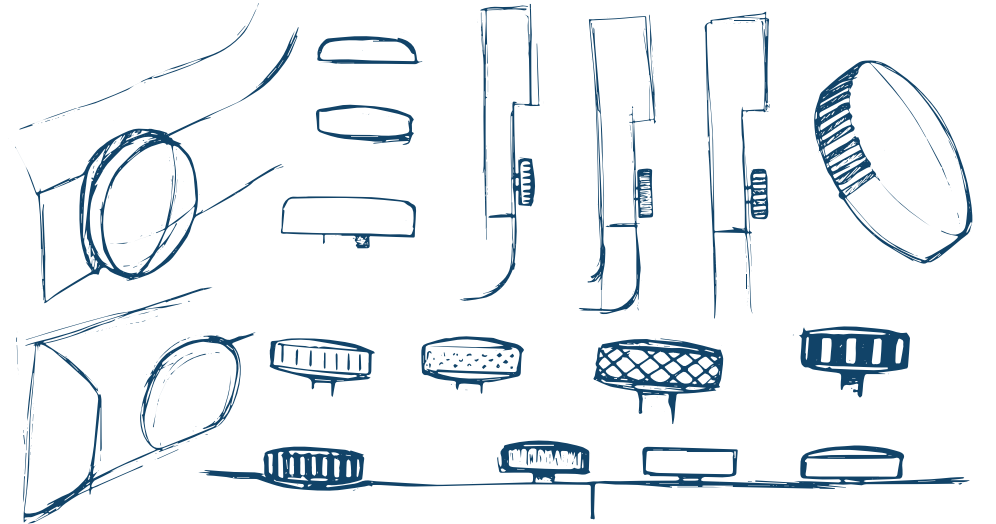
Prepping prototypes

When preparing the new prototypes for user testing, I grabbed the opportunity to try out some colors. This was all very hands-on and spontaneous, using spray paint from the nearest hardware store. The result was not perfect, but it was valuable to see the prototypes in different colors.

User test 5

The fifth and last user test of this project is also the most comprehensive one. For the first time, I had a fully assembled mechanical prototype of the product. Significant findings were made about the phone mount and the gimbal balancing feature in particular. The co-creation of the interface did not turn exactly as I had hoped, but still proved to be a valuable exercise.

Discovery questions

- What do users think about the improved grip?
- Which groove position do users prefer?
- Which groove texture do users prefer?
- What functions do you want to control from the grip? Why?
- What do users think about the improved detachable solution?
- Do users trust the camera lens concept?
- Which release button do they prefer? Why?
- What do users think about the improved roll frame adjustment?
- Do users prefer the clamp mount of case mount? Why?
- Which phone mount feels more secure? Why?
- What do users think about the appearance?

Usability questions

- Can users comfortably hold the grips?
- Which groove provides a more secure grip?
- Is the new groove smooth and comfortable?
- Does the grip feel too heavy? How is the distribution?
- Can users easily understand and work the detachable grip?
- Are the indicators easy to understand?
- Do users get enough feedback from the solution?
- Are the release buttons comfortable to use?
- Are users successfully able to adjust the roll frame length?
- How is the size of the new roll frame knob?
- Does the knob provide enough grip?
- Are users successfully able to insert and remove the phone?

Tasks and prototypes

1. Hold improved grip and evaluate groove and weight distribution
2. Detach grip from camera lens v5 and test three release buttons
3. Co-create on functions and interface layout
4. Adjust the length of the roll frame with new knob
5. Insert and remove phone from clamp mount and case mount
6. Test six different rubber textures: plain, leather imitation, and four geometric patterns
7. Evaluate appearance of stabilizer

User test 5
Findings

General impressions

Overall, the reactions to the prototypes were very positive — both in terms of form and function. Several expressed that it was an elegant and clean look-ing product when they saw the grip and gimbal assembled together. The users loved to see that the tripod mount was included in the grip, but one made a remark about the missing wrist strap loop. He was pleased to hear that I was, in fact, planning to add it. Another user also expressed his dismay of the gimbal dangling freely when powered off and suggested we ought to fix this.

«I would like to have a wrist strap for security. Would be surprised if I didn't get it. I always put on a strap on my things to not lose them.»

— Paulius K.

Textures

The four textured pads were compared with the plain rubber pad on the grip prototype and the leather imitation the FlowMotion ONE. The four textured pads did not provide significantly better grip than the plain one, according to the participants. While the plain pad could have been even more rubberized, the users still preferred this over the four textured patterns. However, all partic-ipants preferred the leather imitation in terms of both tactility, grip, and appear-ance.
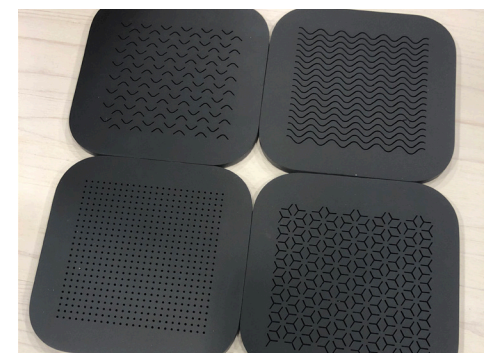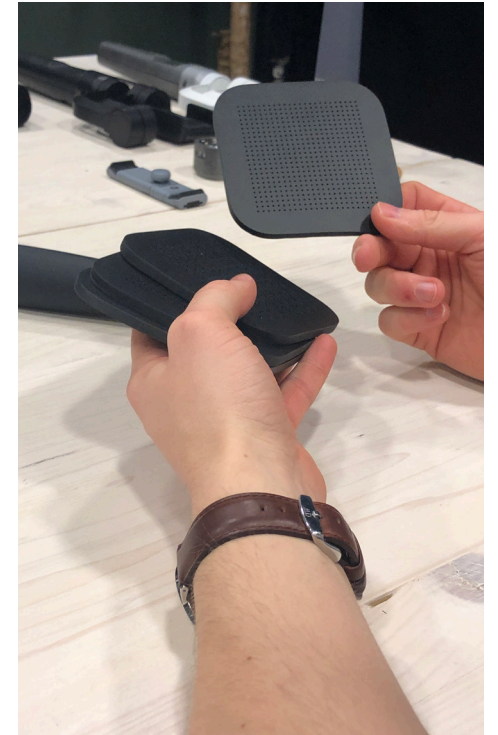
User test 5
Findings

Grip

Two nearly identical grips, one black and one dark gray, were put to the test in this round, with the only practical difference being the placement of the finger groove. On the dark gray grip, the groove sits roughly two centimeters lower than on the black one.

In general, the black grip performed better. Users stated it felt lighter in hand and that this configuration provided the most comfortable and secure grip. The higher placement of the groove resulted in a perceived lighter product and better button reach for the thumb. There is a need for some small adjustments to the position of the groove and the console, but they were otherwise good. With the groove higher up, the position of the hand followed, which meant that the grip was now longer than it needed. Reducing the length will provide a better fit and more portable

product. Participants said the groove pad, which was plain rubber, provided OK friction, but that it would be better with more. Aesthetically, the groove shape performed worse than the slot in iteration four, and it needs to be reworked.

Camera lens v5

All users understood how to operate the mechanism fairly quick. They were generally impressed with the design and confirmed that they trusted this solution to keep the gimbal and their phone safe and secure.

> *«This [Flow Motion ONE] is like closing the door on a cheap Polo or something, while this one [the new solution] feels like a Mercedes Benz. Chunk!»*
>
> *— Paulius K.*

Everyone thought the indicators were easy to understand, and some recognized them from DSLR cameras. Two mentioned they would like to have an additional lock icon above the release button. However, the users also stated that once they had done it, they knew it, and an additional symbol might not be critical.

Users preferred the stiffness of the release button on the silver grip, stating

it was neither too hard nor too loose. However, some users had to use their nail to aid in pushing the button, meaning it was probably too hard after all. A slightly looser spring and increased travel distance will probably be better while maintaining the same level of security. In terms of button design, the big one with an extruded slot performed the best, being the one providing the most grip for the thumb. On all prototypes, the release button would sometimes get skewed or stuck in a middle position. This decreased its perceived quality and caused some confusion about whether it was locked or unlocked. Adding guide pins or mounting the button on a backplate might solve this issue. Furthermore, as users tested the solution while holding it in various positions, they stated that they were satisfied with where the button was located.

User test 5
Findings

«Even though you don't know how to detach, you'll learn how it works after 2-3 times, then it doesn't matter.»

— Alex A.

«Did it once and you know it.»

— Paulius K.

Gimbal balance

With the knob size back to where it was before, participants found the feature easy to operate. They regarded it as solid and secure. The knob provided sufficient grip, and the users seemed to like the slim profile. However, one person would have liked it to be slightly thicker, but considering the low frequency of use, it is also a good idea to keep this mechanism as unobtrusive as possible. It is a necessity for the product to perform at its best, but as a user, you set it once and then you want it gone — unless you are lending it to a friend with a larger or smaller phone than yourself.

«It's not something you're going to adjust all the time since you're only adjusting once to your own phone.»

— Eirik S.

However, the solution did not only get positive feedback. Participants found the mechanism to be inelegant and unimpressive, especially compared to the engineering of the detachable grip.

The solution was further perceived as being cheap. Users stated that they would like to see alternative concepts for adjusting the length of the roll frame, with some suggesting concepts like spring pins, clamps, and spacers.

User test 5
Findings

Buttons and layouts

The users were excited about the co-creation concept and expressed appreciation to be hands-on with the design. However, this task did not provide the specific answers I hoped it would provide. Most users ended up with a fairly simple setup similar to that of FlowMotion ONE, or even more basic.

One user specifically mentioned the possibility of switching between photo and video modes directly from the grip, as well as having a way to capture still frames while recording. Another mentioned zoom but stated it was not essential. Basic functions such as power, record, adjusting gimbal position, and Bluetooth was also mentioned.

Upon discussing directional pads versus joysticks for adjusting the gimbal position, one user preferred the latter to allow for more complex movements. From previous user research, I know that some users struggle with getting smooth movements using a joystick. The main issue seems to be with the increasing speed in relation to how far you move the joystick from its center point. The joystick requires the user to practice very precise micro-movements if the goal is a smooth and continuous path. Of course, one could make the joystick binary — with constant speed, like the d-pad — but that would break the convention of a joystick, and make the mapping flawed. Further, in a previous interview, I have gotten feedback that moving diagonally does not look as good as going straight left–right or down–up. Besides, it might be easier to just use the arm to achieve complex moves.

D-pads are very common in cameras, while joysticks are usually featured in video game consoles. The fact that the stabilizer is a much closer relative to cameras might make an argument for the d-pad. Also considering the expectations of the people the product is for, and that a d-pad is easier to use and, this seems like the most suitable design.
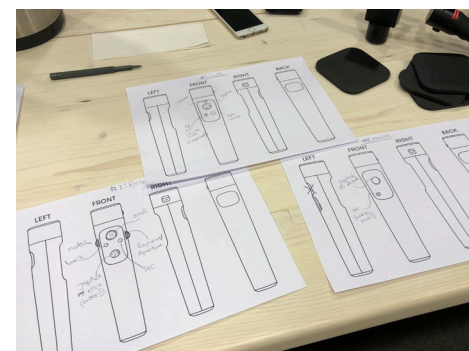
User test 5
Findings

Phone mount

Despite being a crude prototype, the case mount greatly outperformed the clamp mount. A few users felt that the case mount increased the perceived quality of the product, as well as being a unique feature.

However, the clamp did not perform poorly either. To most, it was straightforward to operate and secure, but people also said they felt awkward and clumsy when opening the clamp. One person shared his concern about his phone getting scratches from the clamp, or that it might slip from his grip and fall to the ground when pulling it out, resulting in a shattered screen. Further, the springs were still too stiff according to testers.

«The product feels very premium until you're about to mount your phone. If I were to own a stabilizer, I would have wanted the case mount.»

— Marius O.

With the case mount, users spent a bit more time figuring out how to operate it. Naturally, this is partly due to it being an early prototype. After successfully using it once, all users understood how it worked. Participants trusted the solution would keep their phone safe but stated that it should be a bit tighter. They would also have liked to receive some form of click feedback to be reassured that the phone was properly attached. A couple also mentioned the option of having a release button, similar to the detachable grip. Other than that, people were positive to having a FlowMotion phone cover, as long as it was useful for more reasons than the stabilizer, for instance by having a lens mount, extra battery, or wallet functionality.

User test 5
Conclusions and next actions

Grip

- Reduce length of grip by roughly 10 mm
- Shift finger groove 2–4 mm backward
- Shift console 2–4 mm forward
- Improve appearance of the groove, especially the outer curvature

Textures

- Explore different leather textures
- Research alternatives to rubber and real leather

Camera lens v5

- Reduce spring stiffness of best performing release button
- Increase travel distance (the height of the slot) by 1–2 mm
- Redesign button construction so that it stays straight
- Improve part fitting to avoid button becoming stuck
- Replace painted indicators with plastic chips

Interface

- Make a new MoSCoW diagram
- Map out and analyze all functions in terms of frequency, security, category and sequence
- Make mockups of button layouts

Gimbal balance

- Discontinue set screw solution
- Explore alternative concepts for adjusting roll frame length

Phone mount

- Discontinue, or pause, development of clamp
    - Reduce spring stiffness
    - Increase width of indentations
- Further develop the case mount concept
    - Add tactile and audible feedback
    - Consider adding a release button
    - Extend the usefulness of the case

Other

- Explore stow lock solutions
- Add wrist strap loop to next prototype

Further work

Selecting, refining, and new ideas

This part mainly focuses on developing the grip interface and button design. It also includes further detailing of the product based on the fifth user test and presents new ideas for the roll frame design. Concepts for a stow lock feature are also explored, and I have another look at color and material.

Rethinking the roll frame

After user test five, I went back to the drawing board to find a new solution for adjusting the length of the roll frame. I came up with about a handful of different concepts. The main challenge here, apart from creating a smooth user experience, is to design a solution that is feasible to make. The roll frame is quite small, meaning complex mechanisms can become either very expensive or difficult to develop.

I brought the sketches to Eirik to discuss what to do. After spending some time evaluating my ideas, most of them were deemed impractical to make for this application. One, however, seemed very attainable. It is based on the headband mechanism of the Pioneer SE-L40 headset, shown to me by Trond Are. The operation of it is similar to the roll frame in the Feiyutech Vimble 2, and hopefully a lot smoother and more precise. The concept will utilize one or two spring plungers to keep the frame in place at various lengths. Although I will not be able to prototype the concept within the time frame of this project, I will continue with this for the final design due to its resemblance to the proven solutions of SE-L40 and Vimble 2.

push to adjust length

pull arm

magnets

stainless magnetic?

Electric Automatic

Expensive

pinch to release

then pull to adjust

where to put cables

cogwheel

magnet

pull & turn

threaded rod

turn to extend & contract

cables

how to prevent unintended turning of the knob?
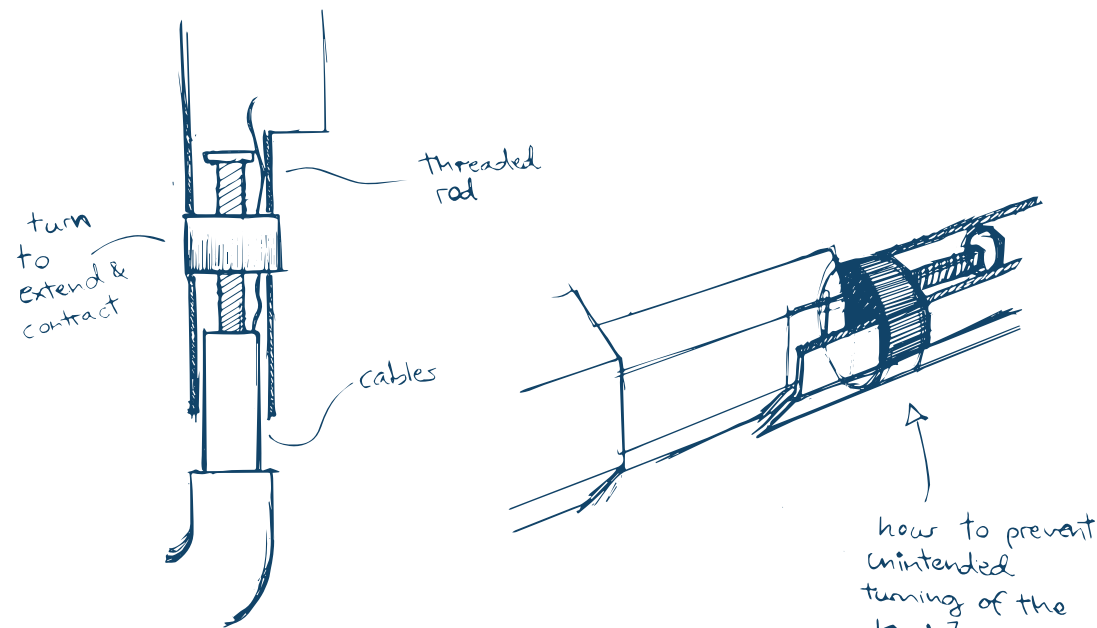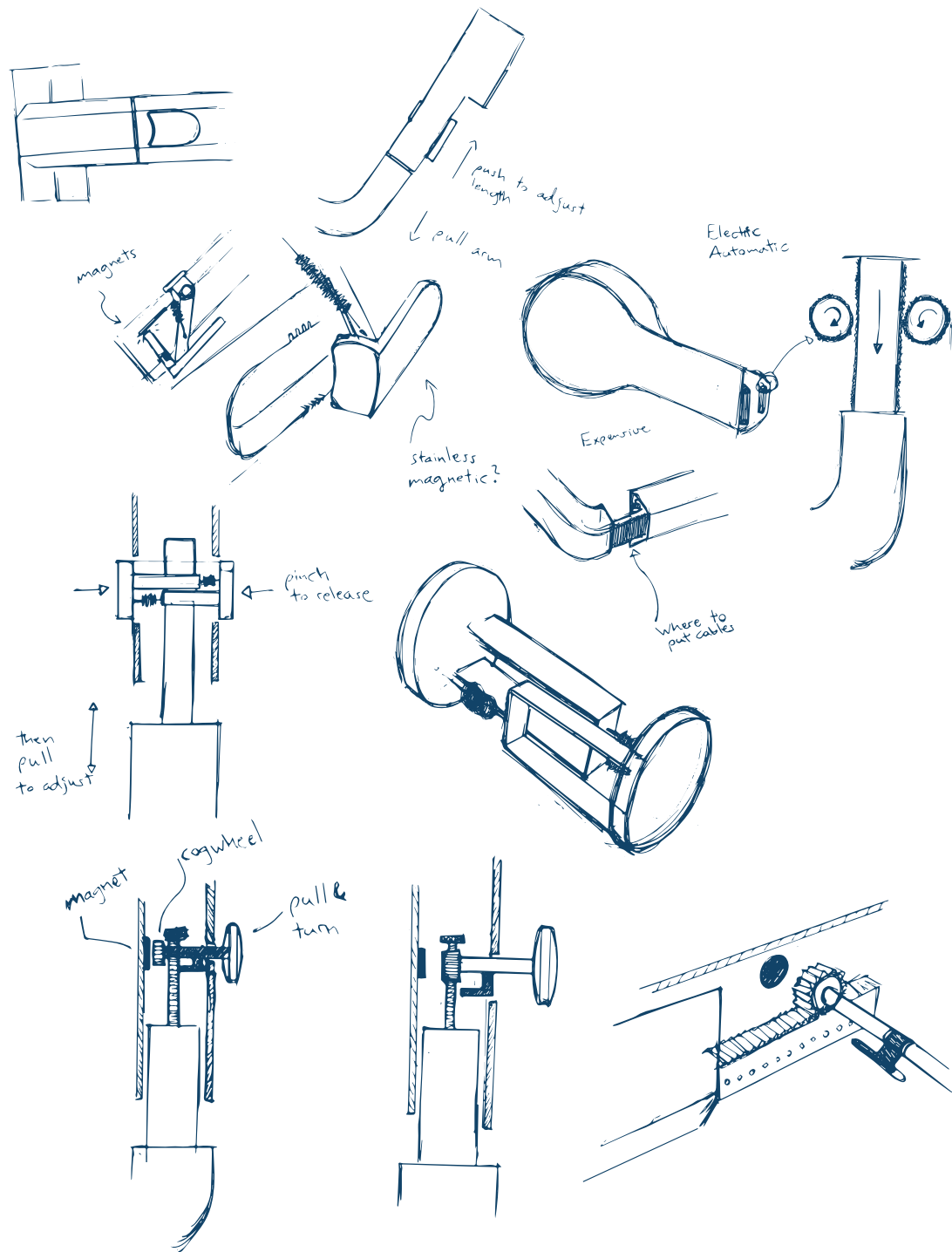
All of these concepts were deemed impractical to make.

spring

spring

lock pin

push & pull to adjust

push to lift pin

FURTHER WORK
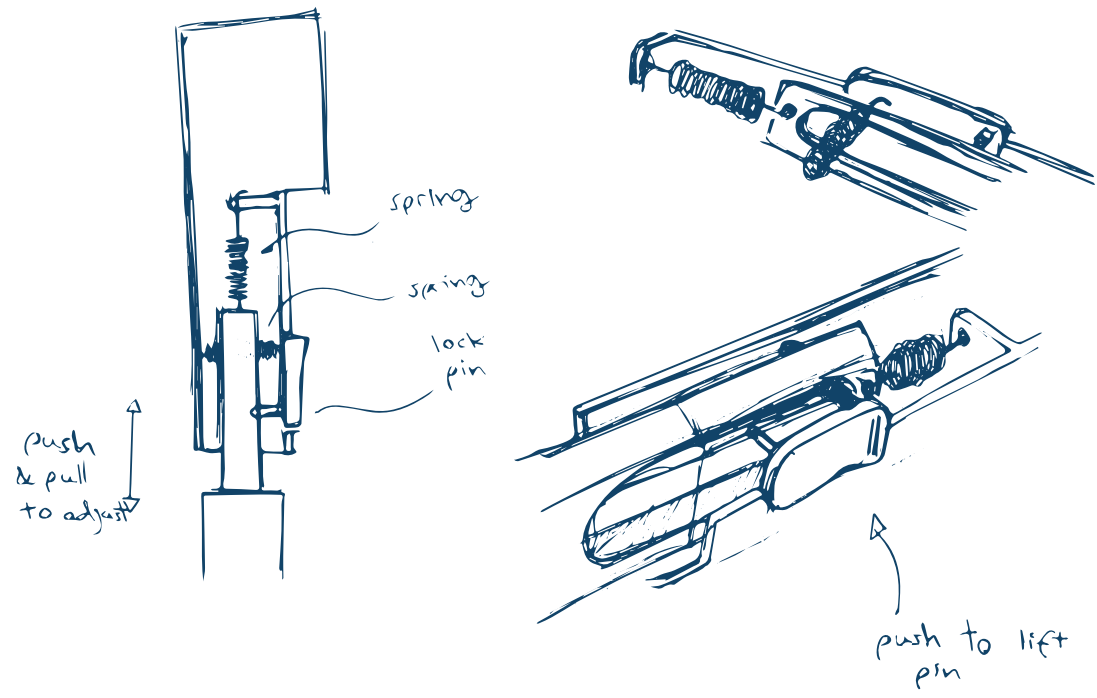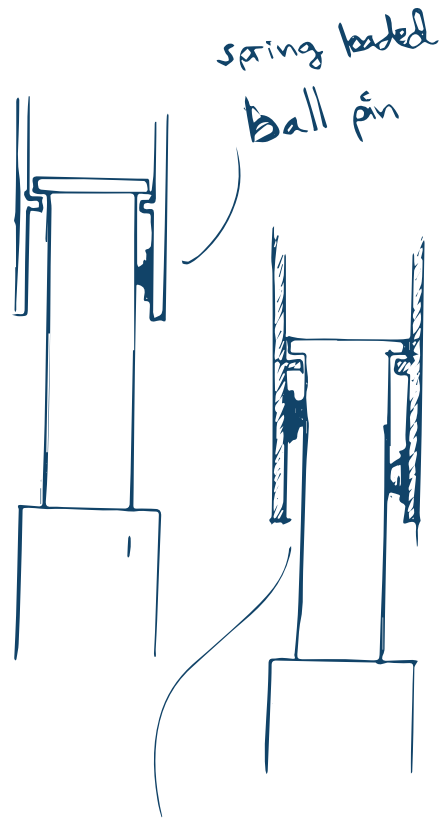
spring loaded
ball pin
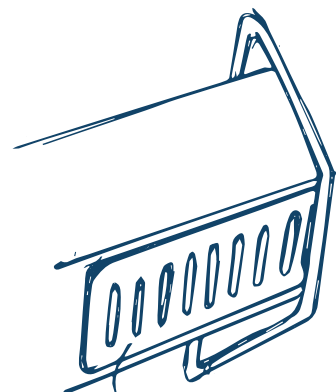
Stainless
Steel

alternatively on
both sides
for stability
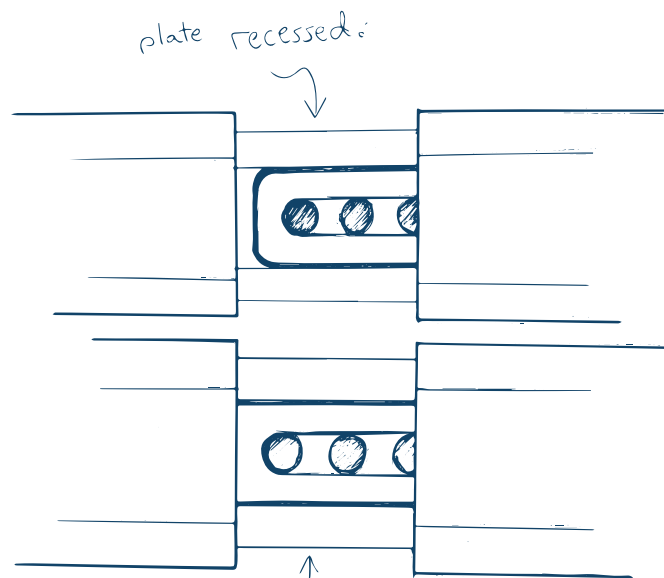
plate recessed:

The concept shown on these two pages is feasible to make and has a high potential. This was chosen for the final design.

or all the way?

Ball pin mechanism
inside
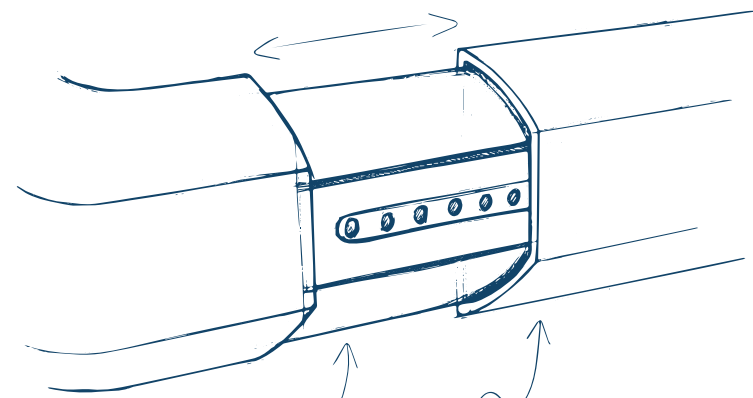
Steel plate,
mounted from
the back?

Cut aways from frame
and mount plate in
front - continue
thin profile

Tiny radius

Simple inlayed

<0.5mm up
from surface
of frame

Plate slightly
extruded and
chamfered

Steel plate
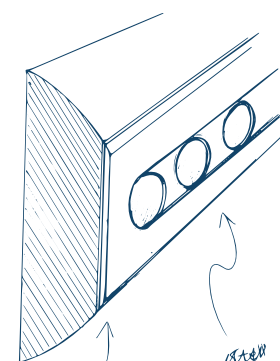
Part of frame
shape (cross section)?
What about inlayed?

Chamfer?

Inlayed in frame
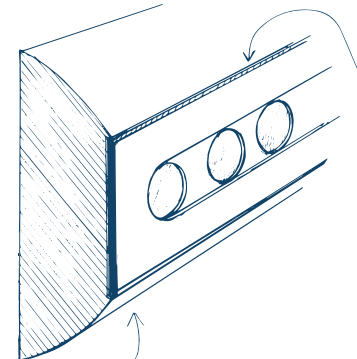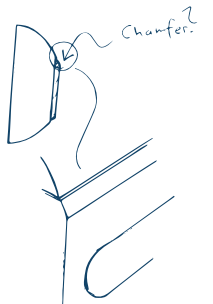
The case mount

For the case mount, I am thinking a sturdy spring plunger will do the trick here as well, at least as far as audible and tactile feedback is concerned. However, it will also improve the security of the mount by a little. To further secure the mechanism, some sort of spring pin similar to the that of the detachable solution might be appropriate. Another idea is to have a wedge that is either spring-loaded or locked in place by turning some type of lever — similar to the quick release mount of the Peak Design Travel Tripod shown in the photos. If the phone mount will need the added security or not is another discussion. For some, the spring plunger might suffice. To others, perhaps in particular users with +1,000 dollar iPhones, a manual locking feature is critical. Considering the latter requires more resources and development, the natural thing to do would be to prototype and test just the spring plunger first to see how it performs. Then, if it fails, the manual lock should be tested. For this reason, and the fact that a plain spring plunger is faster to operate for the user, I will go with this for the final design.

This concept, minus the release button, was chosen for the final design.
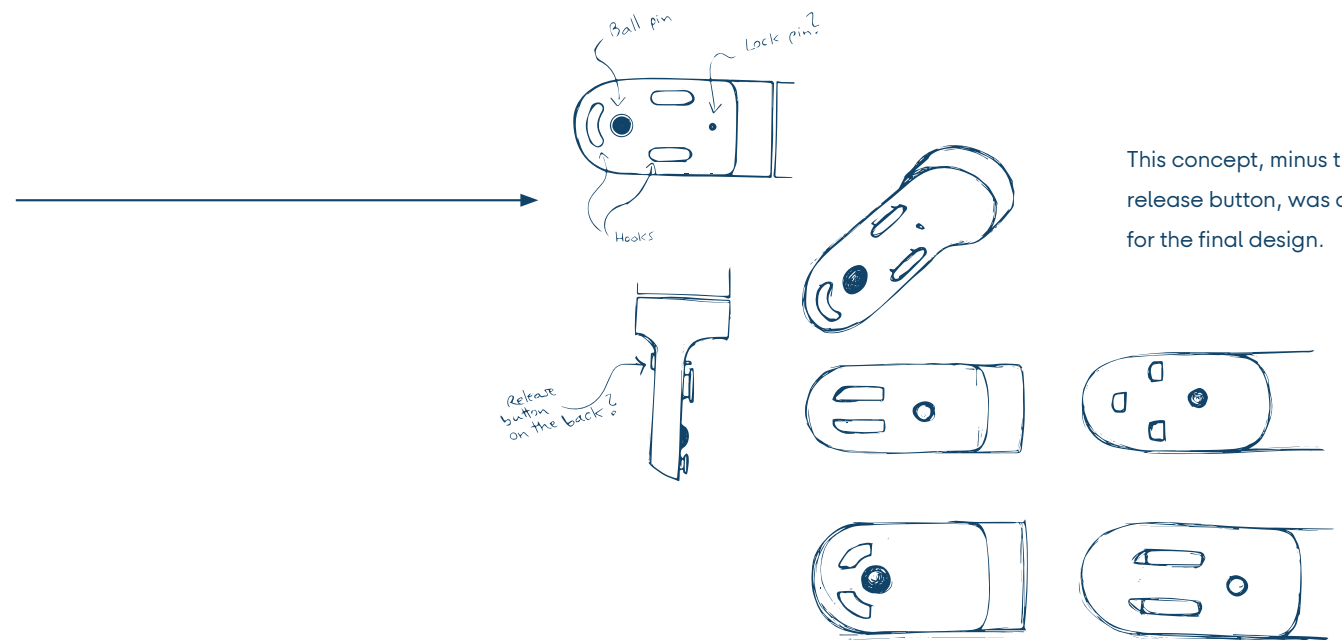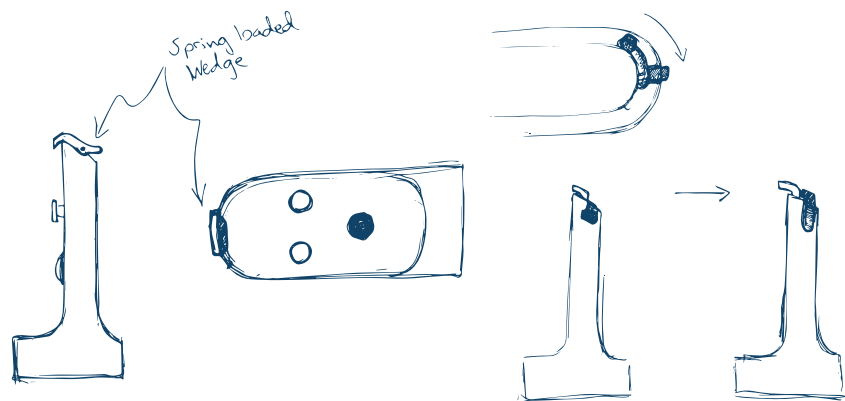
Wrist strap concepts

There are a couple options for the wrist strap as well. The most basic alternative is a simple loop, or hole, where the strap is threaded through. A more sophisticated option is to have a snap fit strap mount. This would let the user attach and remove the strap more easily. However, considering how little space I have to work with at the bottom of the grip, the snap mount is perhaps unrealistic.

push down and pull out to release

spring or sheet metal to hold strap attachment?

Polished stainless steel

Herring-bone pattern

"regular" loop

fixed loop

custom quick release
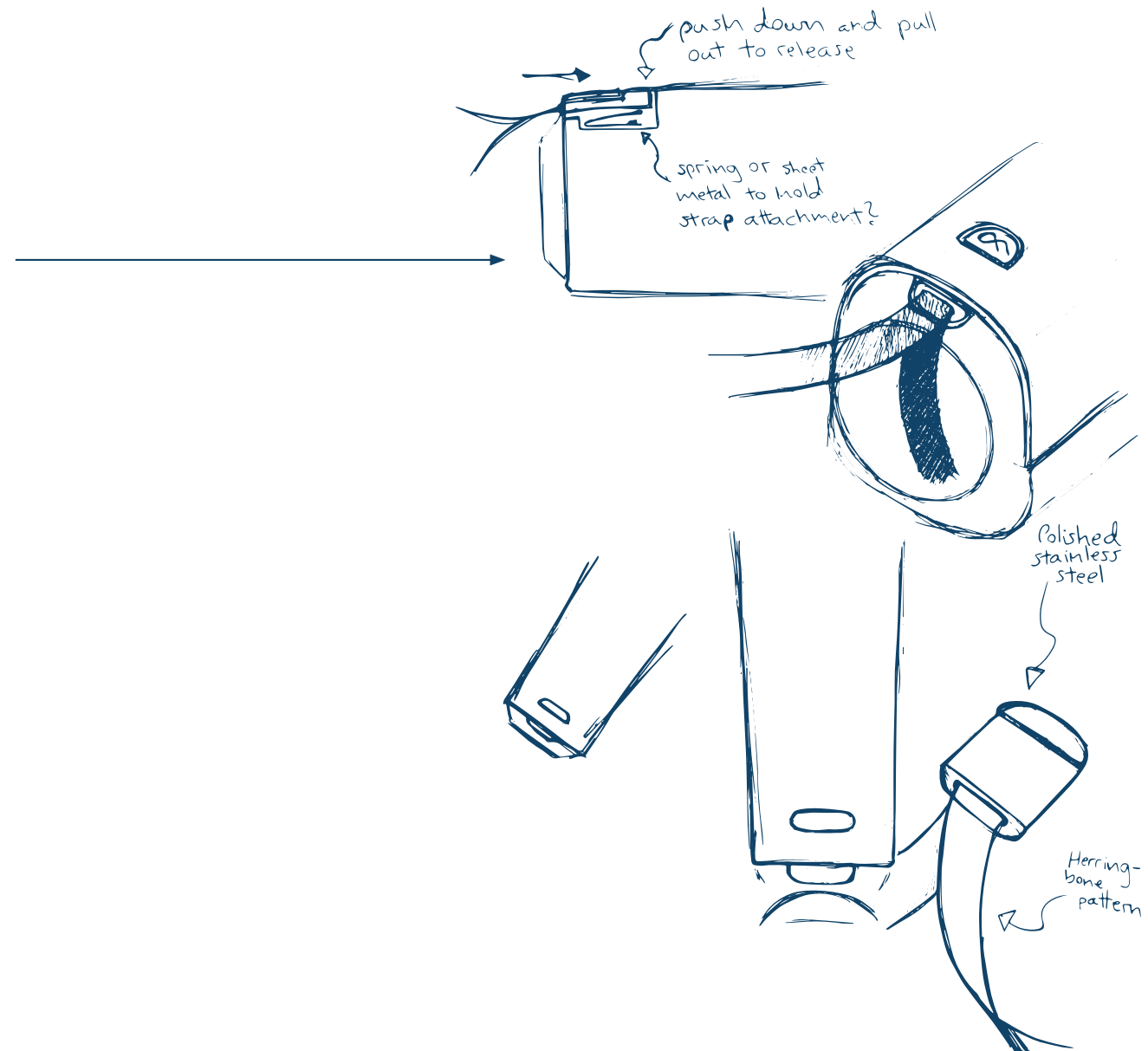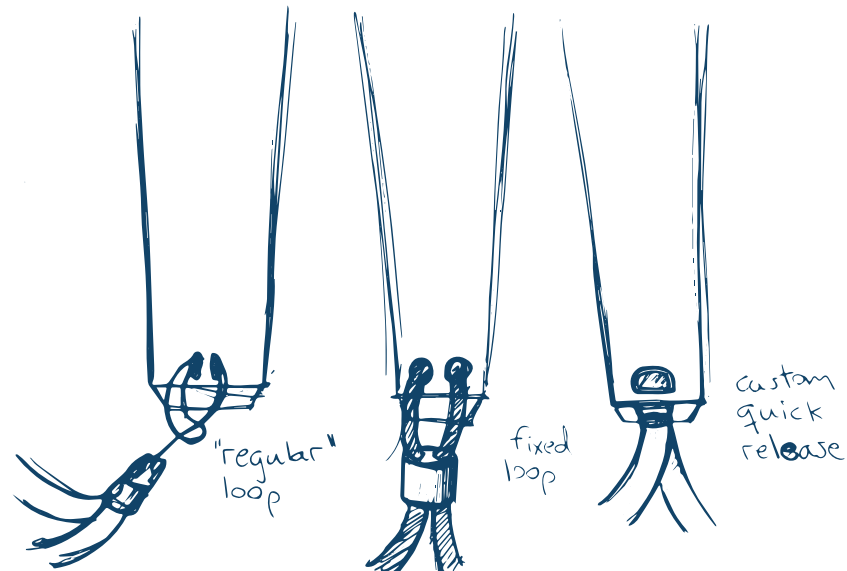
The finger groove

To improve the appearance of the finger groove, its outer edge should be tuned to match the button console of the grip. This will also give the product a more consistent look.

equal cuts

equal curvature & boundary
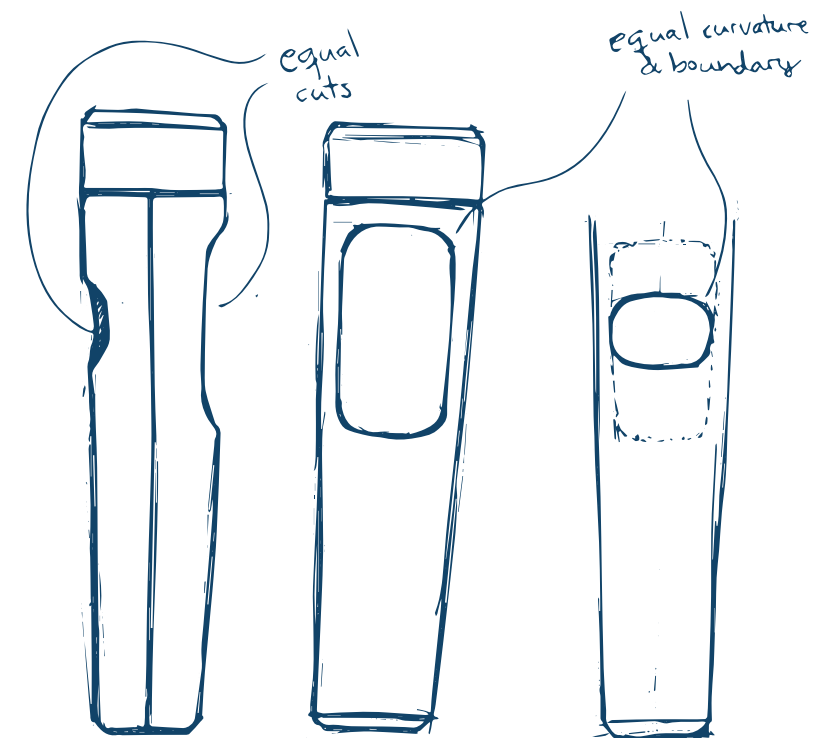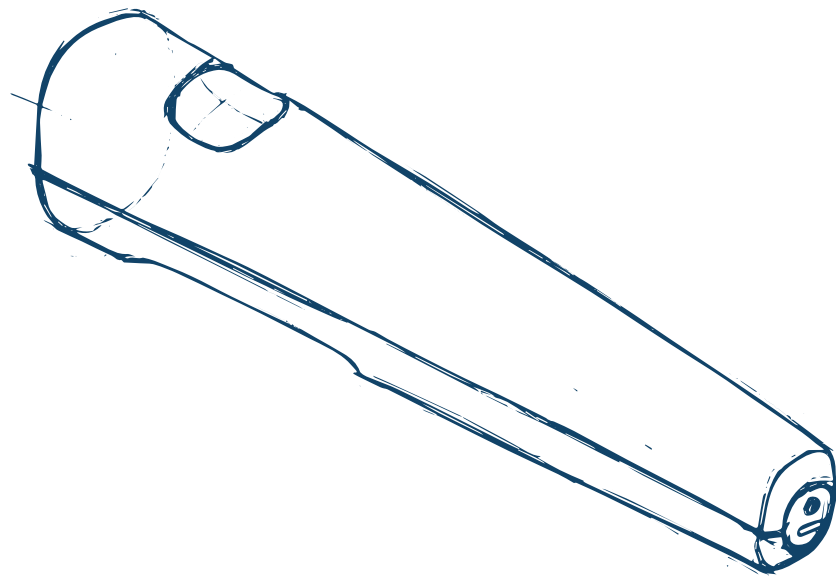
Stow lock ideas

One of the first ideas I had was to add manual locking pins between the frames, but considering the distance between the roll and the yaw frame is variable, this concept was quickly discarded.

For the feature to be feasible, the mechanism has to act directly on the individual motors or between the motor housings. My second idea was therefore to have little wedges you would slide to lock the three motors. However, realizing this would be too time-consuming to perform every time you want to use the product, I left this idea behind as well.

The most complex, or costly, idea I had was to integrate micro linear actuators outside the motors. Then, whenever the user powered the stabilizer on or off, these would automatically retract or extend. It might be feasible but will require significant amounts of resources to develop. Besides, the automatic linear actuators might also inhibit the user from balancing the stabilizer before powering it on — unless some additional unlocked state is implemented or a separate button for locking the device.

A stow lock has not been the most requested feature from users. Taking this into account, a simpler solution should be developed and tested first. As with the roll frame, I am thinking spring plungers would be suitable for this application as well.

this distance is variable

pin

Stow lock activates internal actuator in roll frame and pitch frame?

Linear micro actuator

Spring ball

Mechanical stow lock: Puts stabilizer in sleep mode
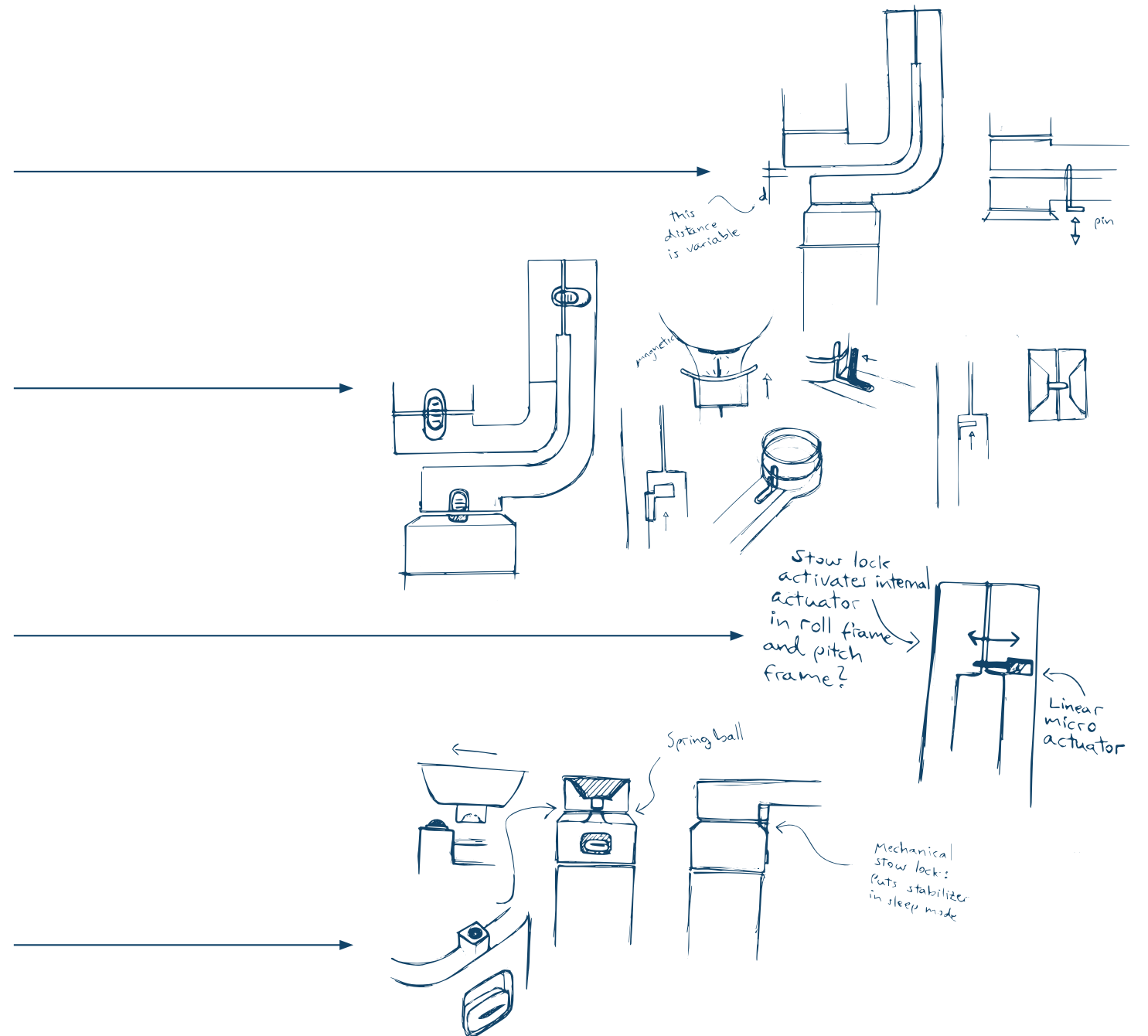
Another interface MoSCoW

Based on all the insights and feedback I have received regarding the interface of the grip, I made a final MoSCoW diagram to guide the process of analyzing and selecting functions.

Deciding what the product should do and not do is an act of balance. On one hand, I want to be sure to include enough features and the right features for the product to catch interest and feel unique, especially in the context of prospective users (Norman, 2008). On the other hand, it is equally important to reduce and simplify to ensure that owners of the product do not feel overwhelmed (Debora Viana Thompson et al., 2005, Loranger, 2015, Norman, 2013). However, simplify a product too much and it will compromise the functionality of the product, leaving users more frustrated than pleased (n.d., 2019c).

Considering the stabilizer will be a second generation product, it is more natural to include most — if not all —

of the should-functions, whereas a first generation stabilizer could pass with just the must haves. Since we are targeting the premium segment, uniqueness is important for the product to be successful (Rydal, 2018). Thus, including only the must haves and should haves does not quite cut it either. There are competitors that do this already. In my opinion, the could haves are the key to stand out. Interface functionality is, of course, only one of many ways to be different.

Generally speaking, buttons should have only one function to be as clear and straightforward as possible. With twenty-one potential functions in the MoSCoW diagram, this would be impractical, and it can make the product difficult and confusing to use. Of course, having three buttons with seven functions each would be worse.

Must

- Power ON/OFF
- Adjust gimbal position
- Reset gimbal position
- Toggle follow modes
- Record video

Should

- Capture photo
- Capture video stills
- Toggle phone orientation
- Zoom
- Enter Bluetooth pairing
- Hard reset stabilizer

Could

- Toggle cameras
- Toggle camera modes
- Auto focus and exposure
- Adjust exposure bias
- Lock focus and exposure
- Capture burst photos
- Adjust focus and exposure point
- Lock gimbal position (temporarily)
- Select tracking target
- Select start and end frames for a path

Won't

- Discrete battery status LEDs
- User programmable button
- Change gimbal responsiveness

Function analysis

As a final exercise before heading to the drawing board, I decided to write out all the functions on sticky notes and put them up on a wall. Then I shuffled the functions around as I analysed them according to frequency, risk, category and sequence. This was done to discover implications for the design, organize my thoughts, and figure out where to simplify. In this process, frequency and risk are the most important parameters to take into account, while sequence and category are secondary.

Function analysis
Frequency
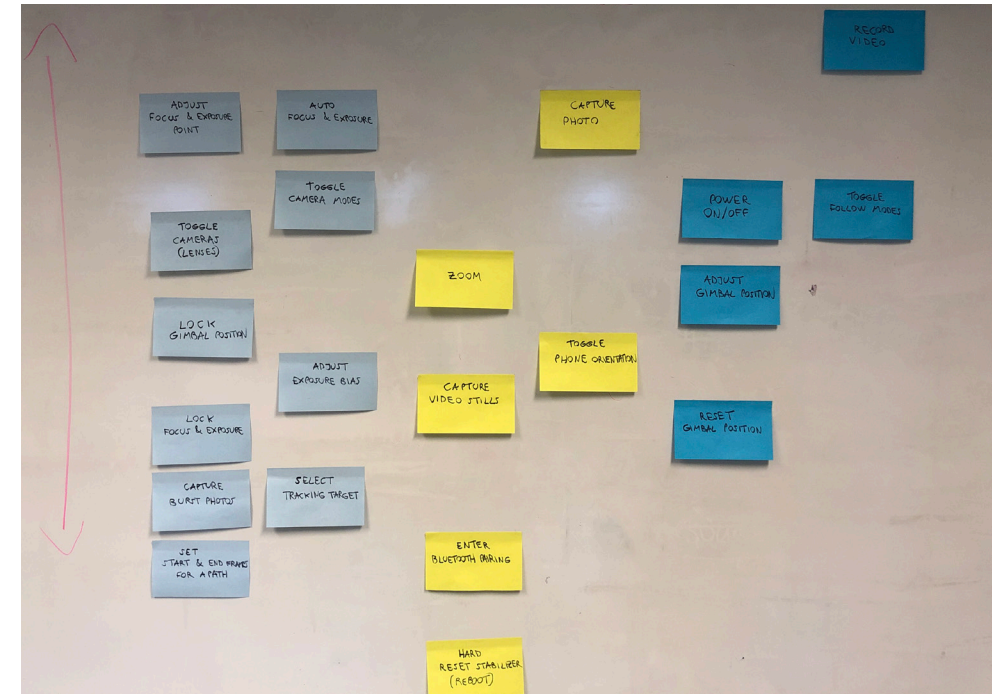
Here functions are organized based on how frequently they are used, which has been informed by interviews, surveys, app analytics, product testing, hands-on experience, and a dash of intuition.

Naturally, recording video will be the main function of the interface and should be quick to find and easy to use. In contrast, hard reset and Bluetooth

pairing are rarely done and can be stowed away to give priority to something more useful. But that is to point out the obvious. I would rather make a few remarks about the not-so-obvious.

Both the auto focus and exposure (AF/AE) and adjusting the point of interest (POI) for focus and exposure are "could haves". However, the functions are needed almost as often as you hit the

record button, which makes a great argument for including them in the physical interface. When AF/AE is a little off and needs redoing, it would be easier to do so via the grip rather than touching the screen with the phone mounted, especially since the touch can move the phone and thereby slightly shift the frame. The same goes for adjusting the POI but this feature can also end up being too slow with physical buttons. Today, many DSLRs on the market feature tap-to-focus but we still see plenty cameras sticking to the traditional buttons.

In my experience, not many users seem to know about exposure lock, which is a feature most camera apps have. However, whenever I have shown someone how to use it they have always responded positively and talked about how they will start using it. Like with the POI, it is unideal to execute on-screen while running around with the stabilizer. With exposure you often need to make further adjustment when shooting outdoor in bright daylight or high contrast environments. The on-screen control for this requires precise interaction, and there is a

risk of moving the POI when adjusting the exposure bias.

Temporarily locking the gimbal position is a quite popular feature. Although not the most frequently used, it already exists in FlowMotion ONE and a few competitors, and it would probably be a miss not to include it. Doing burst photos is very rare, but ensuring users never miss a moment is perhaps the most compelling reason to include it. As for the tracking target and setting a path these are functions that are connected to certain camera modes and follow modes. Based on this, I will remove these from the equation for now but might add them back later on.
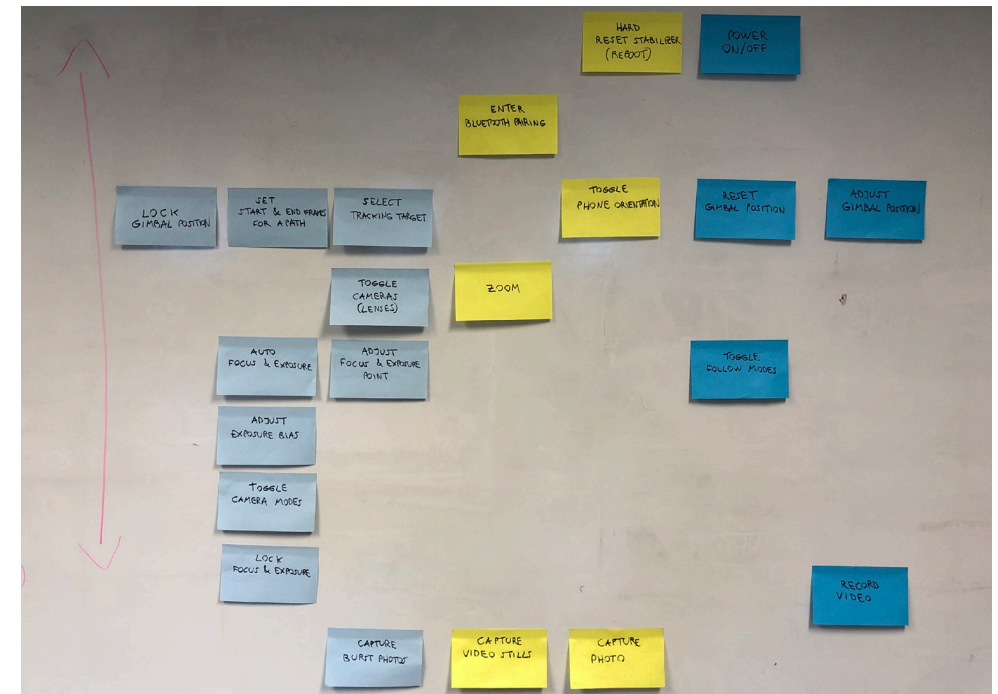
The two most important to note here are the power function and the hard reset. If untimely used or accidentally triggered the result can be quite devastating to the user. Worst case the stabilizer shuts down while recording, effectively ruining the shot, or the stabilizer gets accidentally powered on while transported in a backpack, which can break the product. With the case of entering Bluetooth pairing, the stabilizer would still be on but since it is no longer connected to the phone you would not be able to start or stop recordings from the grip, or perform other actions within the app. The third and fourth rows of functions in the diagram are also noteworthy. These functions may alter the framing of the shot or change the lens, which can also ruin the moment for the user. The other functions are less critical but, of course, frequently getting shots that are blown

Function analysis
Category

out or out of focus can be annoying.

I would like to add one comment to the placement of the video record function: I realize it should have been higher up to reflect the risk of accidentally stopping your recording before planned.

However, the key takeaway from this is to be mindful of functions that change the status and position of the stabilizer or the camera lenses.

For this part, I shuffled the sticky notes around quite a bit, trying out various ways to group the functions. In the end I settled with three main categories: 1) gimbal movement, 2) capture content, and 3) camera settings. I also have one category named system operation that includes power and hard reset. I could perhaps also have included the Bluetooth pairing here but chose to make a separate group for it, which is connectivity. In hindsight, I think the Bluetooth should belong to system operation.

Categorizing functions into appropriate clusters can help users navigate an interface more efficiently and effectively (Soegaard, 2019). Working with the interface, I will refer to the groups when clustering functions together and introducing multifunctional buttons. For instance, both video stills, photos and burst photos could be combined into one button without sacrificing clarity.

Function analysis
Sequence
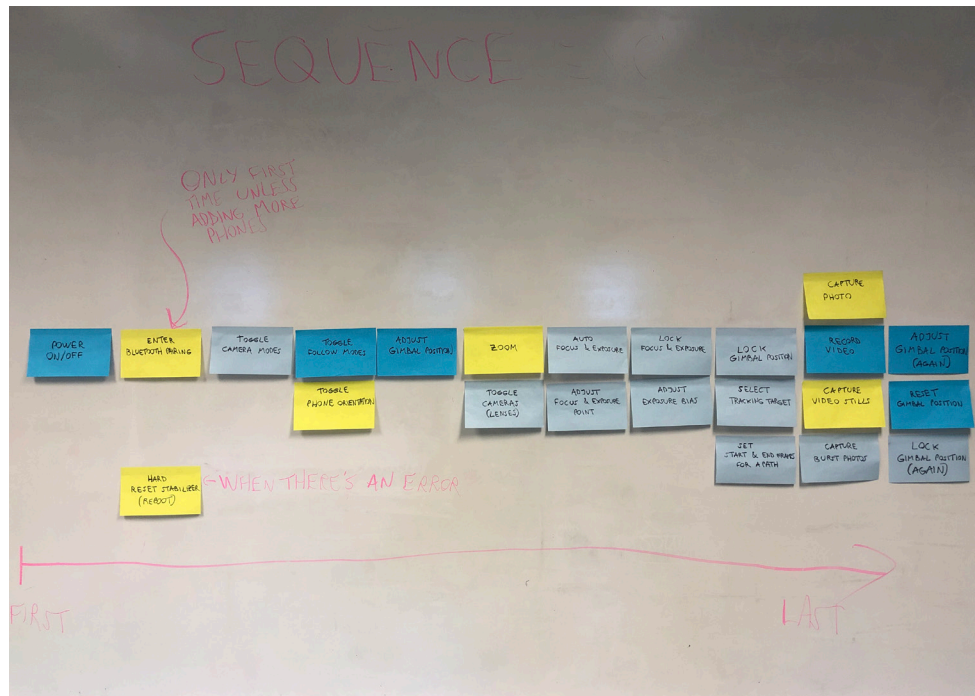
Like with the categories, the one true sequence that contains the only correct way to interact with the product does not exist. In the diagram I have made a general suggestion based on chats with users, people at FlowMotion and myself testing the product. Looking at the sequence, I feel this will be less influential for the final interface.

Function analysis
Conclusions and further thoughts

Continuing, I will attempt to include all functions from the MoSCoW diagram, except for the Won't haves, select tracking target, and select start and end frames for a path. The power, Bluetooth, and hard reset function should be placed away from the main console. Further, functions such as exposure, gimbal movement, and lens toggle should be easily accessible but not close to where the thumb naturally rests, which is right above the console or to either side. Photo capture and video recording should be prioritized and within immediate reach of the thumb. Follow and camera modes are not as frequently used and could be placed further away from the thumb's resting position.

This analysis has provided valuable insights, but I find it difficult to be more specific without sketching and evaluating individual buttons and layouts, which is the next step. Below I provide further thoughts to take into consideration when designing the interface.

Capture photo

Expands the utility and value of the product by making it a camera tool and not only a video accessory.

Capture video stills

With a dedicated shutter button, this feature is only a matter of programming.

Toggle phone orientation

This feature was readily tested and confirmed throughout iterations one and two.

Zoom

Some users are strongly in favour of this feature, including both prosumers and beginners, while others do not seem to care for it, which is an argument for skipping it. A reason to include it is the fact that the quality of smartphone cameras have improved drastically in recent years, which makes it more useful.

Enter Bluetooth pairing

A necessity if a user wants to connect the product to a friend's phone or a new one.

Hard reset stabilizer

A failsafe for any unpredictable errors. In Flow-Motion ONE, you could simply pull out the battery to prompt a hard reset. Since the battery is not removable in the new product I need to implement this function in the interface.

Capture burst photos

Similar to grabbing video stills, this can easily be implemented with a dedicated shutter button and some programming.

Toggle camera

Most phones today have at least two cameras — one on the back and one in front. Having this feature makes a lot of sense if you think about the new ways of sharing content, such as Instagram stories and live streams, where the creator is often switching between filming himself or herself and the surroundings. Besides, this feature is cumbersome to control with touch gestures while the phone is mounted.

Toggle camera modes

As with the case of toggling cameras, switching between modes such as video, photo, and time-lapse is also impractical to do while the phone is mounted. To be compatible with app updates that bring new shooting modes, the button controlling this function have to be general. What I mean by that is that the switch cannot have distinct modes indicated on the piece of hardware itself. It has to work like a continuous toggle, but that does not mean it cannot have click feedback of course.

Auto focus and exposure

Looking to DSLRs, this function could be accessed by a half-press if the interface has a shutter button.

Lock gimbal position (temporarily)

In certain situations it helps the user keep the frame and opens up for some creative shots.

Giving form to function

Since users spend most of their time with other products, designers can make interfaces easier to decode by paying attention to conventions found in similar products for which the user might already have existing ideas of how to operate, so-called mental models. If the form and function of a new product correspond with something people have previously used, it is likely they will know, or think they know, how it works even before trying it (Nielsen, 2010, Benson, 2019, Ko, 2018).

In my case, the camera industry is perhaps the most relevant to look to. Take the record button for instance. There seems to exist an industry agreement that it should be circular with a red dot on top. Most of the time it can be found somewhere in the right upper quarter of the camera body, seen from the back. Here, the red dot is really what tells which function the button performs. In the case with camera modes, the only

rational design seems to be a rotating dial with hard, discrete stops for each mode. This one is usually located on the top of the camera, to the right somewhere.

Another aspect to consider is mapping, or natural mapping to be precise. When designing the interface it is important to keep in mind the relation between the input method and the system output, which can have a huge impact on peoples understanding (Norman, 2013). For instance, the following image of a car seat control in a Mercedes is a great example of interaction design with a clear conceptual model and natural mapping. To get more support in your lower back, you simply push forward the lower part of the button resembling the back support of the seat.

On the following pages you will find sketches and ideas for the buttons and functions making up the interface.

«Users will transfer expectations they have built around one familiar product to another that appears similar.»

— Scott Benson

Giving form to function
Power button

As mentioned, the button for powering the product on and off needs to be secure enough to not accidentally be activated while in a backpack for instance. For that reason, I think a switch-style button is the way to go.

I am thinking Bluetooth pairing and/or hard reset could be implemented somehow in this button, or in a combination with this button. The hard reset will almost never be needed — if the firmware team gets it right — and does not have to be easily discoverable. Bluetooth pairing should be discoverable and understandable just by looking at the interface.

Combined switch and slider

Press and hold for Bluetooth

Slide to power

Springs loaded

OFF

OFF ON

Slide and hold for Bluetooth

Press to power

Not very secure locked

Basic switch

OFF ON

What about the stow lock?

Add sleep function?

Three steps switch

SLEEP = off but not locked

OFF SLEEP ON

Too easy to enter Bluetooth pairing

OFF ON

Knob with Bluetooth push button

N°
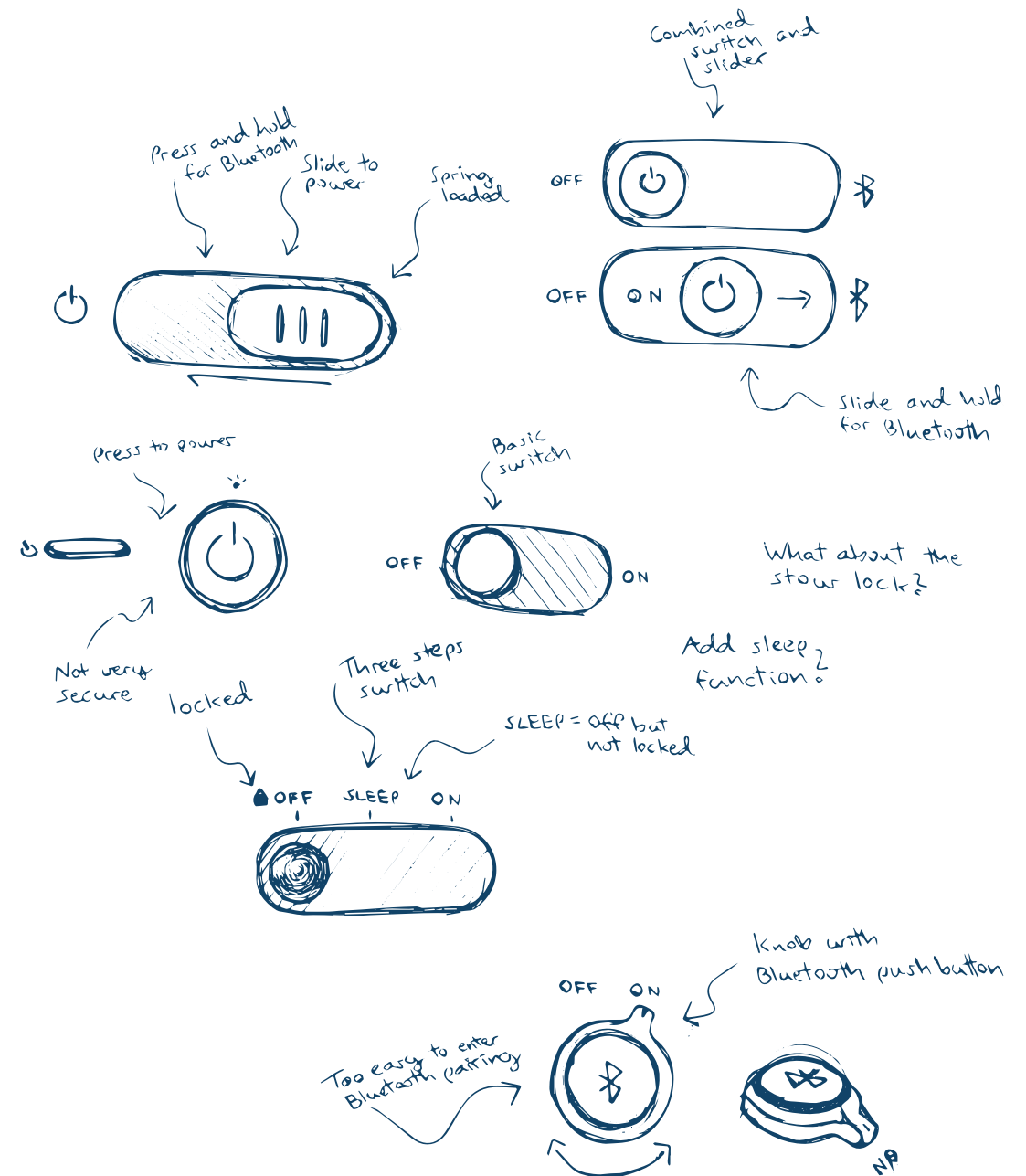
Giving form to function
Gimbal movement and more

In the fifth user test, I argue why I think a directional pad is the best choice for moving the gimbal. Another point to that end is that d-pads can include more functionality than joysticks and thereby possibly bring more value to the user. For instance, d-pads on cameras often contain shortcuts to settings such as exposure and timer.

Now, there are still many variations of a d-pad, all with different advantages and disadvantages. Some include a rotational dial while others have a fifth center button in addition to left, right, up and down. All these are common in cameras today.

Looks like Playstation controller

Easier to feel the directions?
Hard to distinguish middle buttons?

Lock exposure?
Lock movement?

Toggle orientation

Toggle cameras?

Looks very busy

Debossed? Embossed? Silk screen?

Press and hold to move up/down left/right

Regular click to use camera settings etc.

Strange design

Middle button is easier to tell apart

Difficult to feel the directions?

Giving form to function
Shutter and record button

Considering the value a discrete shutter button would bring to the product, I have decided to include this along with a record button for videos. The shutter can host photo capture, video stills and burst photos. In addition, it could also have half-press to trigger AF/AE, which would be very much in line with what you would expect to find in cameras today.

In cameras, the shutter button is usually quite a bit larger than the record button. Since the primary purpose of the product is videos, I chose not to follow this convention.

Red dot for instant recognition

Buttons need to be raised for better tactility

Ia

Does not work well with gloves

Rounded chamfer?

slightly domed

Radial surface pattern for added tactility?

Chamfered

Chamfer or not?

7-8mm?

Full press to capture photo or video stills

Half-press to refocus and expose

Press and hold for burst photos
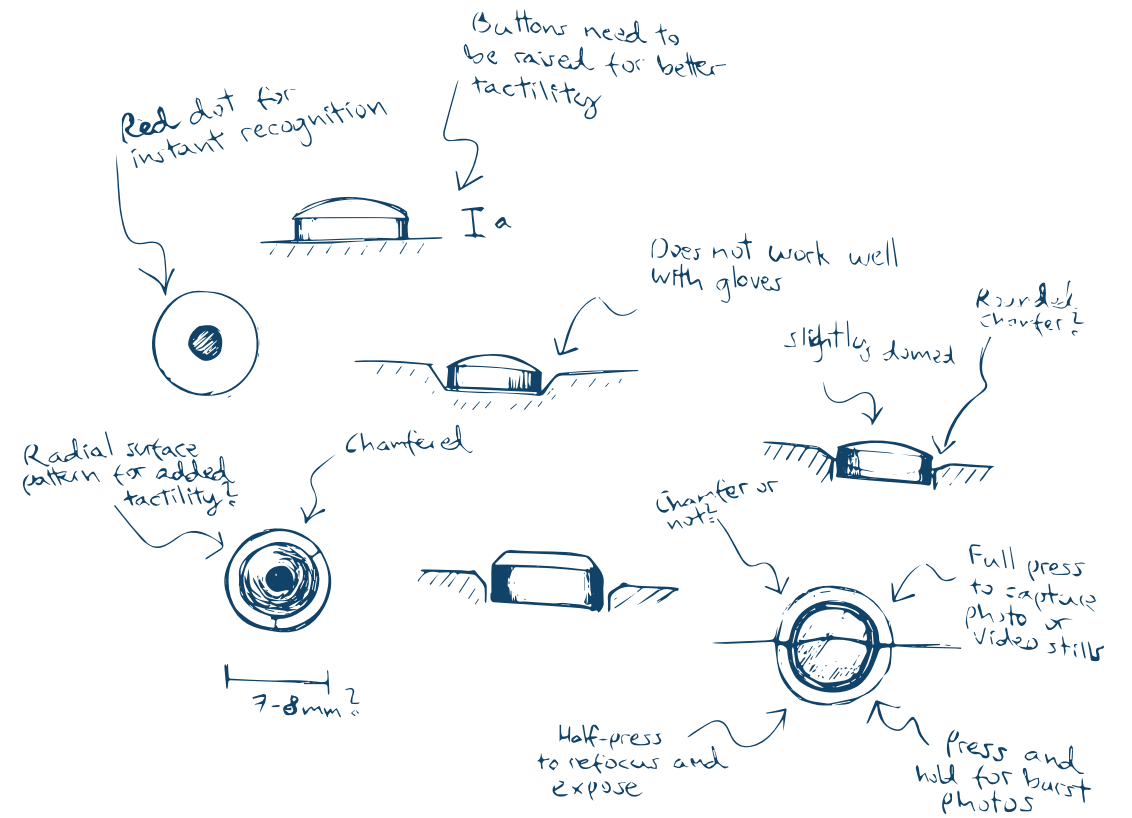
Giving form to function
Follow modes, camera modes, and zoom

For camera modes, a rotating dial is the most true to the convention in DSLRs but it requires significant space for it to be usable. And it can be difficult to operate in situations where you only have one hand available to both hold the grip and interact with the buttons. A two-way slider can work with less space but the mapping might suffer with this choice. Let us say we have a horizontally oriented slider on the grip. Then the camera mode menu in the app should rotate when the phone changes orientation in a way that ensures the menu always stays horizontal with the physical slider on the grip. In my experience, the rotation of a knob is less constricted by the phone's orientation, and is possibly a safer choice when it comes to coordinating the mapping between the control and the app. With a push button the link between the downward press and the change of modes is somewhat unclear, unless you introduce a fancy pushthrough animation in the app's interface. On the positive side, like a rotating dial, it is not constricted by horizontal or vertical orientation.

Follow modes are different. The function itself has no direct link to DSLRs as they appear only in the gimbals sometimes used with various cameras. As far as I know, there are no strong conventions for follow mode controls in either DSLR stabilizers nor smartphone stabilizers. Although some users enjoy the mode switch of the DOBOT Rigiet, this is not a realistic option. At the moment we are looking at five potential follow modes, but this might change over time. Thus, a fixed switch is not future proof. Perhaps an argument for using a push button is the fact that FlowMotion ONE, the first generation product, also has this. Of course, mapping, orientation and space are all relevant in this case as well.

Both a two-way slider, a dial and a scroll wheel are potential candidates to host a zoom function. Where a dial for follow modes or camera modes should have clear, incremental steps to indicate a change, it is important that a zoom control has smooth, continuous turning to not degrade the video recording.
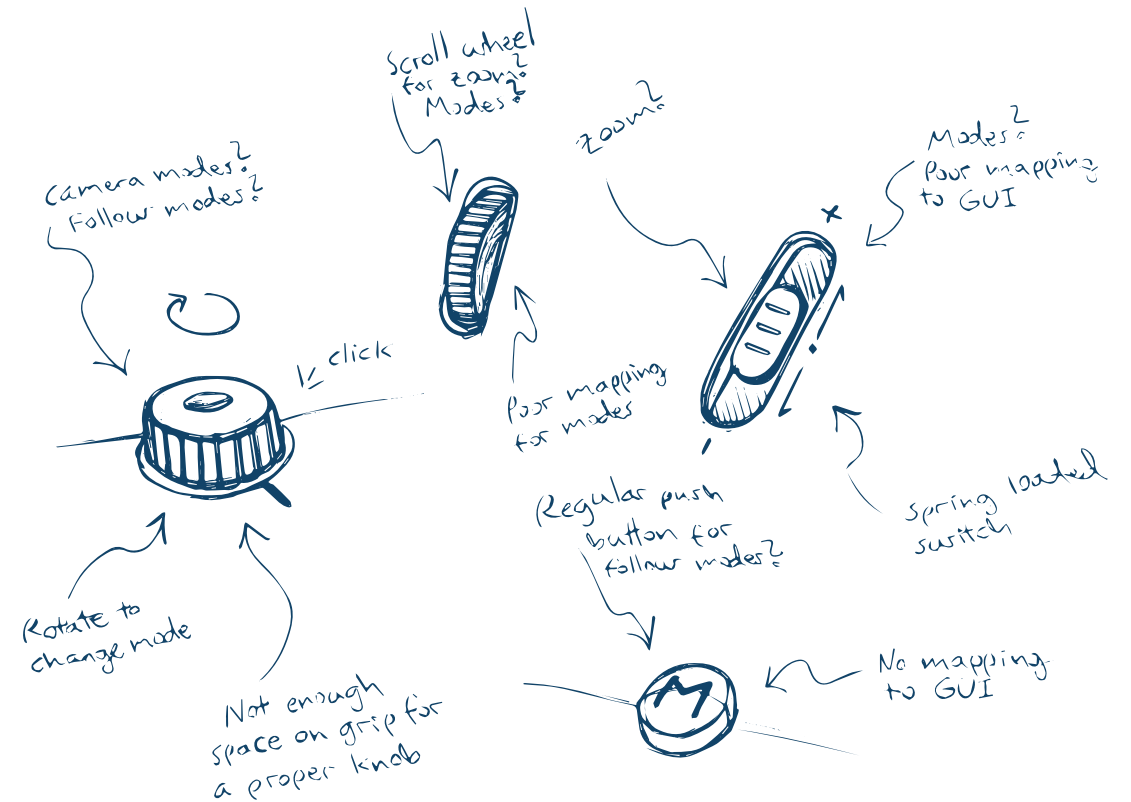
Giving form to function
System LED

In FlowMotion ONE there are six LEDs; one for power status, one for recording, one for Bluetooth and three for battery levels. This is quite a lot, and more than necessary. The number of LEDs increases component costs, complicates production, and takes up precious space for little gain.

Considering the product will always be connected to the phone and display the battery status in both the system OS and the app — even when it is powered off, at least on Apple devices — discrete battery LEDs are hardly necessary. Besides, you do not need to know the battery status at all times; you need to get feedback when it is of importance, i.e. when the level gets low, when it is flat and when it is fully charged. With the Bluetooth pairing, you only need to know that it is active once you enter that specific mode. For recording videos, the feedback on-screen is more than sufficient.

Making sure users feel informed and in control by giving clear feedback about the status of the product is critical. However, it is also important not to give the user information he or she does not need in any given situation, to simplify the system and mental load. To conclude, this means that only one LED will be used in the new stabilizer's interface.

Digital mockups

Next, I wanted to try out alternative layouts for buttons to see how everything might come together, working with the constraints of the grip. In doing this, it was a key to have the buttons and the grip to scale and proportional to each other. I also needed a flexible way to quickly shuffle around and swap out buttons. I figured the most efficient way to do this was with digital mockups using rough illustrations and images in Illustrator. The focus of this exercise was primarily on the logic and the usability of the interface, and not so much the aesthetic appeal.

Working with the digital mockups it quickly became clear that space, or rather the lack of space, is a challenge. Further, it is not an option to have an overwhelming number of knobs and buttons, regardless of available space. For those reasons I have tried to look at ways to combine functions that are meaningful and clear, while not going overboard with multi-functional buttons.

While making mockups of the interface I discussed the different concepts with FlowMotion. I have included both their feed-back and my own thoughts with the sketches.

Digital mockups
Console 1

LED for status and feedback clearly visible but not in the way

Core functionality in the most reachable area

Confusing with double functionality?

Same as FlowMotion ONE — too many functions in one button?
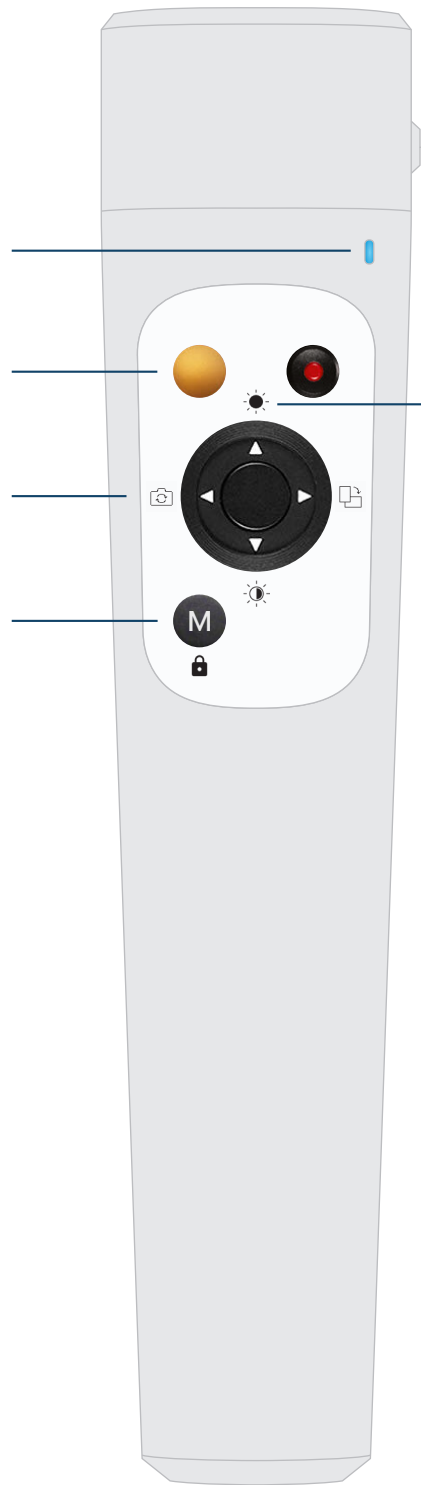
Icon is too close to the other buttons

Are icons necessary?

Unconventional? Better suited for left handed users

Can it be mistaken for a zoom wheel?

Zoom function or camera mode toggle — what brings more value?
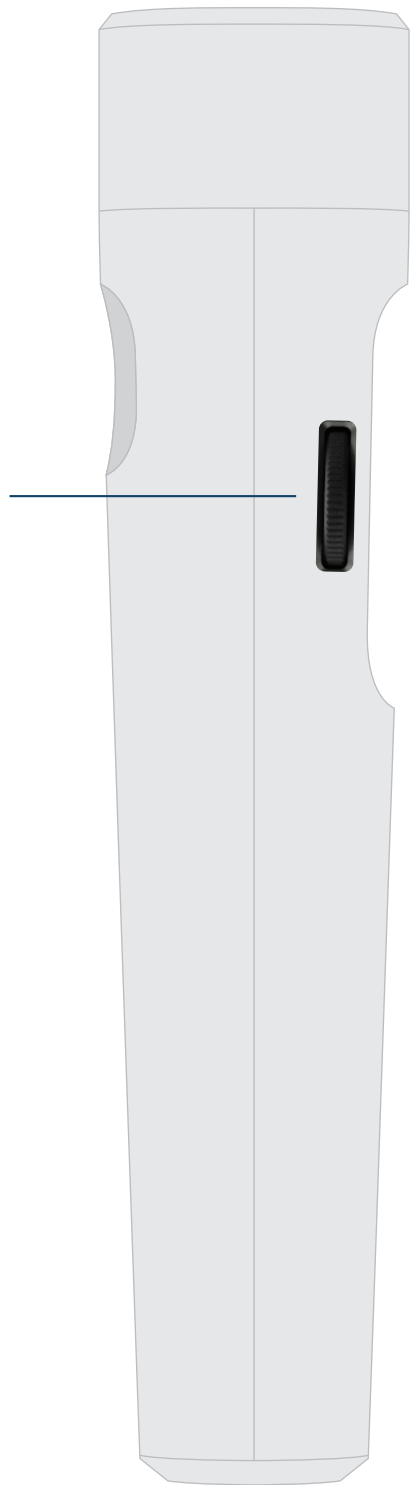
Shutter button
Half press for AF/AE

Full press for photo or video stills

Press and hold for burst photos

Record button
Press for videos

Follow mode button
Single click to toggle modes

Double click to reset position

Press and hold to temporarily lock position

Camera mode dial
Scroll to toggle camera modes

Exposure up

Toggle lenses

Toggle orientation
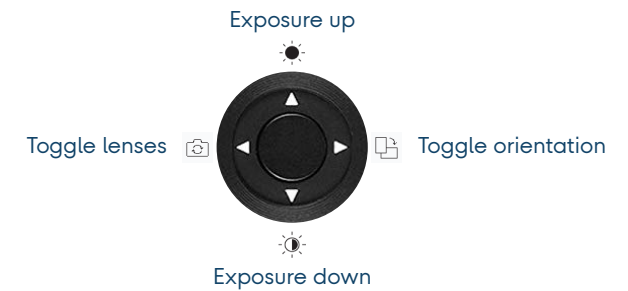
Exposure down

Directional pad
Press and hold to move up/down/left/right

Click center to lock/un-lock exposure

FURTHER WORK

Digital mockups
Console 2
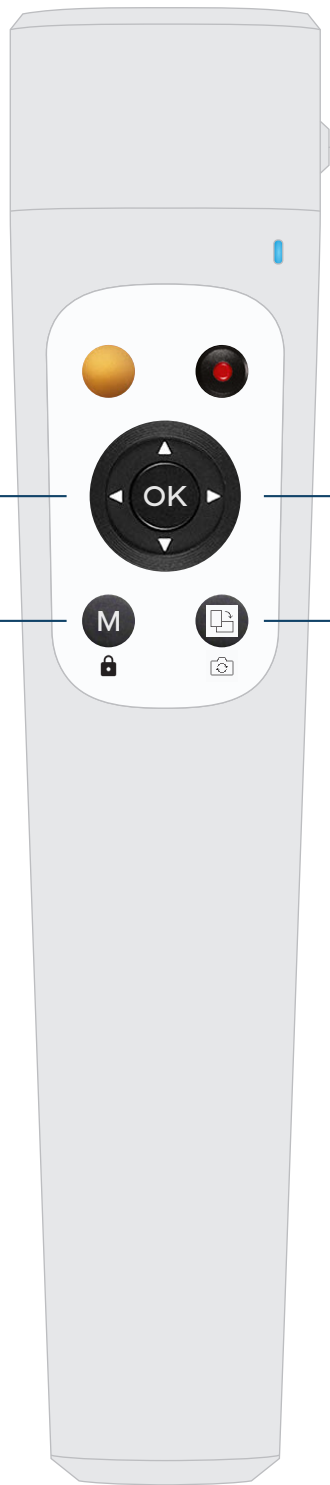
Move "gimbal position reset" to d-pad instead of follow mode button

Makes more sense to only have follow modes and locking together, without reset position

Letter "M" could be mistaken for "movie" or "manual"

"OK" label is confusing unless the button is for navigating a menu

Grouping these functions makes sense

Shutter button

Half press for AF/AE

Full press for photo or video stills

Press and hold for burst photos

Record button

Press for videos

Follow mode button

Single click to toggle modes

Press and hold to temporarily lock position

Orientation and lenses

Single click to toggle orientation

Double click to toggle lenses

Exposure up

Camera mode backward

Camera mode forward

Exposure down

Directional pad

Press and hold to move up/down/left/right

Single click center to lock/unlock exposure

Double click center to reset gimbal position

Digital mockups
Console 3

Dial needs to be raised, and possibly bigger, to be usable

Button spacing is too tight, especially for the center button

This dial looks crude

Lock symbol is ambiguous — it may seem like it locks the interface instead of the gimbal position

Shutter button

Half press for AF/AE

Full press for photo or video stills

Press and hold for burst photos

Record button

Press for videos

Follow mode button

Single click to toggle modes

Press and hold to temporarily lock position

Orientation and lenses

Single click to toggle orientation

Double click to toggle lenses

Exposure up

Camera mode backward

Camera mode forward

Exposure down

Directional pad

Press and hold to move up/down/left/right

Single click center to lock/unlock exposure

Double click center to reset gimbal position

Rotate outer ring to zoom

Digital mockups
Console 4
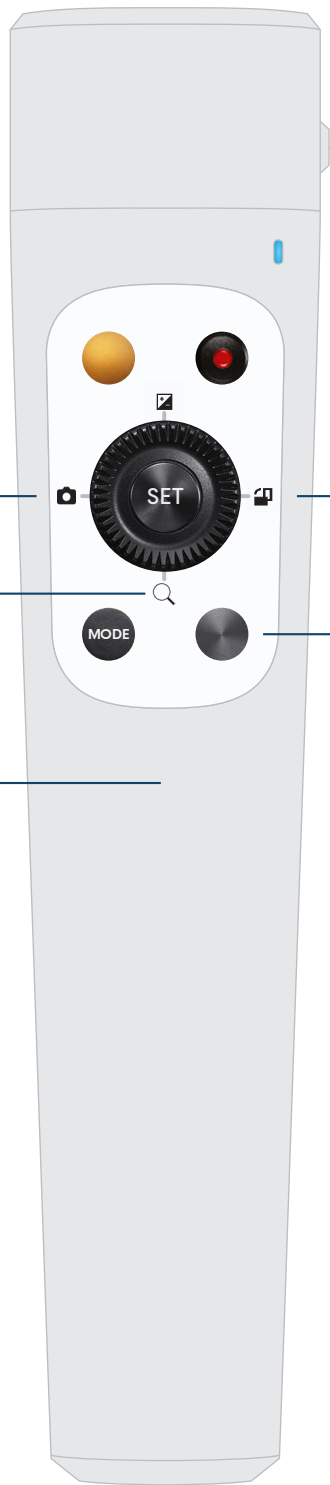
Directions are less discoverable but the four icons might help

Scroll wheel have to be stepless for smooth zooming

Not possible to toggle camera modes with this layout

"SET" label seems more appropriate than "OK"

Discrete button for temporarily locking gimbal position — it should not have this high priority

Makes more sense to have reset position in d-pad center button instead of this one, because you *bring it back to center* when you reset the position

Shutter button
Half press for AF/AE

Full press for photo or video stills

Press and hold for burst photos

Record button
Press for videos

Follow mode button
Single click to toggle modes

Lock trigger
Press and hold to temporarily lock position

Double click to reset gimbal position
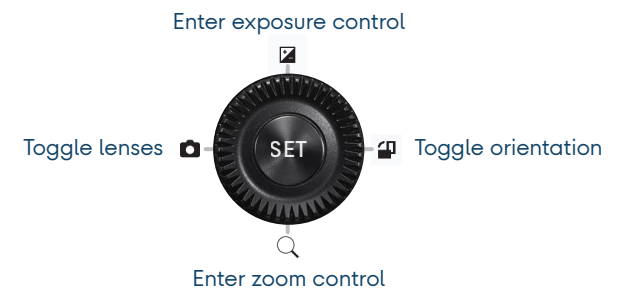
Enter exposure control

Toggle lenses   Toggle orientation

Enter zoom control

Directional pad
Press and hold to move up/down/left/right

Rotate dial to adjust zoom or exposure

Single click center to set exposure or zoom

Digital mockups
Console 5

Debossed arrowheads instead of labels for better tactility, and less visual clutter

What is the main function of the d-pad — should the icons or the arrowheads be outside the button?

Are camera mode toggle and follow mode button too similar?

"Fn" is a common label in camera interfaces

Which button should be labelled with "Fn" and which should have "MODE" — follow or camera modes?

Not possible to zoom with this layout

Shutter button
Half press for AF/AE

Full press for photo or video stills

Press and hold for burst photos

Record button
Press for videos

Follow mode button
Single click to toggle modes

Press and hold to temporarily lock position

Camera mode button
Single click to toggle modes

Exposure up

Toggle lenses   SET   Toggle orientation
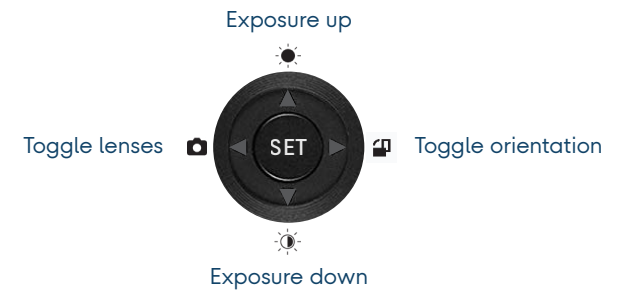
Exposure down

Directional pad

Press and hold to move up/down/left/right

Single click center to lock/unlock exposure

Double click center to reset gimbal position

Digital mockups
Power + BT 1

Combined slider with Bluetooth pairing

Placed on the side for security — to avoid accidental use but accessible enough to allow for one-handed operation

Button does not tell whether product is on or off

Easy to push in the wrong direction and mistake power for Bluetooth and vice versa?

Hard reset stabilizer should not be very accessible — but where to place it?
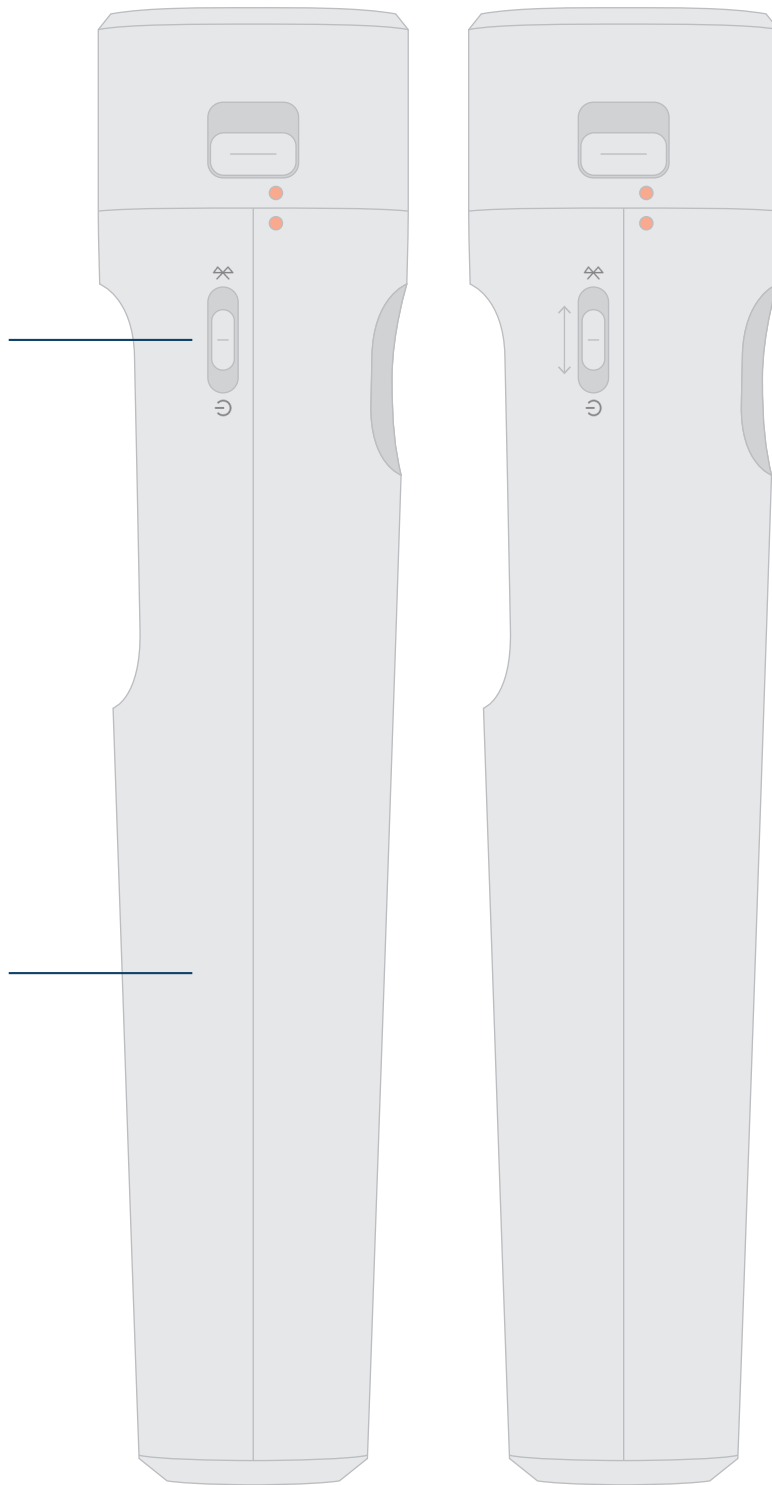
Power + BT 2

Basic on/off switch — use color to indicate state?

Press and hold to enter Bluetooth pairing when powered on — poor discoverability? But you only need it when connecting a new phone, and how often is that really?
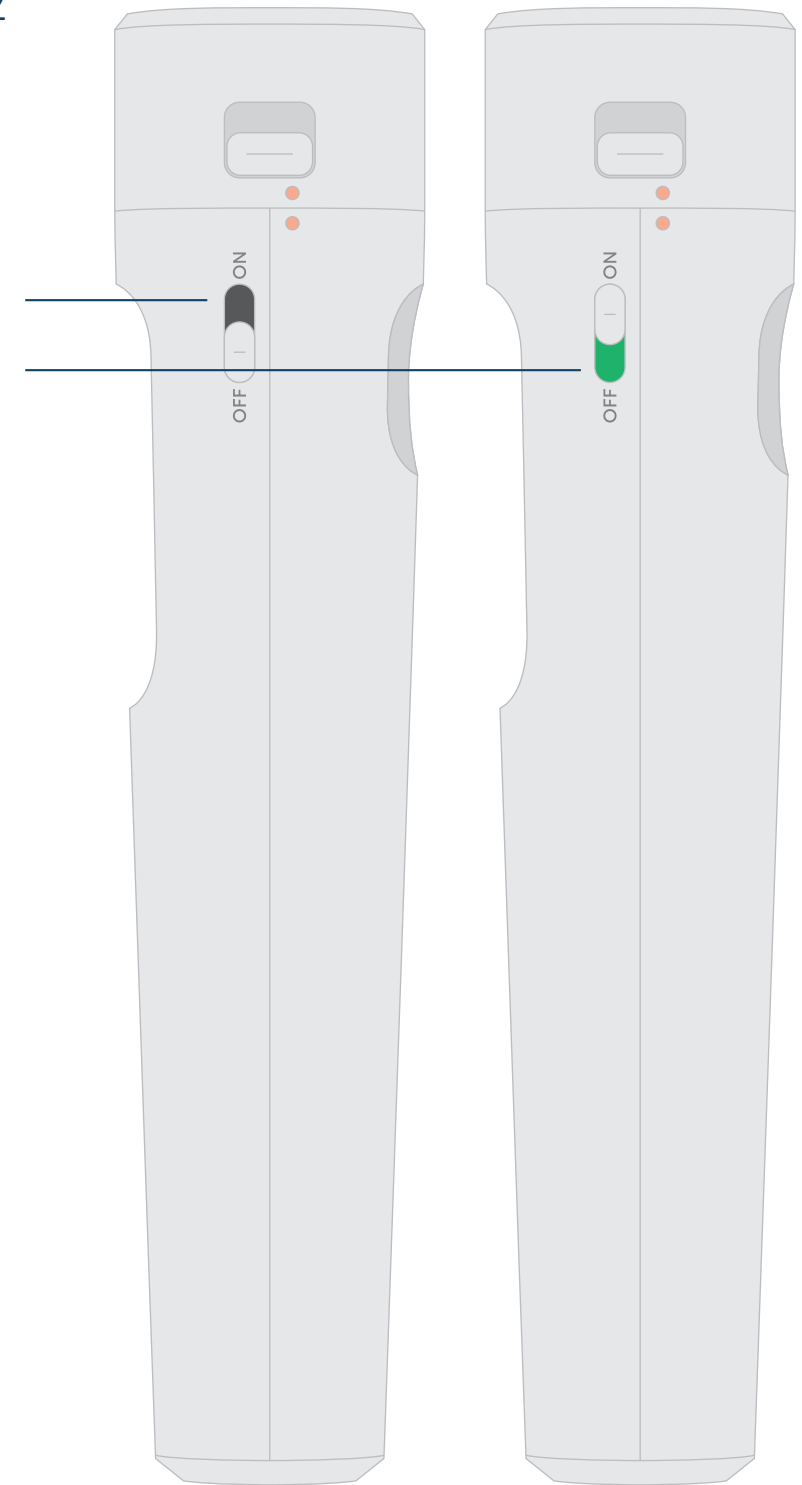
Digital mockups
Power + BT 3

Power switch with Bluetooth slider — does it make sense?

It could appear as if the switch only controls Bluetooth on/off — maybe add a power symbol?

Positioning of the colored dots is ambiguous, especially the green next to the "OFF" label

Power + BT 4

Basic power switch

Unconventional color scheme

Separate Bluetooth button — one too many?

Button is too exposed and has higher priority than what the function should have
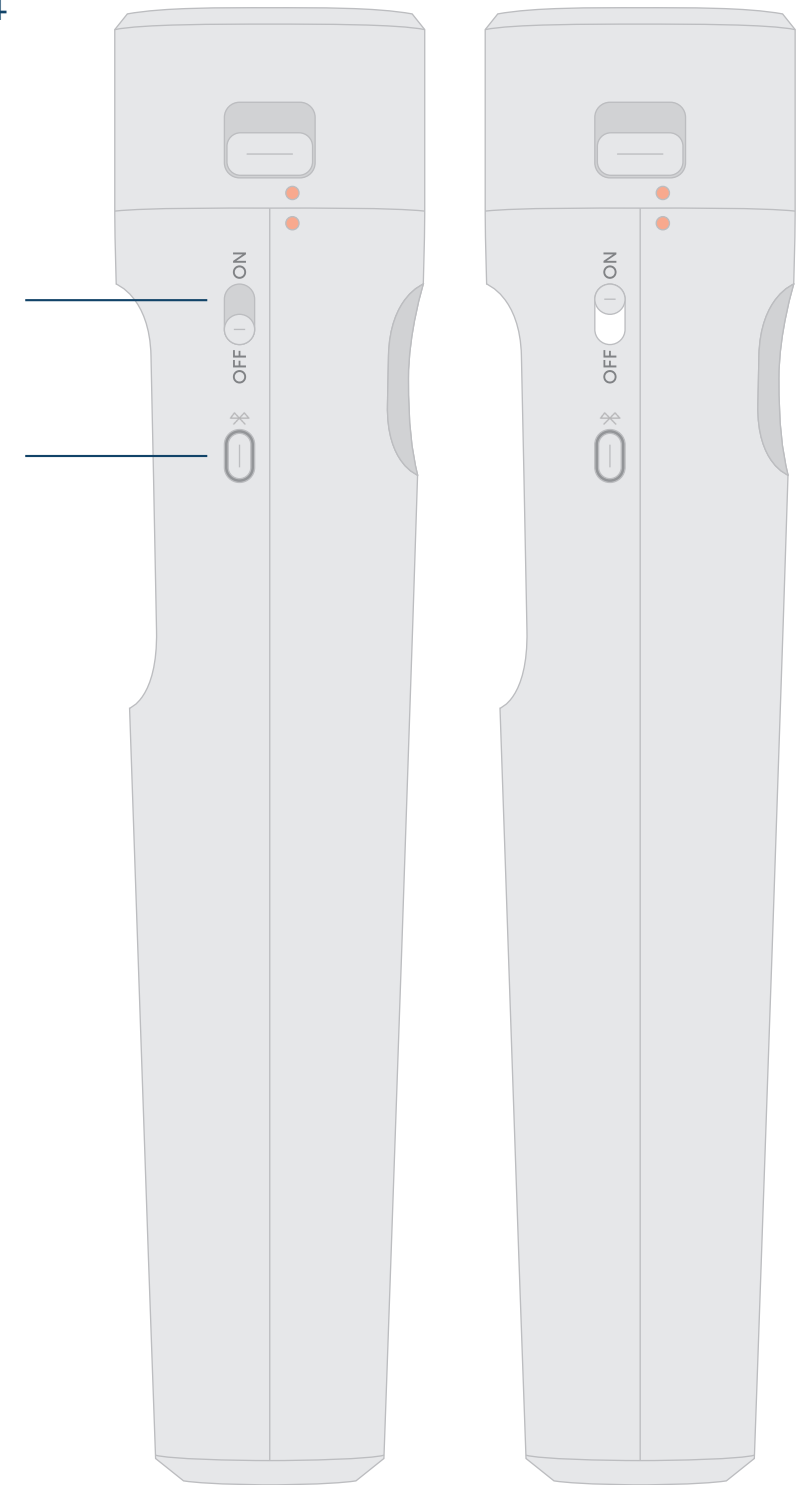
Digital mockups
Power + BT 5

Similar type of power switch with Bluetooth slider — perhaps better use of color and indication of state in this example?

Still not explicit that the button controls both power and Bluetooth

ON
OFF

ON
OFF

Power + BT 6

Is the power symbol and color alone enough to communicate what the button does and what the state is?

The green area looks like it is only partly revealed, as if the button is not successfully switched and product is not powered on

Button seems small — maybe too small for comfortable use

Digital mockups
Power + BT 7

To accommodate labels inside the slot the travel distance of the button increases a lot

OFF

ON
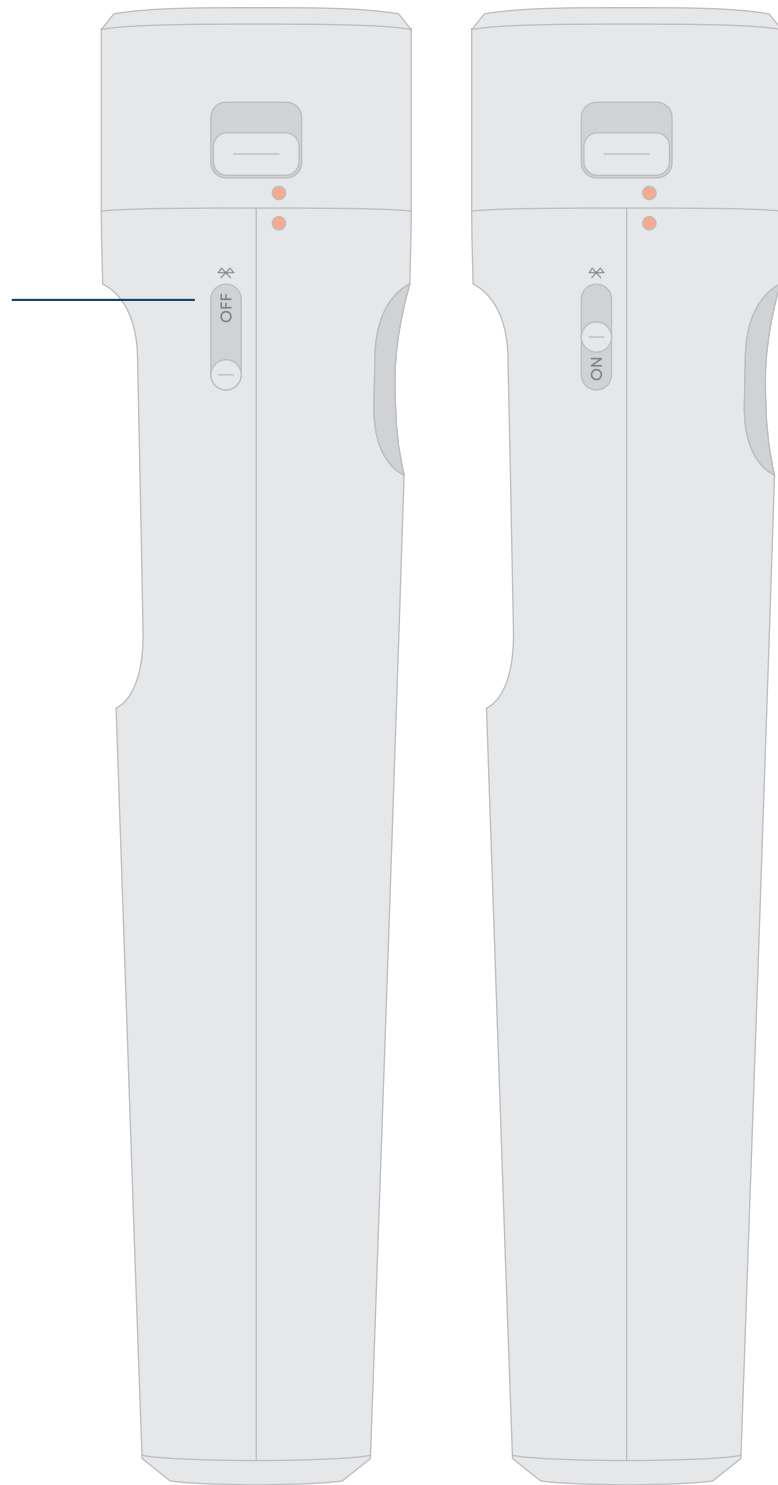
Power + BT 8

Maybe this will work

FURTHER WORK

Choosing a concept

My initial work on the interface is based on data from product reviews, customer feedback and discussions with the team. In later stages user interviews, usability theory and past experiences with physical interfaces have played a central role. Synthesizing this information and translating it to a design has been a complex and demanding task, but I believe the process has given a strong foundation for choosing a concept for the interface.

For the final design proposal, I ended up making a concept that is a mix of the ideas discussed above. I have tried to find a sweet spot between functionality and usability, as well as keeping it simple. I think the concept is a good starting point for further testing of the product, and that it reflects the insights gained throughout the project. The concept is described on the following pages using sketches and digital illustrations.

The concept includes the most sought-after functions that are needed just before or in the moment of capturing content. It seeks to meet the basic criteria of a stabilizer and further introduces new features that enable the user to reduce his or her interaction with the touch screen, for a smoother one-handed experience. The concept attempts to do so with a thoughtful layout that neither overflows the user with buttons nor complexity.
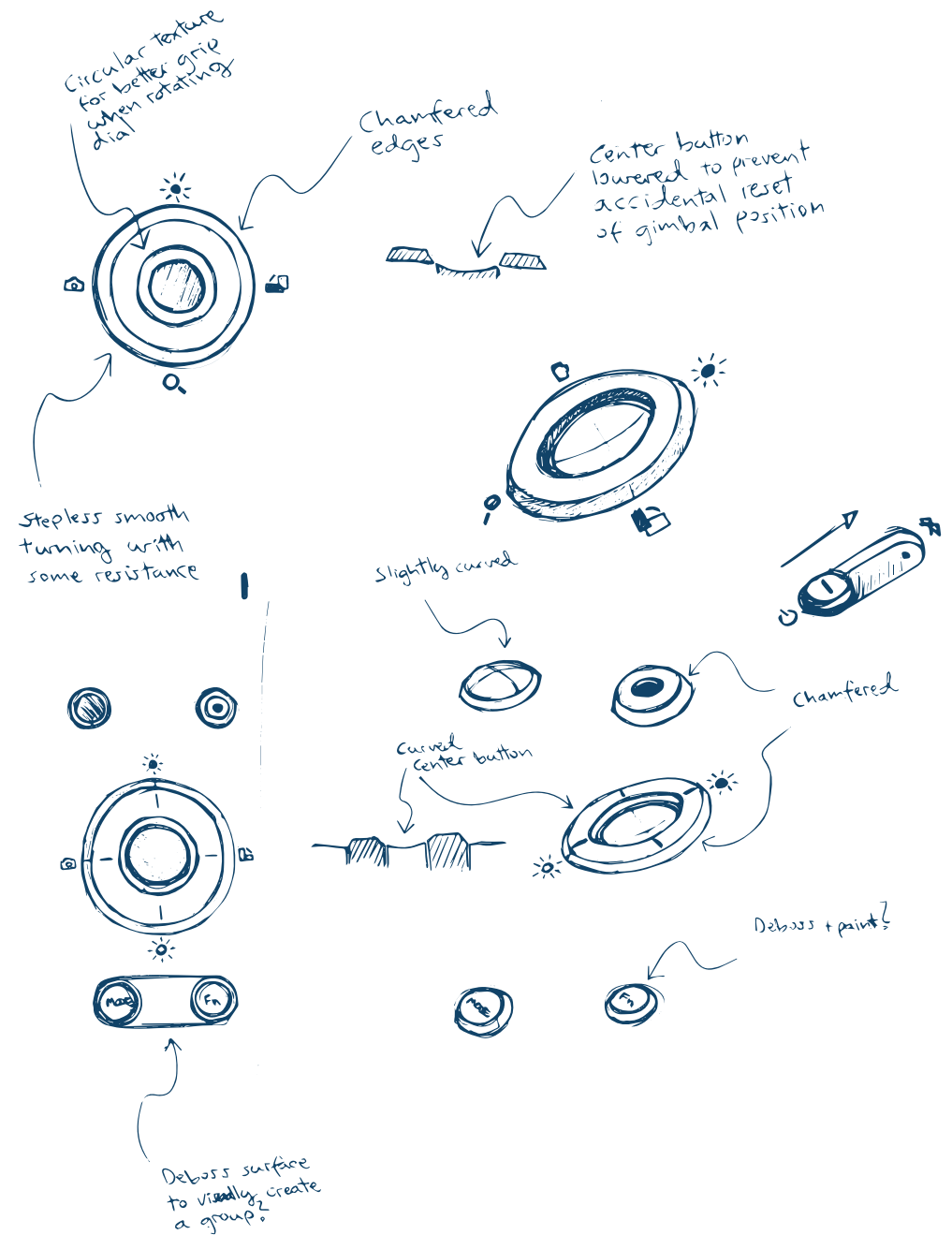
Shutter button

Half press for AF/AE

Full press for photo or video stills

Press and hold for burst photos

Record button

Press for videos

Follow mode button

Single click to toggle modes

Press and hold to temporarily lock position

Camera mode button

Single click to toggle modes

Enter exposure control

Toggle lenses

Toggle orientation

Enter zoom control
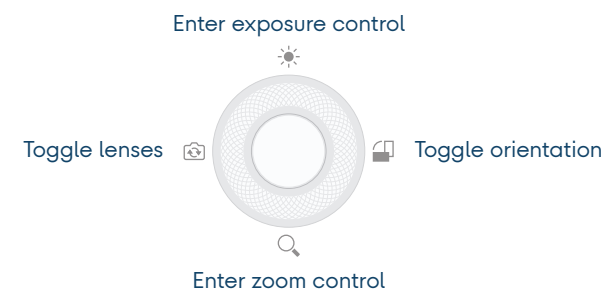
Power button

Flick right to power on

Slide all the way to the right and hold for 2s to enter Bluetooth pairing

Hard reset stabilizer

Press and hold d-pad center + Fn button simultaneously for 5s

Directional pad

Press and hold to move up/down/left/right

Rotate dial to adjust zoom or exposure

Single click center to lock/unlock exposure

Long press center to reset gimbal position

FURTHER WORK

Width: 1.3 mm
Height: 4 mm

Curved surface, up
(this button only)

Diameter: 2 mm, deboss

Diameter, outer: 20 mm
Diameter, inner: 10 mm
Chamfer: 1 mm

Curved surface, down
(this button only)

MODE Fn

Diameter: 7 mm
Chamfer: 5 mm
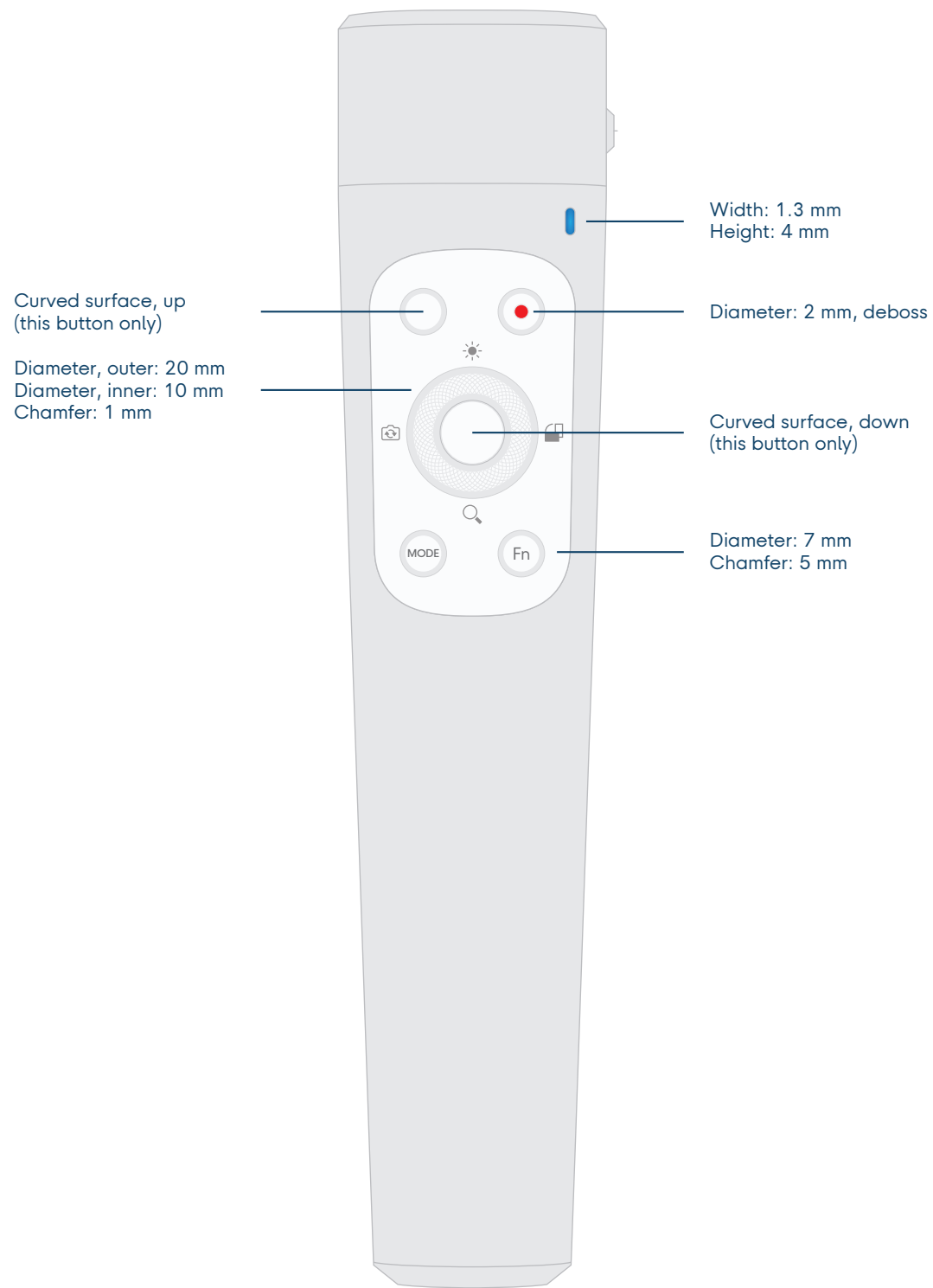
Width: 12 mm
Height: 10 mm
Radius: 2 mm

Diameter: 2 mm, deboss
Distance x: 2 mm
Distance y: 1 mm
Dome or chamfer 0.3 mm

y

T
x

Width: 4 mm
Height: 10 mm

Diameter: 1 mm, deboss

Chamfer: 0.3 mm
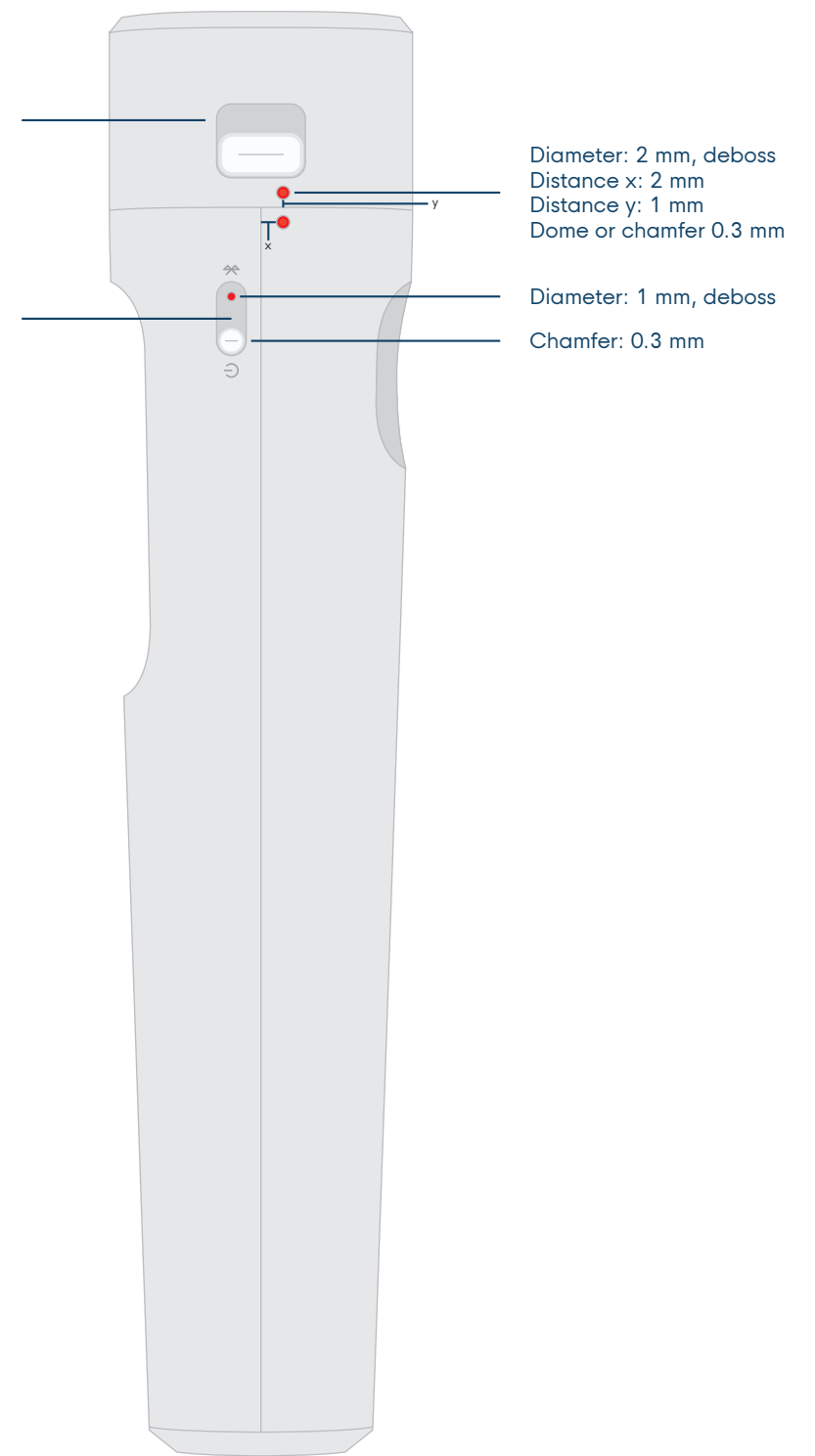
Color and material

One of my intentions with the design is to make it unobtrusive — to push the technology to the background and let the user focus on the act of creating. After all, we don't really love technology, we love what it can do for us. However, that does not translate to dull colors or the absence of color — color is also part of what brings products to life. I think there is beauty with form that follows function, and my view on color is connected to that thought. Color should be used sparingly and intentionally and is at the most effective and beautiful when it enhances function. For instance, in this diver's watch by NOMOS Glashütte the crown stem is accentuated in red to draw the user's attention if the crown is not screwed all the way in, to avoid water entering the watch case.

The stabilizer is an accessory — and not the core product — which is another reason to take a modest approach to branding and color. It should neither compete nor be in strong contrast to the phone. It should feel like a natural extension and complement the user's phone. Considering seventy percent of FlowMotion's customers use iPhones, the stabilizer should embrace familiar materiality and finish to manifest a visual connection. Of course, that is not to say it should not be a beautiful product on its own and rooted in the FlowMotion brand.

«Having small touches of colour makes it more colourful than having the whole thing in colour.»

— Dieter Rams

06   DELIVER

Putting everything together

—

Part six presents the final design of the product, concluding the previous user research and concept development. It attempts to place the product within the strategic scope defined in part four and looks at the product in a larger context.

What is the result?

To me, the result of this project is by and large the physical prototypes and the insights gained throughout the development phase, where the final design is the culmination of this process. The result tells a story of how the product came to be through close collaboration with users and FlowMotion. In this regard, the shared experiences and acquired knowledge from undertaking this project is also part of the result. On the following pages, I showcase the final design before tapping into collateral meanings of the product, such as sustainability.

FlowMotion TWO
A premium smartphone stabilizer

Unique features for a
true mobile experience

Detachable grip

Get shooting or pack down in seconds with the all-new quick-release grip. Add an extension pole or other accessories and get creative.

Quick-release phone mount

Mounting your phone has never been so easy. No more fiddling around.

The controls you need for uninterrupted shooting

Power in your palm

All the control you need right from the grip. Shoot in portrait mode at the flick of a switch. Dial in exposure and zooming on the fly. Toggle follow modes and camera modes, capture burst photos, and so much more. See the full button legend on page 333.

DELIVER

Short time to magic

One-time gimbal set-up

Set it and forget it. Balance the gimbal once and you're good to go.

Stow lock with sleep mode

Carry with ease and always be ready, whether you're in the city or on the trail. The automatic sleep mode saves power so you can capture even more.

DELIVER

Make it yours

Choose between four colorways — black, space gray, silver, and sargasso blue.

For the times you need it

Wrist strap loop

Never drop your stabilizer — or phone.

Tripod mount

Attach the stabilizer directly to a tripod for epic motion time-lapses and automatic panoramas.

DELIVER

Ergonomic grip

Redesigned from the ground up, the new grip feels better and lighter in hand — no matter if you're a lefty or righty. The grip packs up to 16 hours of battery time so you can capture all day long.

Built to last

Made from high-quality magnesium alloy. The new design brings increased dust and splash-resistance.

DELIVER

More than a stabilizer

A good way to provide more value and a holistic user experi-ence is to branch out and create an ecosystem of products — a product family. The new phone mount design means people will have to use a specific case for their phone, which opens new opportunities. The case could be designed to be compat-ible with exchangeable lenses for instance, or even wallet sleeves. Microphones, tripods, an extension pole, video lights, and travel bags are just some other products that would be great complements to the stabilizer.

DELIVER

Considerations for production

Materials

The enclosure can be made of either magnesium alloy or PPS, depending on the desired result and cost. Precision parts, such as the tripod mount, can be made in stainless steel. Buttons and smaller components can be made in either of the three materials, depending on the requirements.

Enclosure

Depending on the required precision and other factors such as cost, finish, and volume, the main parts of the grip and the gimbal can be made by either injection molding or CNC machining.

Mounts and other mechanisms

For components such as the grip mount or the phone mount, where precision is critical, CNC machining might have to be used.

Coloring

Stainless steel and magnesium alloys can be finished by anodization or physical vapor deposition. Plastic parts will be solid dyed.

Assembly

For plastic parts, a snap-fit design will cover most of the cases. Some components might require additional fasteners or glue. For metal parts, fasteners will be the main assembly method. In the case of metal motor caps, they will be threaded and fastened using a 3-prong wrench — similar to assembling waterproof wristwatch case backs.

DELIVER
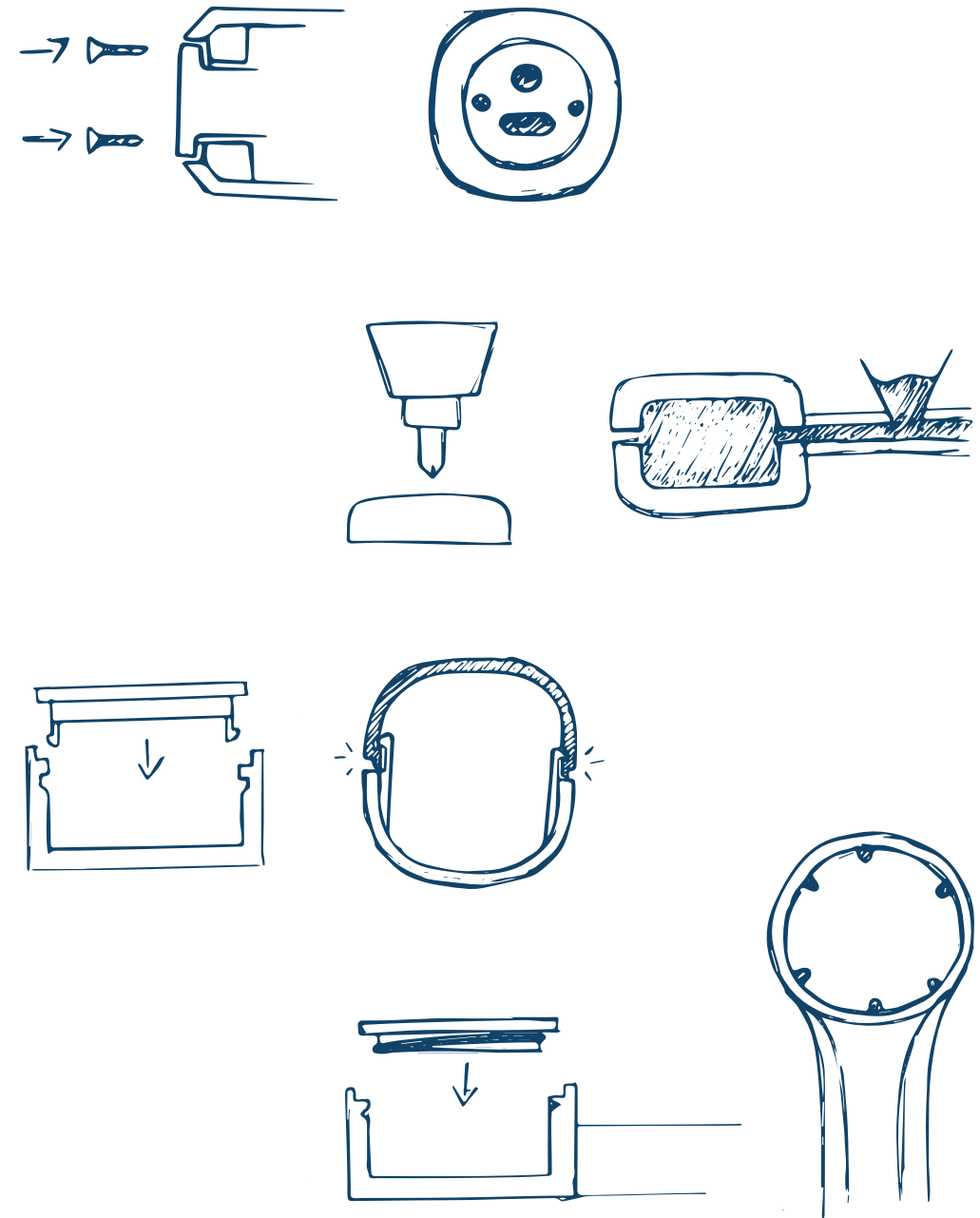
Sustainability

Producing and selling products creates pollution. Both the business and the designer have a responsibility to minimize the impact this has on the environment. Perhaps now more than ever before, businesses and consumers alike are concerned with the environmental impact of their actions and look for sustainable solutions for the future. In a global context, the stabilizer is just another thing made to delight people, and empower creative work and self-realization. I feel its only right and given that the product has a clear sustainable profile.

The biggest problem to tackle is plastic as a material, specifically virgin plastic. The environmental effects of plastic products and waste are devastating. If possible, the product should utilize only recycled plastics, and perhaps even biodegradable ones. The

initial plan was to use PPS as the main material. After doing some research on sustainable alternatives, I came across ArcBiox™ BGF30-A1, which is a bio-based composite material reinforced with biodegradable glass fiber. It has similar properties as PPS and is designed for injection molding (n.d., 2018a, LTD, 2017). Before settling on PPS, a comprehensive analysis of the ArcBiox™ material should be done. If the final product is made in a magnesium alloy instead, this should also be sourced from recycled materials.

For the finger groove on the grip, we should experiment with leather alternatives such as the apple peel based material developed by the Italian company Frumat. The material is made from apple waste from food production and polyurethane — hopefully, the recycled kind (n.d., 2018b, n.d., 2019b). So

far, I have not succeeded in getting in touch with Frumat to discuss the possibility. Another candidate is Piñatex®, which is made from pineapple leaf fiber (n.d., 2019d). In the case of using real leather, it should be cruelty-free and vegetable-tanned instead of chrome-based.

In addition to using recycled materials, the product should be designed to be fully serviceable, meaning that every little part can be repaired and replaced if needed — instead of having to replace the entire product. Smart use of snaps, hooks, and fasteners instead of permanent glue is just one of the implications this has for the design and production.

Another part of sustainability regards the social impact throughout the production. When deciding which manufacturers and suppliers to part-

ner with, FlowMotion should ensure they provide fair standards of payment, safety, and conditions to their workers.

The premium segment seems to be more sensitive to sustainability, or at least show more willingness to pay a price premium for environmentally conscious products (Rydal, 2018). This attitude should further motivate a transition to sustainable production. Finally, as suggested in the SWOT analysis, sustainability can also be useful to create uniqueness and a competitive advantage.

Packaging
The current design

Early last year, I designed the packaging of FlowMotion ONE. The packaging received great feedback. So, the quick and easy solution for the new product would be to follow the same recipe.

However, the current packaging is non-recyclable. This is due to the use of foam as the tray material inside the box and how it is glued stuck to the cardboard. I also think the packaging should have been made using only recycled materials. The black ink also turned out to be challenging to work with when designing the packaging graphics.

«Very iPhone-esque.»

«Very, very nice packaging. I really like this, it looks really cool. A lot of thought has gone into this.»

«That's a very nice box! Kind of reminds me of the old Apple boxes a bit...»

«Oh my God, the packaging is nice!»

«I wonder if it's recyclable.»

Packaging
Improvements for the new design

I intend the new packaging to be made of recycled paper and cardboard. For the tray, we could replace the foam with a paper pulp mold. The paper should be uncoated for easy recycling. The packaging needs to be protective enough for shipping, but I still want to try to minimize the amount of material used.

Heavily inspired by the packaging of INSTRMNT Watches, I think a deconstructed layout of the grip and gimbal would look exclusive and professional. This is also similar to how some DSLR camera kits are packaged. Additionally, the deconstructed layout makes it possible to size down the box, which will reduce the amount of material needed.

Further, by having the users perform the final assembly of the grip and the gimbal, they might experience a feeling of accomplishment and satisfaction and thereby an increased attachment towards the product early on. This hypothesis needs to be tested before jumping to conclusions, and, for this to work, the assembly cannot be too challenging or time-consuming. Otherwise, it can become an annoyance and harm the first impression of the product. For the packaging graphics, I consider using a light color or white for the background to make it easier to achieve consistent quality.

DELIVER

Packaging
Quick mockups

Paper pulp tray

Grip

Gimbal

Cables

Grip

Gimbal

Cables

Phone case in separate box

This design use more material ~ double walled

~2mm thickness

Product color?

Cut-aways for easier opening

Vacuum closing?

Logo mark Opening feature

Needs a sleeve to keep closed?

Name
Product graphics
Branding

Quick start guide

GETTING STARTED

DELIVER
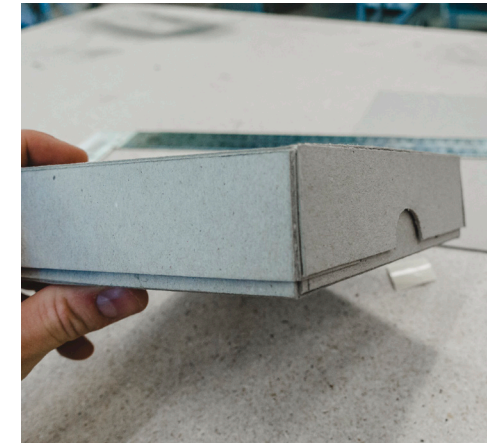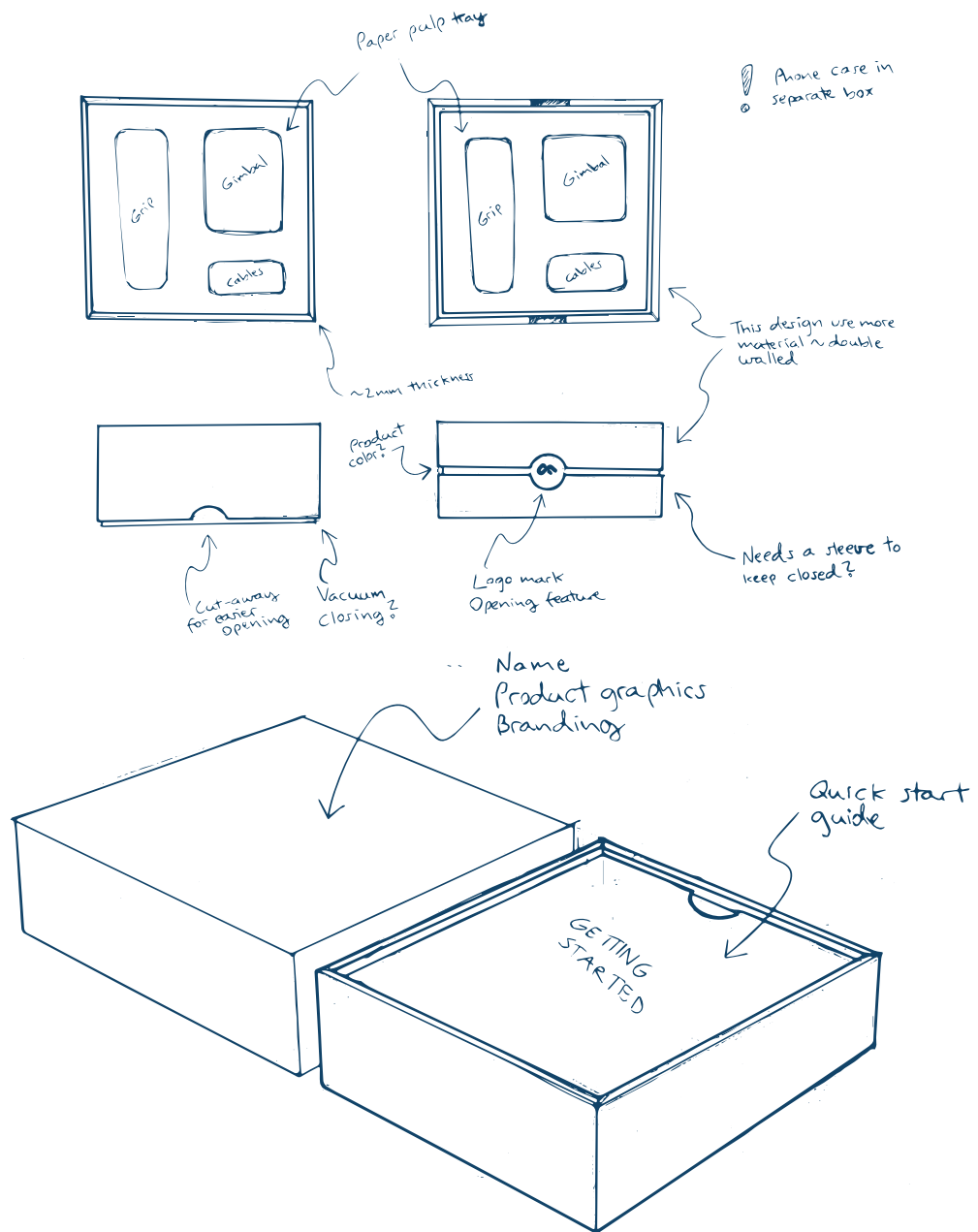
Moving forward

The next natural step would be to prototype the proposed design and conduct more user tests — especially of the roll frame design, the phone mount, the grip interface, and the stow lock. Then, depending on the results, make changes and further iterations. A low-fidelity design of the new app needs to be in place for testing the grip interface.

If time and resources allow, potential improvements to the product include an automatic stow lock, wireless phone charging, and voice control. However, these features require a lot of development and might not pay off, and could instead be saved for a future generation. Going forward, packaging concepts should also be prototyped and tested.

When the final concept of the product is decided, production drawings should be made and presented to potential manu-facturers. As pre-production runs are being done and molds are being made, product documentation and certification should be finished. Finally, the development of accessories for the stabilizer should also begin rather soon to support the value proposition relating to versatility, as mentioned in the Define phase.

DELIVER

07   EVALUATION

Reflecting and wrapping up

—

Part seven concludes the report. Here, I discuss the project from three key aspects; the product, the approach, and the collaboration. The focus is on what I have learned and gained from undertaking this assignment.

The product

Designing this product has been a steep learning curve, despite my previous experience with stabilizers. The product addresses the user needs I have discovered throughout the project and attempts to exceed expectations in what appears as the most critical aspects — interface, phone and grip mounts, ergonomy, and ease of use. Overall, I am satisfied with the result, although I had to make a few rushed decisions following the final user test.

In Discovery and Define, I discuss cultural value as a measure of the product's success. This parameter is difficult to control without contextual user testing of the product over longer periods of time. It might not be fully understood before the product is launched as the attribute depends on the people using the product, and it needs time to mature — not to mention the power of marketing and storytelling. However, I do believe high perceived qual-ity increases the likelihood of cultural value. And although the perceived quality is subjective, it is possible to monitor during product development by adopting user-centered methods.

One of the major challenges with the product was to design the interface on the grip. This is mostly due to the lack of time and resources to conduct testing of the interface. In order to confidently choose a concept, I would have preferred to perform user tests on several of the concepts described in the part Digital mockups before making any final decisions.

To make such tests a reality I would need a very flexible and modular set of prototypes that could be wired and programmed — kind of like an advanced Arduino kit. The prototypes would also need the ability to communicate with a low-fidelity camera app. As I am neither an electrical engineer nor capable of programming this sort of product firmware, I would also need the right guy from the FlowMotion team to assist me in this process. Within the time frame of the project, it has simply not been possible to pull off, as it would require quite a few weeks to set up.

Since the new app design is yet to be made, designing buttons and mapping of functions has been another challenging aspect. Particularly, this goes for the app-specific functions but also others such as toggling follow modes, which all would require some sort of on-screen menu, feedback, and animation. The app design has not been within the scope of this project. However, if there had been time to start designing the app at the same time as the stabilizer, working with the interface would have been easier.

For the purpose of finalizing the stabilizer design, I did choose a concept for the interface — a concept I believe has a lot of potential and advantages over competing products. However, I emphasize and acknowledge the need to verify its usability as part of future development. The same goes for the new roll frame design and, to a certain degree, the new phone mount. Also here, I do have confidence that the chosen solutions will provide a great user experience.

Whether it is the most lovable stabilizer or not remains to be seen. At least, I believe it brings significant improvements for the end user compared to existing solutions on the market.

The approach

The goal of this project was to design a smartphone stabilizer for the premium market. To achieve this, I chose to primarily rely on user testing and proto-typing. This decision partly comes from my intention to focus on the develop-ment phase of the project, which, in turn, originates from the well-defined scope and objective of the project. By and large, I believe my approach to have been effective and suitable for the task at hand.

I acknowledge that without these preliminary conditions, my approach might seem constricted. If the project started out with a wider design prob-lem, I would have needed to distribute my time more evenly, and especially with regards to the first two phases of the design process. Looking back at the process, I still think I would have benefitted from spending more time in the early stages and utilizing a broader repertoire of research methods.

If there was one thing I really would have liked to have done more of, it is to observe users while they are using the prototypes in context. All the user testing in phase three was conducted inside in a conference room. This has been great for testing in a controlled environment, but I believe contextual testing would have resulted in different user behavior, and, thus, enriched the product devel-opment with new insights.

Although user testing has been conducted under more or less the same conditions, there are, of course, some potential sources of error. For instance, I have not always had a perfect match be-tween my recruitment screener and the actual testers, but it has been adequate. Considering the ergonom-ics of the grip, the test participants represent a wide range of hand sizes, but one can nev-er be sure to have all nuances covered. Further, some of the mechanical prototypes have been more

attractive than the solutions they are up against, which might have influenced the users' per-ception and decisions (Moran, 2017).

Personally, I have gained a lot from this approach. I feel more confident in conducting user inter-views and test-ing now than when I started this proj-ect. With every interview and test, the process has gone smoother, and the sessions have been better and more insightful — and establishing a frame-work has been paramount to that end.

The collaboration

Collaborating with a company has had both advantages and disadvantages. As you often have with student–business collaborations, or businesses in general, there is always a challenge to balance company needs and interests with user desires — even if the mission is to create lovable products. In a student solo project there is usually more room to explore. For example, early on in the project I wanted to test new concepts for balancing the gimbal and mounting the phone because my intuition and research told me that these were important touch points that needed attention. But back then the decision was to postpone it because we already had acceptable solutions to those parts and it would have required too much resources to pursue new solutions at the time.

Of course, working with a business on a real project has given plenty of opportunities for which I am very grateful. With-

out the support, expertise and resources of the team, it would have been hard to imagine getting this far and detailed with the product development. Producing such complex prototypes by myself, with all the different variations, would require huge amounts of time. The collaboration also gave me unique access to their customer base and market, empowering me to perform a solid user driven process fueled by interviews, product testing and surveys.

Going into this project, I wanted to practice and improve my skills in conducting user research and testing, as well as conceptual development of form and function. Working closely with Eirik helped me achieve this. With his background in mechanical engineering and technical product development, I was able to devote more of my time to what the users thought, felt, and experienced, and spent less time figuring out the complex mechan-

ics of the product. As the project has progressed, Eirik's expertise in CAD and making functional prototypes has been crucial. Eirik's background made it possible to assess the viability of new concepts on the go — in terms of both financials, technology, and manufacturing — which helped the project to progress efficiently. The synergy between the two of us and our respective disciplines fostered many new perspectives and ideas along the way. I think it is safe to say both parties have seen professional growth and benefitted from the collaboration.

Projects seldom play out exactly as planned, and this one is no exemption. While I was working on the new stabilizer, FlowMotion encountered a challenging financial situation. The team had to secure more funding to keep the business running, and time was not on our side. This resulted in a conflict of interest for me. On one hand, I wanted

to invest all my efforts into the thesis to achieve the best possible result and grow as a designer. On the other hand, as part of the FlowMotion team, I definitely wanted to secure the future of my job and the company, meaning I felt compelled to put the project aside to assist the team in resolving the financial challenges. Simply put, I felt trapped. In more practical terms, FlowMotion had to be very restrictive with their resources and could no longer provide funds to produce prototypes and conduct user tests. My motivation took a hard hit from being in this situation and seeing my plans fall apart.

I chose to include these details to highlight some of the potential risks when collaborating with a startup on an extensive project such as a master's thesis, and, in this particular case, a student startup you happen to be part of.

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APPENDIX

User Recruiting Screener

Who do we want to talk to?	What *exact criteria* will identify the people you want to talk to?	What screening questions will you ask? (Questions shouldn't reveal "right" answers.)
Premium tier smartphone users	Flagship devices from the past two years from Apple, Samsung, Huawei, LG, OnePlus, Xiaomi, etc.	What maker/brand and model of smartphone do you own?
Range of ages, from 18 to 45	Quota: 2 aged 22-30, 3 aged 31-45	Age? ___
Mix of men and women	3 men, 2 women	Gender: M, F
Interested in video	Captures video clips regularly on either a smartphone, mirrorless DSLR, full-frame DSLR or industry level cameras	Do you capture video clips with your smartphone or any other camera?
Range of knowledge with stabilizers, from none to advanced	Quota: 2 beginner, 1 average, 2 advanced	Are you familiar with camera and/or smartphone stabilizers? Yes/No How would you rate your experience/knowledge with stabilizers? Beginner/Average/Advanced
Social media users	Use social media platforms (Facebook, Instagram, YouTube, Twitter, etc.) on a weekly or biweekly basis	Do you use social media? Yes/No If yes, how often? ___
Mid to high range of educational background. Don't skew too highly educated.	Quota: 3 with at least some college, 2 with graduate degrees (masters)	What is the highest level of education you've completed?

Who do you want to exclude?	What *exact criteria* will identify the people you want to exclude?	What screening questions will you ask? (Questions shouldn't reveal "right" answers.)
Non-smartphone users	Don't own a smarphone	Do you own a smartphone?
Minors	<18 yrs old	Age? ___
Little to no interest in capturing video	<1 video clip captured per month	Do you capture videos with your smartphone? How often?
Unusually technical	Work as eng, PM, market researcher, etc.	If you're currently working, what is your occupation? ___
Work for companies related to smartphone stabilizers, smartphone accessories or mobile photo/video capturing	Work for Moment, DJI, FeiyuTech, Olloclip, Belkin, or similar, or hardware retailers	If you're currently working, who is your employer? ___

Sample User Research Questions

Types of Questions for Discovery Research

- **Specific Examples:** Who did you call from your cell phone yesterday?
- **Complete List:** What are all the payment apps on your phone? Are there any others?
- **Activities:** What do you typically do to get ready for a trip?
- **Reenactment:** Please show me exactly how you do that.
- **Sequence:** Please walk me through a typical day. How do you start? And then what do you do next?
- **Inputs and Outputs:** What information do you need to gather before you can do x? How and where do you get that information? What do you do with it when you're done?
- **Guided Tours:** Can we take a look at your email account together?
- **Projection:** What do you think would happen if. . .?
- **Changes over Time:** How does that compare to the way you did that a year ago?
- **Exceptions:** Under what circumstances do you do that differently?
- **Suggestive Opinion:** Some people have very negative feelings about using cell phones in cars while others don't. How do you feel about it?
- **Identification:** Who do you think would use something like that? Who wouldn't?
- **Outsider Perspective:** How would you describe <feature or activity> to someone who hadn't done that before? What advice would you give to somebody who was going to try it?
- **Comparisons:** What's the difference between Tweeting and sending an email? How do you do that differently when you're at home vs. at work?
- **Successes and Failures:** What would be the worst case scenario? Can you tell me about a time when this didn't work?
- **Fill in the blank:** So in that situation, you. . . [pregnant pause]?
- **3 wishes:** If you had 3 wishes to make this better for you, what would they be?

Follow-up Questions

- **Why?**
- **Point to participant's reactions** contradictions, paradoxes, non sequiturs, unexpected reactions, or laughter. Why do you roll your eyes when you say that?
- **Clarification:** When you say "her" you mean your daughter, right?
- **Reflecting Back:** So, what I hear you saying is_____. Is that right?
- **Native Language:** Why do you call your computer "my brain"?
- **Silence:** Trust your question and wait for participants to fill in the gaps. Or try leaving pregnant pauses: "When that happened, you felt. . .?"

Types of Questions for Design/Usability Evaluations

Getting first impressions

- What is this site/product? What is it for?
- Who do you think this product is aimed at?
- What do you see?
- What questions does this raise?
- What information would you want to see here?

After user has completed a task

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- What would you expect to happen next?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

When debriefing UI or product overall

- Can you describe to me what you see on this page?
- Which parts of this page are most/least important to you?
- What do you think this [point to UI element] might do?
- What does this [point to UI element] mean?
- If you wanted to _____, how would you...?
- Under what circumstances would you use this? Why?
- What do you like/dislike about this?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- How would you describe this to a friend?

When comparing designs, prototypes, or competitors' products

- How would you compare those different versions? What are the pros and cons?
- Which parts of each design would you combine to create a new, better version?
- Which one worked better for you? Why?
- How is X different from Y?
- What does each of these do well? Poorly?
- What types of people does each of these versions seem to be designed for?

FlowMotion ONE

Although ONE is no longer the newest stabilizer on the market, it introduced a set of unique features that differentiates it from competitors even three years after launch. In FlowMotion ONE the battery is located in the pitch frame of the gimbal. This means the grip is not needed to film, making it possible to mount the gimbal directly to e.g. helmet mounts and tripods. Since the grip is detachable, the product is easier to fit in most pockets or bags. The optional extension pole can be mounted between the grip and the gimbal for increased arm reach and more creative shots. The interface has four input controls: power button, record video, mode toggle and a joystick. FlowMotion ONE has both landscape and portrait shooting capabilities, and balancing the gimbal is done by positioning your phone further in or out in the clamp. The battery is rechargeable and interchangeable, and the gimbal can be folded flat when powered off. Unlike all the others tested, it does not have a built-in tripod mount, meaning the only way to attach it to a 1/4-inch screw is to swap out the grip with the included tripod adaptor.

The grip feels nice to hold. The size is a quite good fit for my hands. If the shape was less tapered towards the bottom, it would have been even better. Having the main controls located on a lowered section of the grip feels comfortable and there is little tension in my thumb when reaching for buttons. However, there is one major problem with this grip, and that is the weight distribution. The grip is extremely light compared to the battery and components located in the pitch frame of the gimbal, which is an aluminium construction, making the stabilizer front heavy. Because of this, longer use can become tiring, especially in the wrist. The rubberized underbody is quite hard and adds very little friction to the grip. It is a nice detail and the texture is pleasant to touch but it feels mostly like an aesthetical feature rather than a functional one. The grip would easily have been among the better out there if the weight had not been an issue. The detachable feature is definitely cool

and unique, but the threaded mount design makes it feel somewhat cheap and imprecise. There is also little information about how to work this feature the first time — but when you know, you know. Further, since the grip itself is so light compared to the gimbal, it feels less premium and sturdy than the rest of the product, lowering the overall perception of quality.

The interface of FlowMotion ONE is pretty straight-forward. The big power button is printed with a clear, universal power symbol. The record button is painted with a red dot, like in most DSLR cameras. The mode button, painted with a white dot, is not as intuitive. Since the mode button is identical to the record button, except the color, it may lead users to expect the button to control something related to the record. The joystick is generously sized and feels better to use than any other I have tested. The tactility is also good. The buttons have sufficient resistance and travel, and they have different surface texturing making them easier to identify.

The mode and record buttons are a little on the small side and have somewhat sharp edges. Further, it feels like they are placed just a bit too close to each other and the joystick. The tight fitting is primarily an issue when wearing gloves. Under such conditions, the buttons should have been even more raised from the grip body as well. Although far from worst on this scale, there is still room for improvement. The power button feels great to use. When pressed, the user receives snappy haptic feedback and the device powers on instantly. This form of clear communication is important because it increases the chance that the user feels in control of the product and not the other way around (Harley, 2018, Norman, 2013). With its six dedicated LEDs, the LED panel gives explicit information about power, Bluetooth, video and battery status. However, six feels like overkill and I believe relevant information could have been expressed with fewer LEDs, in favour of a simpler display.

To change the orientation of your phone you simply move the gimbal into position using your free hand, and the stabilizer will snap into place. This feature is a bit hidden but when you first know how to do it, it feels simple to use. The single biggest advantage with this solution is that you do not have to remove your phone when doing so, meaning your shooting session can continue with little interruption. The feature is nice but the implementation could have been better. Good design is both understandable and discoverable — unfortunately, the latter is not true for this design (Norman, 2013). The solution for balancing the gimbal is very minimal. It is simply a line of dots indicating where to align your phone. There is something elegant about such a simple way of solving this problem. However, as a user I have to remember which dot my phone is supposed to line up with and make sure I get it right every time I want to use the product. On the upside, this makes it easy to share the product with a friend, who might have a different phone size, because there is nothing to adjust with the stabilizer itself. Having that said,

I'm not convinced this is a superior solution to the more traditional roll frame set screw on other stabilizers. Pulling the clamp is OK. There is not much material to grab but the springs are not too stiff either. The clamp and the springs have a cheap and unpleasant sound created by friction between surfaces and the extension of the springs.

The appearance is to a large extent what makes the FlowMotion ONE so striking. The detailing is neat, such as the chamfered edges of the gimbal frames. The silhouette looks fast and sporty — maybe even too sporty. In fact, when the idea of the product was conceived, it was intended for action cameras. A changing market and new ideas led to the startup pivoting to smartphones instead. During development, the aesthetic might have continued carrying influences from this. The protruding power button is perhaps not so flattering. The construction feels very solid and robust.

03 DISCOVER
Reviewing existing solutions

DJI Osmo Mobile 2

Compared to the first generation, the Osmo Mobile, this stabilizer offers more or less the same functionality. The main differences are the presence of cheaper materials and the lack of interchangeable batteries. The Osmo Mobile 2 sports a pretty basic set of features considering the button interface, which offers a joystick, combined record and photo button, combined mode and power button, and a zoom slider. The gimbal supports both portrait and landscape orientation, and the gimbal frames fold down flat. Balancing the gimbal is done by adjusting the length of the roll frame. The Osmo Mobile 2 can also charge the phone via an USB cable.

The grip of DJI Osmo Mobile 2 is surprisingly good. It feels very secure and comfortable. You can tell the development team has been conducting studies on human factors. The slightly curved shape towards the top end makes the grip rest naturally in a power grip. The same feature ensures the buttons are out of the way when not needed. The only downside with this is that you feel a slight tension in the hand — especially the thumb — when trying to reach the buttons. In all the grip feels very ergonomic but this goes for the appearance as well, unfortunately.

The tactility of the buttons is good but not great. It could have benefitted from being slightly stiffer and with longer travel. Because the surface of the buttons feel more or less identical with that of the housing, they can be difficult to recognize. The spatial distribution of the buttons makes it easier to remember where to interact for different outcomes. As mentioned above, two of the buttons are multifunctional. This is perhaps OK for the combined video/photo button but a rather unideal situation for the mode/power button, where the two functions are less related to each other. Testing with a glove, it gets a bit difficult to feel which button is which, especially distinguishing the record and the mode button. For this to be better the buttons would have to be more raised and distinct in form. The feedback from the buttons is good with the power button being the exception. Since it is multifunctional you have to perform a long press to power on. The long press in itself is not an issue. The issue is the time it takes for the stabilizer to boot up and the poor feedback in-between input and output. To this end, the flashing LEDs do little in communicating what is happening. As a user, it is crucial to get timely and clear feedback to make the right decisions about what to do next and to prevent unwanted results (Norman, 2013). Although this particular case is not all too bad, the point is still valid.

Swapping between portrait and landscape is done by turning a set screw on the pitch frame followed by rotating the frame. Oddly enough, the design allows the user to lock the pitch frame at various angles in between the horizontal and vertical end positions. This does not make sense from the end user perspective. Filming with a fixed skewed horizon has never been desirable. The biggest concern regarding this design is the fact that you have to unmount your phone to swap orientation, increasing the time needed to setup your gear before getting the shot. Twisting the set screw feels great. The turning is smooth and the knob provides plenty grip. Adjusting the length of the roll frame is done with a nearly identical set screw. This one also feels great to use. However, my main issue is with the placement of the knob. It is located on the inside of the roll frame making it cumbersome to reach. Upon pulling the clamp the springs are rather on the loose side. Pulling also reveals the not so flattering ribs of the plastic parts. On the positive side, the sound produced when pulling the clamp is among the better I have experienced.

Looking closer, it's clear that some irrational design decisions were made regarding the parting lines, most prominent on the front of the grip. However, the design team deserves kudos on the consistent use of chamfers, reminding me of the unmistakable aesthetic of Hasselblad cameras (in which DJI

acquired a majority stake back in 2017). The construction feels solid and rugged. The glass fibre-reinforced plastic body provides a somewhat unusual but pleasant sensation.

A final thing to mention is the external rotation stoppers for the motors, which limits the rotation to less than 360 degrees. In some cases, this can become an issue for the user depending on the movement in the shot. The presence of physical stoppers also means there are no slip rings, which can be implemented to allow full rotation.

Freefly Movi

The Movi differs from other stabilizers in more than form factor. Instead of controlling the position of the gimbal, the directional pad is used for adjusting and locking exposure and focus, toggle front and back camera, and playback last clip. In addition, the stabilizer has a power and sleep button, and two trigger buttons on the back for controlling video recording and locking of roll or tilt. To adjust the position of the gimbal the user have to physically shift the angle of the frames. Freefly prioritizing the exposure control is perhaps a reflection of the needs of their target users. Instead of pulling, the phone mount is a clamp that opens by squeezing on the opposite ends of each hand, much like how you would open a clothespin. To move the phone to portrait orientation you rotate the stabilizer ninety degrees clockwise. Balancing the gimbal works in a similar manner as the FlowMotion ONE, where you slide the phone further in or out in the clamp. It also has an automatic sleep feature when the stow lock on the yaw frame is used.

The L-shaped grip has some advantages over a traditional grip. The most obvious one is the ability to put down the stabilizer on almost any surface in both landscape and portrait orientation. It also allows for a steadier two-handed hold in demanding situations. On the downside, the grip is less universal as it is optimized for a right-handed person. Further, the rotational moment exerted on the wrist is quite large, which makes it difficult to operate the buttons while holding the product with only one hand, especially the directional pad. For instance, to comfortably perform exposure adjustments, I have to support the product with my left hand. The grip shape itself is OK, neither great or bad. The texturing is very smooth making the grip feel less secure in my hand. The ability to put the stabilizer down on any surface is valuable but I am not convinced it is worth the resulting challenges and pain points encountered during normal use. After all, the stabilizer is first and foremost a tool for moving shots and not stationary scenes — for that we have tripods.

As already mentioned, the interface of Movi is different. There are some interesting aspects and a few quirks. For starters, I dislike that the only way to adjust the gimbal position is by direct physical manipulation by hand, because it then requires using both hands. Secondly, I find it inconvenient that there is no button for toggling follow modes on the grip, with the only method being interaction with the companion app on your phone — which also means third party camera apps are a no go if you need to change modes. Personally, I change follow modes frequently and often while recording. However, I enjoyed the ability to adjust and lock exposure and focus via the grip. Performing this on a touch display can be cumbersome, especially under harsh daylight conditions. The buttons feel slow and mushy to operate — perhaps the worst of all the stabilizers — with no distinct click to signal a successful press. Even though the directional pad is a little raised from the surface, the rounded edges and narrow spatial layout make interaction with gloves a problem. It

would have been nice to see a greater difference between the surface texture of the grip and the buttons.

Going to portrait mode is easy and straightforward. But as with the Flow-Motion ONE, the method is not very discoverable when you have not been told how to do it. Another concern with this implementation is that it is left to the stabilizer to decide when it should change orientation. At worst this might ruin a shot as the stabilizer assumes the user wants to change orientation when, for instance, the intention was to add a bit of motion. As mentioned, balancing the gimbal works exactly like Flow-Motion ONE except for one significant difference — there are no ruler marks or guides to help the user remember from time to time where his or her phone needs to go. The clamp design of Freefly Movi feels superior to use compared to the other stabilizers, and the mechanical concept is more in line with how general spring clamps work. Ease of use is where this design really shines — it enables the user to open the clamp

with only one hand, leaving the second hand to insert the phone.

For an otherwise impressive product, the design is very crude. At a premium price of 299 USD, I would expect more focus on craftsmanship and finesse. The visible fasteners and rough lines combined with the orange and grey colour scheme give the product an industrial aesthetic reminiscent to hand drills and other objects found in your dad's toolbox. The same holds true for the build quality, which is rock solid, but that is a good thing.

Zhiyun Smooth 4

Zhiyun Smooth 4 offers all the basic functions found on most gimbals, such as buttons for recording video, power, photo capture. Instead of a joystick Smooth 4 has a directional pad for manipulating the gimbal position, adjusting camera settings and navigating the UI of the companion app. Additionally, it has switches and buttons for changing follow modes, zoom, pull focus and select. Smooth 4 folds down flat and has a spring loaded mechanism to lock the gimbal frames into place when it is not being used. It supports portrait and landscape orientation, and balances in a similar fashion as the DJI Osmo Mobile 2. It can also charge the phone while the stabilizer is being used.

The grip shape is not very ergonomic. It has sharp, unpleasant corners and the dimensions feel off — at least for my own hands. There is no groove for the fingers for an extra secure grip. The flat sides help in preventing the grip from rotating in my hand. At best, the grip is comfortable if held perpendicular to what is intended.

There is a lot to say about the interface of this stabilizer. Although daunting to look at due to all the buttons, Zhiyun Smooth 4 shares many similarities with camera interfaces, which might make it easier to understand, if you are familiar with cameras. Clicking the buttons feels good, the click is snappy. As with the Osmo Mobile 2, also on this product I would have liked the buttons to have a different surface texture than the housing as well as being more raised. Considering the number of buttons, it is even more critical being able to identify the buttons without looking down. Ambiguous button labelling and icons is another factor complicating the interface of Smooth 4. For instance, the select button has a flash symbol while the function button responsible for toggling between zoom and focus pull has a target symbol. The follow mode toggle is a bit hidden unless you are familiar with gimbals. For this you have to toggle the PF-L switch, which stands for Pan Follow and Lock respectively. While more modes can be accessed by using the trigger buttons on the back of

the grip, these interactions put my hand in an uncomfortable position. Due to its size and placement in relation to how the hand grips the stabilizer it is very easy to push the buttons without intending to. Further, the large scroll wheel on the left side of the grip is practically impossible to use for left handed users. Although having a dedicated power button, the stabilizer requires a fairly long press followed by a few seconds of flashing LEDs before booting up. I am sure the advanced interface have been developed in good faith, and it is not all that bad, but it feels rather premature.

Switching between landscape and portrait orientation works the same as with Osmo Mobile 2. You turn a knob on the back of the pitch frame to release or fasten it, and you have to unmount your phone while doing so. You can also fasten the frame at any given angle between horizontal and vertical. The knob is not as good to use as with Osmo Mobile 2, and the whole mechanism feels cheaper during use. The same goes for the knob used for

adjusting the length of the roll frame. Also in this stabilizer, it is placed on the inside of the frame, making it cumbersome to operate. The clamp feels sturdy and the springs have a satisfying stiffness. The sound from pulling the clamp is pleasant, and almost unnoticeable. The mechanical stow lock keeping the gimbal frames from moving freely when the product is transported is quite good. However, this solution is a bit of a compromise. Being mechanical and fixed, it limits the rotation of the gimbal and thus reduces freedom of movement making the product less forgiving should the user move the stabilizer to an awkward position. Another issue I experienced was that it is easy to forget that the lock is there — especially when you do not have a sleep function like the Freefly Movi. So when powering the stabilizer I would press the power button and wonder why it would not start to move, before remembering to release the lock.

Aesthetically, the product does not strike me as particularly remarkable.

It is both big and bulky, and not very well composed. Most of the surface is speckled making it look like the popular camera bodies from Canon — a nice touch. The surface texture feel good to touch, but is still a step down from FlowMotion ONE and DJI Osmo Mobile 2.

DOBOT Rigiet

Do not let the modest design fool you. DOBOT has managed to pack a punch of functionality and features in their stabilizer. The amount of control you get from just four buttons is actually quite impressive. The buttons let you power the product on and off, record videos, manipulate the gimbal, toggle shooting modes, cameras and follow modes, and zoom. It also fits a replaceable battery, accessed at the bottom of the grip. The balancing feature is similar to that of Smooth 4 and Osmo Mobile 2. In contrast to the previous stabilizers, you turn a knob to compress the clamp that holds your phone. Rigiet supports landscape and portrait orientation by rotating the gimbal into position. Like the previous, the stabilizer has a port for charging your smartphone.

Although notably smaller than the DJI Osmo Mobile 2, the grip still feels OK to hold. A larger diameter would have been better. The part covered in rubber has a leather-like texture and feels great to touch. It is more rubberized than the FlowMotion ONE, which gives it a softer feel and more secure grip. On the downside, the texturing also attracts more dust and particles.

The buttons have good tactility. The click is not as snappy as with the Smooth 4, but the buttons have a different surface texturing than the body, which is a huge plus. The combined power and record button could have been more raised. There should also have been a small symbol indicating that this button will power the stabilizer on and off, as well as controlling the recording. The toggle for changing shooting modes, cameras and zooming is clever but the functionality is a bit hidden. The mapping for toggling modes and zooming feels quite natural. However, the camera toggle is not as straightforward and takes some time to get used to. The second toggle is labelled Y–L–YP, which stands for Yaw, Lock and Yaw–Pitch, and is for changing the follow mode of the gimbal. As with the Smooth 4, this button is not directly understandable. The main issue, regarding both toggles, lies with the shape of the buttons. They are small and

protruding with square edges, making them uncomfortable to operate. The DOBOT Rigiet is the only stabilizer that I know of using a ball joystick, and using it feels unusual. The button could use more surface friction for easier operation. I would argue this type of joystick require higher precision from the user, making it less forgiving and inferior to the previous joysticks.

The phone mount on the Rigiet both feels and looks more premium than the spring clamps. In principle it is still a clamp principle but there is just something cheap about the spring construction. Unfortunately, the Rigiet clamp does not feel as safe as the competitors' solution. It feels like little force is required to make the knob compressing the clamp come loose, resulting in your expensive smart-phone crashing to the ground. The knobs for mounting the phone and adjusting the roll frame has a sharp texture and is not as smooth to turn as the ones on the DJI Osmo Mobile 2. However, the placement of the roll frame knob is far better and more accessible than on the

other stabilizers.

The DOBOT Rigiet is primarily made from aluminum with an elegant matte finish. The construction seems rugged and premium, with the rattle noise coming from the slightly loose clamp being the only flaw breaking the spell. It features a sleek aesthetic. Having that said, the geometry still has some potential regarding composition, line work and finesse, in particular the interplay between the grip and the gimbal.

Feiyutech Vimble 2

With five buttons, Vimble 2 gives the user control over video and photo capture, power, switching front and back cameras, zooming, follow modes, and manipulating the gimbal position. It features the ordinary spring clamp you would pull to insert your phone. Balancing the gimbal and changing orientation is similar to previous examples but happen without the use of knobs. By using an internal buckled surface structure, the roll frame extends and contracts simply by pulling or pushing it. The pitch frame rely on a pocket spring mechanism to stay secure in either portrait or landscape position. Vimble 2 also has an attachment point for lanyards, and a very unique built-in telescopic extension pole. This one also comes with a phone charging feature.

The grip feels pretty great and ergonomic — while maintaining a compact and clean shape. It reminds me quite a lot of the FlowMotion ONE's grip. The surface texture of the main part is more or less the same as the DJI Osmo Mobile 2, only more refined. The rubberized

underbody has a decent leather-like texture. It feels softer than that of ONE but has the same problem with dust and particles as the Rigiet.

The interface is laid out in a similar way as the DOBOT Rigiet, thereby making it ergonomic — although not superior to the FlowMotion ONE's lowered console section. The push buttons have a good click to them, perhaps a little on the loud side. Their height should have been greater and the travel distance could have been longer. The joystick has too little grip and rotates around its own axis, making it feel low-end and imprecise. The zoom slider also lacks some grip and the travel is too short. The trigger button on the back is pleasant to use. Powering on the stabilizer is a little slow but not too bad. Like the Flow-Motion ONE, Vimble 2 also provides haptic feedback upon powering on. However, the implementation is very poor. It generates a quite strong and almost violent vibration as if the product was signaling an error. The same goes for the accompanying boot up sound. I

also think the product team went a little overboard with the multifunctionality, for instance with the power button which you can give a triple click to toggle between front and back cameras.

The orientation design of Vimble 2 is far better to use than the other solutions with knobs. It is faster and snappier, and can never be in an awkward position between landscape and portrait. You have to remove and reinsert the phone to change orientation still, and for that very reason, the solution of Freefly Movi and FlowMotion ONE is still superior. I am fond of the simplicity of the balancing mechanism. However, it is not that pleasant to use and it feels like it left the factory while still being in the prototyping stage. Although it takes some force to shift the position of the mechanism, there is still a chance it will accidentally move out of balance while being transported in a backpack. A simple pin to fasten the roll frame would have done the trick, and gives the user reassurance that it is secure and proper. The clamp is all plastic and the construction seems a little flimsy. The tension feels nice — neither too tight or loose.

Aesthetically, the Vimble 2 is among the better ones out there. The grey color is dull, and the product is mostly plastic, but the silhouette is clean and quite attractive. Upon closer inspection, the build quality is good but not great — especially in the grip the snaps and joinery have room for improvements. Other than that, there are some questionable decisions in detailing of the product.

FMX UT1 User Interview Guide

Name of study or project

FMX, user test 1

Intro spiel (5 minutes)

Interviewer (with a big smile!):

Thanks for coming in today! We're constantly trying to improve our product, and getting your frank feedback is a really important part of that.

I like to keep these sessions pretty informal. I'm just trying to learn from you today. I'll ask a lot of questions, but **I'm not testing you.** There are no right or wrong answers.

I'll start this session by asking some background questions. Then I'll show you some things we're working on, and ask you to do some tasks. As you work on the tasks, please **think aloud.** This means that you should try to give a running commentary on what you're doing as you work through the tasks. Tell me what you're trying to do and how you think you can do it. If you get confused or don't understand something, please tell me. If you see things you like, tell me that too. And, of course, you're **free to take a break or leave** at any time during the session.

Since I didn't design this, you **won't hurt my feelings** or flatter me. In fact, frank, candid feedback is the most helpful.

Again. . . I'm not testing you. I'm testing the product. If you get stuck or confused, it's not your fault. It helps us identify the problems in the design that we need to fix.

If and when you do get stuck, I'm **going to try not to answer your questions** or tell you what to do. I'm just trying to see what you would do if you were using it on your own. But don't worry—**I'll help you if you get completely stuck.**

Today we're going to use **a prototype.** That means some features may not work quite right. You can still click anywhere you like to do the tasks. When you run into something that's not working, I'll let you know.

Do you have **any questions** before we begin?

Discovery (5 minutes)

Zoom out. Use discovery questions to better understand users' existing behaviors and attitudes related to whatever you're studying. Refer to what you wrote in the *User Research Plan* under "What do we want to learn?". Ask open-ended questions (Who? Where? When? What? Why? How?). Try to get info that will help you personalize the subsequent usability tasks for this user. And remember to start out with easy-to-answer questions to help build rapport and trust.

(Refer to *Sample User Research Questions* worksheet.)

- What smartphone do you own?
- Do you use it to capture videos?
- What types of videos do you capture with your phone? Where do you do that?
- Have you heard of or used a stabilizer before with your phone or a camera? Which maker was it?
- How was it to use that product?
- If you had a magic wand, what would make the stabilizer better for you?

Example (if you were interested in the use of thermostats):

- What kind of home do you live in currently?
- Does anyone else live there with you?
- When temperatures get hot or cold around here, how do you stay comfortable in your house?
- In the past few days, what are examples of when you adjusted the temperature in your home? What did you do? Why?
- What kinds of things did you do to minimize the costs of utilities in your home? Examples?
- How has that changed in the last 6 months?
- Last time you went on a trip, what did you do to prepare your house before you left?
- Who in your home is responsible for programming the thermostat? Why?
- If you had a magic wand, what would make the site/app/product better for you?

Tasks (30 minutes)

Interviewer:

Now I'd like to show you some rough prototypes of ideas we're experimenting with. These are just prototypes, or in some cases just pictures of screens. Even though they look real, they won't work completely. You don't have to worry about breaking anything.

First impressions (5 minutes)
To begin, please just take a look at <X>.

- What is this?
- What's this for?
- How can you tell?

Task scenario 1 (10 minutes)

Let's pretend you want to take a vertical video with these stabilizers in portrait mode. How would you make the gimbal hold the phone in portrait orientation?

Follow-up probes
- Which one do you prefer? Why?
- Was <X> easier/harder to understand than <Y>?
- What would have helped you understand what to do with <design X>?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 2 (5 minutes)

Let's pretend you want to detach/remove the grip from the gimbal. How would you do that with these products?

Follow-up probes
- Which design do you prefer to use? Why?
- Which was easier to understand? Why?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 3 (5 minutes)

Let's pretend you want to hold the various grip models in your palm. How would you hold them?

Follow-up probes
- Which grip shape do you prefer? Why?
- How was the size of the various designs?
- When you held model <X>, why did you pick it up like so (mirror participant's behavior)?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Debrief (5 minutes)

Standard examples:

- What do you like/dislike about this?
- If you had 3 wishes to make this better for you, what would they be? Why?
- How would you describe this to a friend?
- Under what circumstances would you use this? Why?
- Can you describe to me what you see on this page?
- Which parts of this page are most/least important to you?
- What do you think this [point to UI element] might do?
- What does this [point to UI element] mean?
- If you wanted to _____, how would you. . .?

Wrap up and cool down (5 minutes)

This has been incredibly helpful.

[Interviewer: Try to briefly summarize some key parts of the discussion or issues.]

Your input is really valuable for me and the team as we think about the next steps for these ideas. We really appreciate your taking the time to come in, and answering all of my questions. Thanks SO much!

[Interviewer: Give participant incentive gift.]

FMX UT2 User Interview Guide

Name of study or project
FMX user test 2

Intro spiel (5 minutes)

Interviewer (with a big smile!):

Thanks for coming in today! We're constantly trying to improve our product, and getting your frank feedback is a really important part of that.

I like to keep these sessions pretty informal. I'm just trying to learn from you today. I'll ask a lot of questions, but **I'm not testing you.** There are no right or wrong answers.

I'll start this session by asking some background questions. Then I'll show you some things we're working on, and ask you to do some tasks. As you work on the tasks, please **think aloud**. This means that you should try to give a running commentary on what you're doing as you work through the tasks. Tell me what you're trying to do and how you think you can do it. If you get confused or don't understand something, please tell me. If you see things you like, tell me that too. And, of course, you're **free to take a break or leave** at any time during the session.

Since I didn't design this, you **won't hurt my feelings** or flatter me. In fact, frank, candid feedback is the most helpful.

Again. . . I'm not testing you. I'm testing the product. If you get stuck or confused, it's not your fault. It helps us identify the problems in the design that we need to fix.

If and when you do get stuck, I'm **going to try not to answer your questions** or tell you what to do. I'm just trying to see what you would do if you were using it on your own. But don't worry—**I'll help you if you get completely stuck**.

Today we're going to use **a prototype**. That means some features may not work quite right. You can still click anywhere you like to do the tasks. When you run into something that's not working, I'll let you know.

Do you have **any questions** before we begin?

Discovery (5 minutes)

Zoom out. Use discovery questions to better understand users' existing behaviors and attitudes related to whatever you're studying. Refer to what you wrote in the *User Research Plan* under "What do we want to learn?". Ask open-ended questions (Who? Where? When? What? Why? How?). Try to get info that will help you personalize the subsequent usability tasks for this user. And remember to start out with easy-to-answer questions to help build rapport and trust.

(Refer to *Sample User Research Questions* worksheet.)

- What smartphone do you own?
- Do you use it to capture videos?
- What types of videos do you capture with your phone? Where/when do you do that?
- What kind of accessories do you own for your smartphone?
- Have you heard of or used a stabilizer before with your phone or a camera? Which maker was it?
- How was it to use that product?
- If you had a magic wand, what would make the stabilizer better for you?

Tasks (25 minutes)

Interviewer:

Now I'd like to show you some rough prototypes of ideas we're experimenting with. These are just prototypes, or in some cases just pictures of screens. Even though they look real, they won't work completely. You don't have to worry about breaking anything.

First impressions (4 minutes)

To begin, please just take a look at <X>.

- What is this?
- What's this for?
- How can you tell?

Task scenario 1 (7 minutes)

Let's pretend you want to hold the various grip models in your palm. How would you hold them?

Follow-up probes

- How do they feel?
- How is the sizing of the grips?
- Do they feel secure/insecure in your palm? Why?
- What do you like/dislike about <X>? Why?
- What do you like/dislike about the appearance? Why?
- Which are the top 3?
- Which one do you prefer the most?
- What do you like/dislike about this?
- Which parts of each design would you combine to create a new, better version?
- If you had 3 wishes to make this better for you, what would you wish for? Why?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 2 (7 minutes)

Let's pretend you want to detach the grip from these stabilizers. How would you do that?

Follow-up probes

- Which design was easier to understand? Why?
- What would have helped you understand what to do with <design X>?
- Do you feel safe using this design? Do you trust it's securely fastened?
- Which one worked better for you? Why?
- How is X different from Y?
- What does each of these do well? Poorly?
- Which design do you prefer to use? Why?
- Which parts of each design would you combine to create a new, better version?
- If you had 3 wishes to make this better for you, what would you wish for? Why?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 3 (7 minutes)

Let's pretend you want to record a vertical/portrait video with these stabilizers. How would you set the gimbal to portrait/vertical orientation/mode?

Follow-up probes

- How was that? What happened there?
- What do you like/dislike about this?
- What does this solution do well? Poorly?
- What would have helped you understand what to do with <design X>?
- If you had 3 wishes to make this better for you, what would you wish for? Why?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Debrief (5 minutes)

- What's your general impression from what we have done today?
- How was it to participate in this user interview? What could've been better?
- Do you have any further comments or questions for us? Anything?
- **Would you be interested in participating in further user interviews?** How should we contact you?

Standard examples:

- What do you like/dislike about this?
- If you had 3 wishes to make this better for you, what would they be? Why?
- How would you describe this to a friend?
- Under what circumstances would you use this? Why?
- Can you describe to me what you see on this page?
- Which parts of this page are most/least important to you?
- What do you think this [point to UI element] might do?
- What does this [point to UI element] mean?
- If you wanted to _____, how would you. . .?

Wrap up and cool down (5 minutes)

This has been incredibly helpful.

[Interviewer: Try to briefly summarize some key parts of the discussion or issues.]

Your input is really valuable for me and the team as we think about the next steps for these ideas. We really appreciate your taking the time to come in, and answering all of my questions. Thanks SO much!

[Interviewer: Give participant incentive gift.]

FMX UT3 User Interview Guide

Name of study or project
FMX user test 3

Intro spiel (5 minutes)

Interviewer (with a big smile!):

Thanks for coming in today! We're constantly trying to improve our product, and getting your frank feedback is a really important part of that.

I like to keep these sessions pretty informal. I'm just trying to learn from you today. I'll ask a lot of questions, but **I'm not testing you.** There are no right or wrong answers.

I'll start this session by asking some background questions. Then I'll show you some things we're working on, and ask you to do some tasks. As you work on the tasks, please **think aloud**. This means that you should try to give a running commentary on what you're doing as you work through the tasks. Tell me what you're trying to do and how you think you can do it. If you get confused or don't understand something, please tell me. If you see things you like, tell me that too. And, of course, you're **free to take a break or leave** at any time during the info session.

Since I didn't design this, you **won't hurt my feelings** or flatter me. In fact, frank, candid feedback is the most helpful.

Again. . . I'm not testing you. I'm testing the product. If you get stuck or confused, it's not your fault. It helps us identify the problems in the design that we need to fix.

If and when you do get stuck, I'm **going to try not to answer your questions** or tell you what to do. I'm just trying to see what you would do if you were using it on your own. But don't worry—**I'll help you if you get completely stuck.**

Today we're going to use **a prototype**. That means some features may not work quite right. You can still click anywhere you like to do the tasks. When you run into something that's not working, I'll let you know.

Do you have **any questions** before we begin?

Discovery (5 minutes)

Zoom out. Use discovery questions to better understand users' existing behaviors and attitudes related to whatever you're studying. Refer to what you wrote in the *User Research Plan* under "What do we want to learn?". Ask open-ended questions (Who? Where? When? What? Why? How?). Try to get info that will help you personalize the subsequent usability tasks for this user. And remember to start out with easy-to-answer questions to help build rapport and trust.

(Refer to *Sample User Research Questions* worksheet.)

- For returning testers: Have you made any new thoughts on the matter since our last meeting?
- What smartphone do you own?
- Do you use it to capture videos?
- What types of videos do you capture with your phone? Where/when do you do that?
- What kind of accessories do you own for your smartphone?
- Have you heard of or used a stabilizer before with your phone or a camera? Which maker was it?
- How was it to use that product?
- If you had a magic wand, what would make the stabilizer better for you?

Tasks (25 minutes)

05 DEVELOP
Iteration 3: User test 3

Interviewer:

Now I'd like to show you some rough prototypes of ideas we're experimenting with. These are just prototypes, or in some cases just pictures of screens. Even though they look real, they won't work completely. You don't have to worry about breaking anything.

First impressions (3 minutes)

To begin, please just take a look at <X>.

- What is this?
- What's this for?
- How can you tell?

Task scenario 1 (10 minutes)

Let's pretend you want to detach the grip from these stabilizers. How would you do that?

Follow-up probes

- Which design was easier to understand? Why?
- What would have helped you understand what to do with <design X>?
- Do you feel safe using this design? Do you trust it's securely fastened?
- Which one worked better for you? Why?
- How is X different from Y?
- Is there enough grip space to comfortably work the different solutions?
- How is the feedback and the visual indicators? Why?
- How was the button on the DSLR lens solution?
- How was the clamps on the tripod/DJI solutions?
- What does each of these do well? Poorly?
- Which design do you prefer to use? Why?
- Which parts of each design would you combine to create a new, better version?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- Which of the DSLR solutions do you prefer? And of the tripod solutions? Why?
- **Which one is your overall favourite? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 2 (7 minutes)

Let's pretend you want to hold the various grip models in your palm. How would you hold them?

Follow-up probes

- How do they feel?
- How is the sizing?
- Do they feel secure/insecure in your palm? Why?
- What do you think about the index finger indent? How is the size and placement?
- What do you like/dislike about <X>? Why?
- What do you like/dislike about the appearance? Why?
- How is the roundness of the grips?
- What do you like/dislike about this?
- Which parts of each design would you combine to create a new, better version?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- **Which one is your overall favourite? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 3 (5 minutes)

Please have a look at the appearance of these parts. What do you think they are? (These are frames for the gimbal).

Follow-up probes

- What do you think about the appearance of the different frame designs?
- Which one is the most elegant/sophisticated? Why?
- Which one do you like the least?
- **Which one is your favourite? Why?**
- How would you place them on a rating?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Debrief (5 minutes)

- What's your general impression from what we have done today?
- How was it to participate in this user interview? What could've been better?
- Do you have any further comments or questions for us? Anything?
- **Would you be interested in participating in further user interviews?** How should we contact you?

Standard examples:

- What do you like/dislike about this?
- If you had 3 wishes to make it better for you, what would they be? Why?
- How would you describe this to a friend?
- Under what circumstances would you use this? Why?
- Can you describe to me what you see on this page?
- Which parts of this page are most/least important to you?
- What do you think this [point to UI element] might do?
- What does this [point to UI element] mean?
- If you wanted to _____, how would you. . .?

Wrap up and cool down (5 minutes)

This has been incredibly helpful.

[Interviewer: Try to briefly summarize some key parts of the discussion or issues.]

Your input is really valuable for me and the team as we think about the next steps for these ideas. We really appreciate your taking the time to come in, and answering all of my questions. Thanks SO much!

[Interviewer: Give participant incentive gift.]

Grip Interface Interview Findings

Name of study or project	
FMX grip interface	

Warm-up questions	Findings and conclusions
Background	• Three males, two in their mid-thirties and one 23 year old • The former works in the film industry while the latter is a student • They all use some version of the iPhone • Two have used ZY Smooth Q, one have used DJI Osmo Mobile
Types of video	• Work projects (one mentions marketing purposes) • Vacations and recreation • Blog-style • Mostly in landscape orientation
Editing	All prefer editing on a laptop. Two strongly prefer editing on a computer as it is very cumbersome on a smartphone. Have to transfer clips to laptop from phone.
Camera app	They all prefer the native camera app on iPhones, reasoning with how quick it is to launch and ease of use. They have experience with the native app for the various stabilizers, but dislike them for being difficult to use and having poor UIs, although sometimes they have to use them to get the extra functionality.
Stabilizer review	• The user with the DJI Osmo Mobile thinks the product performs just OK. It is quite easy to use. However, sometimes it can be unpredictable and not very stable. He adds it being slow to get ready for action (long time to magic) – difficult to insert phone and buggy to power on. • The Smooth Q users are not quite content with the way the product performs, but states that it correlates with the price level. The build quality and design is poor. The grip could have been more ergonomic. Can't handle bigger phones. Inserting a phone can be a bit cumbersome. Mostly use the basic features (stabilization) and sometimes use the joystick to pan (left/right) or tilt (up/down). About the design: "It's fine but nothing to brag about."

Main questions	Findings and conclusions
Actions before taking a photo/video	Framerate, ISO, slow-motion, set focus and exposure. No users seemed to be using focus and exposure lock (in the native app). However, one user didn't use the feature because he hadn't discovered it, but would love to use it now that he knew. Adjust gimbal position (with joystick), reset and level gimbal. One user states he will only adjust along one axis at the time because going in multiple directions looks bad.
Actions while recording a video	Change POI for focus, adjust tilt/pan. One user would like to switch between presets for gimbal modes. No one really use zoom while recording.
Functions/buttons they want on the grip	• Record • Joystick or a d-pad (with sensitivity settings in app) • Focus and exposure — and lock • One user wants zoom • One user wants the ability to change follow speed (of gimbal) • No strong desire for toggle between front/back camera – but they definitely see some users needing/wanting such a feature. "Mer enn det vil gjøre det overkomplisert. Lukker og blender tenker jeg blir overflødig." Stated one user, but at the same time he said he wanted to control as much as possible from the grip and avoid touching the screen.

What functions/buttons do they use on their stabilizers?	Record, joystick, still photo and lock position (of gimbal).
	Battery status is nice to have (especially as performance can decrease at lower battery levels).
	One user mentions a triple click button to toggle selfie-mode, a function which he thinks is useless because it is faster and better to manually grab the gimbal and perform the switch (position/rotation).
	"Everything except the zoom-button"
Thoughts on buttons/functions/indicators	They all think the functionality of the products is quite easy to understand. Spacing between buttons and their placement is good. It's good that the buttons are physically unlike to identify which is for what without having to look down.
Wishes that would make the product better	• Better build quality • Improved ergonomic grip • An easier way to attach the phone – "Det hadde vært kult å ha en løsning hvor man klikker telefonen inn." • Smaller size: The stabilizer is too big to put in a regular daypack • Larger battery: "Everyone wants more battery" • Customizable buttons • Phone charging • A simple tripod • Ability to connect a microphone

FMX UT4 User Interview Guide

Name of study or project
FMX user test 4

Intro spiel (5 minutes)

Interviewer (with a big smile!):

Thanks for coming in today! We're constantly trying to improve our product, and getting your frank feedback is a really important part of that.

I like to keep these sessions pretty informal. I'm just trying to learn from you today. I'll ask a lot of questions, but **I'm not testing you.** There are no right or wrong answers.

I'll start this session by asking some background questions. Then I'll show you some things we're working on, and ask you to do some tasks. As you work on the tasks, please **think aloud**. This means that you should try to give a running commentary on what you're doing as you work through the tasks. Tell me what you're trying to do and how you think you can do it. If you get confused or don't understand something, please tell me. If you see things you like, tell me that too. And, of course, you're **free to take a break or leave** at any time during the session.

Since I didn't design this, you **won't hurt my feelings** or flatter me. In fact, frank, candid feedback is the most helpful.

Again. . . I'm not testing you. I'm testing the product. If you get stuck or confused, it's not your fault. It helps us identify the problems in the design that we need to fix.

If and when you do get stuck, I'm **going to try not to answer your questions** or tell you what to do. I'm just trying to see what you would do if you were using it on your own. But don't worry—**I'll help you if you get completely stuck**.

Today we're going to use **a prototype**. That means some features may not work quite right. You can still click anywhere you like to do the tasks. When you run into something that's not working, I'll let you know.

Do you have **any questions** before we begin?

Discovery (5 minutes)

Zoom out. Use discovery questions to better understand users' existing behaviors and attitudes related to whatever you're studying. Refer to what you wrote in the *User Research Plan* under "What do we want to learn?". Ask open-ended questions (Who? Where? When? What? Why? How?). Try to get info that will help you personalize the subsequent usability tasks for this user. And remember to start out with easy-to-answer questions to help build rapport and trust.

(Refer to *Sample User Research Questions* worksheet.)

For returning testers:

• Have you made any new thoughts on the matter since our last meeting?
• How was it to use that product?
• If you had a magic wand, what would make the stabilizer better for you?
• **What settings/actions do you make before taking a video/photo? Can you walk us through how you would take a photo/video?**
• **If you could control anything from the grip, what would it be?**

For new testers:

• What smartphone do you own?
• Do you use it to capture videos?
• What types of videos do you capture with your phone? Where/when do you do that?
• What kind of accessories do you own for your smartphone?
• Have you heard of or used a stabilizer before with your phone or a camera? Which maker was it?
• How was it to use that product?
• If you had a magic wand, what would make the stabilizer better for you?

Tasks (30 minutes)

Interviewer:

Now I'd like to show you some rough prototypes of ideas we're experimenting with. These are just prototypes, or in some cases just pictures of screens. Even though they look real, they won't work completely. You don't have to worry about breaking anything.

First impressions (3 minutes)

To begin, please just take a look at <X>.

- What is this?
- What's this for?
- How can you tell?

Task scenario 1 (10 minutes): Detach grips

Let's pretend you want to detach the grip from these stabilizers. How would you do that?

Follow-up probes

- Which design was easier to understand? Why?
- What would have helped you understand what to do with <design X>?
- Do you feel safe using this design? Do you trust that it is securely fastened?
- Which one worked better for you? Why?
- How is X different from Y?
- Is there enough grip surface to comfortably work the different solutions?
- How is the click feedback?
- Do the visual indicators make sense to you? Why?
- How is the button on the mirrorless solution?
- How is the clamp on the DJI lock?
- What does each of these do well? Poorly?
- Which design do you prefer to use? Why?
- Which parts of each design would you combine to create a new, better version?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- **Which one is your overall favourite? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 2 (7 minutes): Grips and indents

Let's pretend you want to hold the various grip models in your palm. How would you hold them?

Follow-up probes

- How do they feel?
- How is the sizing?
- Do they feel secure/insecure in your palm? Why?
- What do you think about the finger indents? Which shape works better for you? Why?
- How is the size and placement of the finger indents?
- What do you like/dislike about <X>? Why?
- What do you like/dislike about this?
- Which parts of each design would you combine to create a new, better version?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- **Which one is your overall favourite? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 3 (5 minutes): Grips and pad surface

Let's pretend you want to compare the "grippiness" of these two grips. How do they compare?

Follow-up probes

- Which one feels more secure in your hand? Why?
- Do they offer a big difference in grippiness to you?
- Which appearance do you prefer? Why?
- What do you think about the material? How does it feel? How would you change it? Why?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- **Which pad surface do you prefer? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 4 (5 minutes): Roll frame adjustment

Iteration 4: User test 4

Let's pretend you want to adjust the length of this frame. How would you do that?

Follow-up probes

- Is the design easy to understand? Why?
- Are you able to comfortably work the knobs?
- Do the knobs feel secure? Why?
- How do you know the knob is properly tightened/loosened? Why?
- How do the knobs feel?
- How is the size of the knob?
- Which knob surface pattern feels better?
- Which appearance do you prefer? Why?
- Which looks more elegant?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- **Which knob do you prefer? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Debrief (5 minutes)

- What's your general impression from what we have done today?
- How was it to participate in this user interview? What could've been better?
- Do you have any further comments or questions for us? Anything?
- **Would you be interested in participating in further user interviews?** How should we contact you?

Standard examples:

- What do you like/dislike about this?
- If you had 3 wishes to make this better for you, what would they be? Why?
- How would you describe this to a friend?
- Under what circumstances would you use this? Why?
- Can you describe to me what you see on this page?
- Which parts of this page are most/least important to you?
- What do you think this [point to UI element] might do?
- What does this [point to UI element] mean?
- If you wanted to _____, how would you. . .?

Wrap up and cool down (5 minutes)

This has been incredibly helpful.

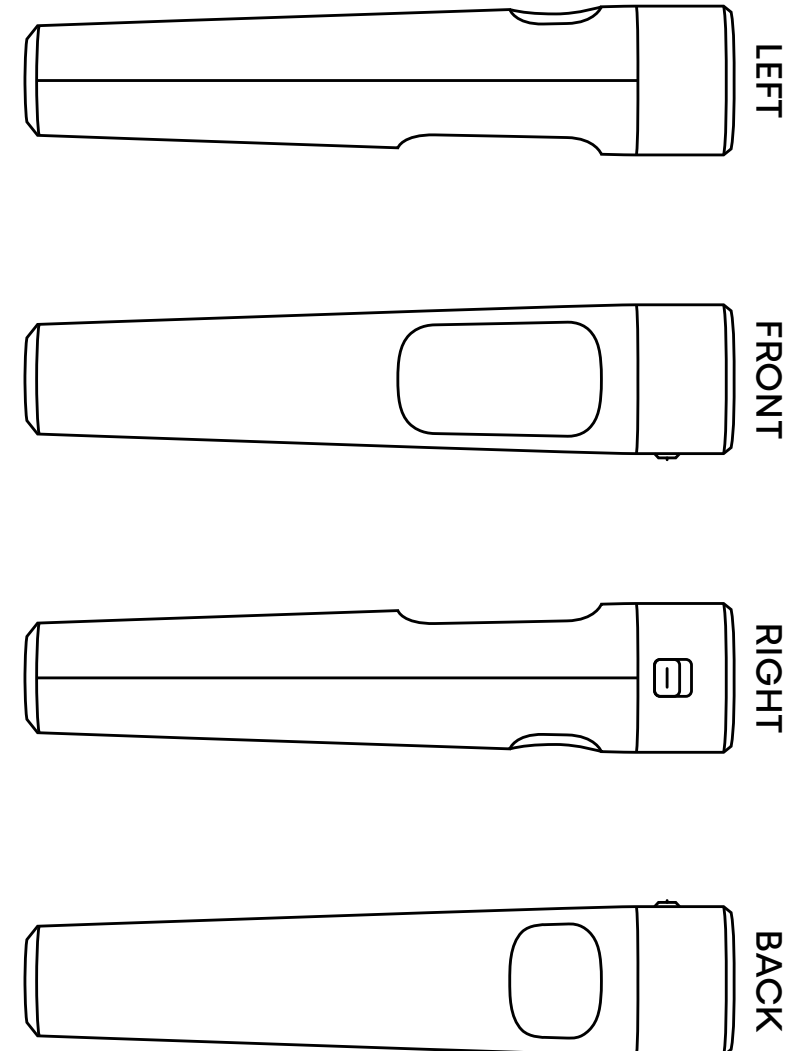[Interviewer: Try to briefly summarize some key parts of the discussion or issues.]

Your input is really valuable for me and the team as we think about the next steps for these ideas. We really appreciate your taking the time to come in, and answering all of my questions. Thanks SO much!

[Interviewer: Give participant incentive gift.]

Iteration 5: Interface co-creation

LEFT

FRONT

RIGHT

BACK

FMX UT5 User Interview Guide

Name of study or project
FMX user test 5

Intro spiel (3 minutes)

Interviewer (with a big smile!):

Thanks for coming in today! We're constantly trying to improve our product, and getting your frank feedback is a really important part of that.

I like to keep these sessions pretty informal. I'm just trying to learn from you today. I'll ask a lot of questions, but **I'm not testing you**. There are no right or wrong answers.

I'll start this session by asking some background questions. Then I'll show you some things we're working on, and ask you to do some tasks. As you work on the tasks, please **think aloud**. This means that you should try to give a running commentary on what you're doing as you work through the tasks. Tell me what you're trying to do and how you think you can do it. If you get confused or don't understand something, please tell me. If you see things you like, tell me that too. And, of course, you're **free to take a break or leave** at any time during the session.

Since I didn't design this, you **won't hurt my feelings** or flatter me. In fact, frank, candid feedback is the most helpful.

Again. . . I'm not testing you. I'm testing the product. If you get stuck or confused, it's not your fault. It helps us identify the problems in the design that we need to fix.

If and when you do get stuck, I'm **going to try not to answer your questions** or tell you what to do. I'm just trying to see what you would do if you were using it on your own. But don't worry—**I'll help you if you get completely stuck**.

Today we're going to use **a prototype**. That means some features may not work quite right. You can still click anywhere you like to do the tasks. When you run into something that's not working, I'll let you know.

Do you have **any questions** before we begin?

Discovery (3 minutes)

Zoom out. Use discovery questions to better understand users' existing behaviors and attitudes related to whatever you're studying. Refer to what you wrote in the *User Research Plan* under "What do we want to learn?". Ask open-ended questions (Who? Where? When? What? Why? How?). Try to get info that will help you personalize the subsequent usability tasks for this user. And remember to start out with easy-to-answer questions to help build rapport and trust.

(Refer to *Sample User Research Questions* worksheet.)

- What smartphone do you own?
- Do you use it to capture videos?
- What types of videos do you capture with your phone? Where/when do you do that?
- **What settings do you adjust before recording a video?**
- **Can you walk us through how you would record a video?**
- What kind of accessories do you own for your smartphone?
- Have you heard of or used a stabilizer before with your phone or a camera? Which maker was it?
- How was it to use that product?
- **If you could control anything from the grip, what would it be?**
- If you had a magic wand, what would make the stabilizer better for you?

For returning testers:

- Have you made any new thoughts on the matter since our last meeting?

Tasks (43 minutes)

Interviewer:

Now I'd like to show you some rough prototypes of ideas we're experimenting with. These are just prototypes, or in some cases just pictures of screens. Even though they look real, they won't work completely. You don't have to worry about breaking anything.

First impressions (3 minutes)

To begin, please just take a look at <X>.

- What is this?
- What's this for?
- How can you tell?

Task scenario 1 (5 minutes): Try grips and finger grooves

Let's pretend you're about to use these stabilizers for recording a video, by holding the grips in your palm. How would you pick them up and hold them?

Follow-up probes

- How do they feel?
- How is the sizing?
- Do they feel comfortable in your hand? Why?
- Do the grips feel (front) heavy or light? Why?
- What do you think about the finger groove? Which placement works better for you, middle or top? Why?
- Which grip/groove placement feels more secure in your hand? Why? Is it secure enough?
- Would you move the placement of the groove if you could? Why?
- How is the size of the finger groove? Is it too deep/shallow, or small/large?
- Does the rubber pad provide enough grip?
- What do you like/dislike about the grips? Why?
- If you had 3 wishes to make this better for you, what would you wish for? Why?
- **Which one is your overall favourite? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 2 (5 minutes): Detach grip from gimbal

Let's pretend you're about to pack the stabilizer in a case or bag, and you want to detach the grip from the gimbal. How would you do that?

Follow-up probes

- Is the design easy to understand? Why?
- Are you able to get a good grip on the release buttons?
- Which release button worked better for you? Why?
- How is button X different from Y?
- Do you feel safe using this design? Do you trust that it is securely fastened?
- What would have helped you to better understand how to work this solution?
- Is there enough grip surface to comfortably operate this feature?
- How is the click/feedback? Should it be more/less present? Why?
- Do the visual indicators make sense to you? Why?
- What does this design do well? Poorly?
- **If you had 3 wishes to make this better for you, what would you wish for? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 3 (9 minutes): Place functions and buttons on grip

Let's pretend you're in charge of the design of the interface on the grip. What functions would you like to include and how would you arrange the buttons?

Follow-up probes

- What functions can you not live without? Why?
- Which features should also be included? Why?
- What else would be nice to have? Why?
- Is there anything you do not want to have on the grip? Why?
- Where would you place that? Y?
- Do you want the buttons to only have one function, or would you combine features? Why?
- Should some of the buttons be customizable? Why?
- Can you think of any interfaces or functions you have tried before that made an impression on you? What was is?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 4 (6 minutes): Adjust length of roll frame

Let's pretend this gimbal is unbalanced, so you need to adjust the length of this (roll frame). How would you make this longer/shorter?

Follow-up probes

- Is the design easy to understand? Why?
- Are you able to comfortably work the knobs?
- How is the turning (smooth, hard, choppy, loose)?
- Do the knobs/solution feel secure? Why?
- How do you know the knob is properly tightened/loosened? Why?
- Would you want more/less feedback? How? Why?
- How is the size of the knobs?
- Do the knobs provide enough grip?
- Which knob provides the most grip?
- Which appearance do you prefer? Which looks more elegant? Why?
- Do you like this solution? How would you change it? Why?
- **If you had 3 wishes to make this better for you, what would you wish for? Why?**
- **Which knob do you prefer? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 5 (5 minutes): Insert/remove phone from clamp

Let's pretend you're getting ready to record a video using the stabilizer and your phone. How would you insert your phone in the clamp?

Follow-up probes

- Is the design easy to understand? Why?
- How is it to insert the phone? And removing it? Why?
- Are you able to get a good grip on the clamp(s)?
- How is the size of the finger grooves?
- What about the stiffness of the clamps, are they too loose/tight?
- Which stiffness do you prefer? Why?
- Do you trust that it is tight enough to hold your phone securely? Why?
- What do you like/dislike about this solution? Why?
- **If you had 3 wishes to make this better for you, what would you wish for? Why?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 6 (7 minutes): Compare clamp design with case design (and test it)

05 DEVELOP
Iteration 5: User test 5

Now, you just tested a fairly refined prototype of what we refer to as the clamp design. Currently, we are also working on a completely different way of attaching your phone to the gimbal. This new design involves a phone case with some slots or other mechanism on the back. It will make it possible to just slide the phone onto the gimbal. We have a pretty rough and early prototype for this, that we want you to have a look at. Do not think about the appearance at this stage, but how you perceive the concept in general and the way it works.

Follow-up probes

- In general, what do you think? Why?
- Do you have any questions about how it works? What?
- Do you see any problems, or have any concerns using such a solution? Why?
- Do you currently use a case for your phone? Which one?
- How would you feel about using a custom case for using the gimbal? Why?
- What do you like/dislike about this solution? Why?
- Would you trust this design, that the phone would be secure? Why?
- What do you think about this solution compared to the clamp design? Why?
- If you were the designer, how would you make this solution? Why?

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Task scenario 7 (3 minutes): Feel and evaluate rubber pad patterns

Let's pretend once again you're in charge of the design. Please have a look at and try these samples of rubber pads for the grip and the gimbal.

Follow-up probes

- In general, what do you think? Why?
- How do they feel? Why?
- Which pattern provides the most grip?
- Which appearance do you prefer? Why?
- **If you had 3 wishes to make this better for you, what would you wish for? Why?**
- **Which pattern do you prefer? Why?**
- **Would you choose any of these over the plain one already on the prototypes?**

Standard examples:

- So what happened there?
- Was that what you expected? Why or why not?
- So what goes through your mind as you look at this?
- Which part of the page were you looking at?
- Did you find what you were looking for?
- What would you do next? Why?
- Is there anything else you would do at this point?
- Is there any other way to do that?
- What did you think of that?
- In what ways would you want this changed to make it better for you?
- What additional info would have helped?

Debrief (3 minutes)

- What's your general impression from what we have done today?
- How was it to participate in this user interview? What could've been better?
- Do you have any further comments or questions for us? Anything?
- **Would you be interested in participating in further user interviews?** How should we contact you?

Standard examples:

- What do you like/dislike about this?
- If you had 3 wishes to make this better for you, what would they be? Why?
- How would you describe this to a friend?
- Under what circumstances would you use this? Why?
- Can you describe to me what you see on this page?
- Which parts of this page are most/least important to you?
- What do you think this [point to UI element] might do?
- What does this [point to UI element] mean?
- If you wanted to _____, how would you. . .?

Wrap up and cool down (3 minutes)

This has been incredibly helpful.

[Interviewer: Try to briefly summarize some key parts of the discussion or issues.]

Your input is really valuable for me and the team as we think about the next steps for these ideas. We really appreciate your taking the time to come in, and answering all of my questions. Thanks SO much!

[Interviewer: Give participant incentive gift.]