



Norwegian University of
Science and Technology

Designing a smartphone stabilizer

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Designing a smartphone stabilizer

BY VIKTOR RYDAL



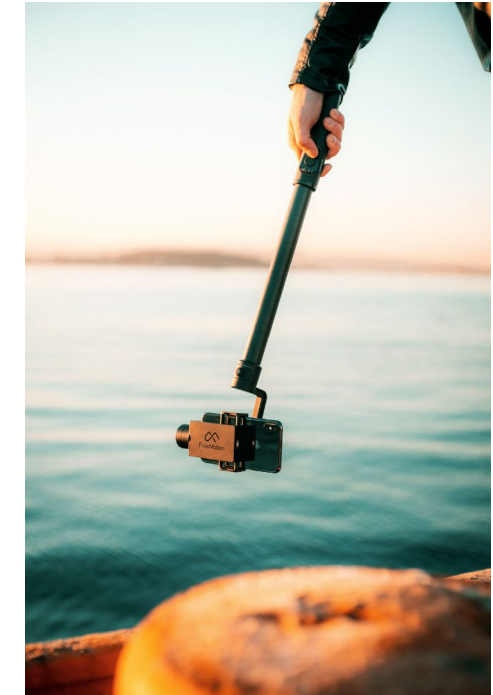
About FlowMotion

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.

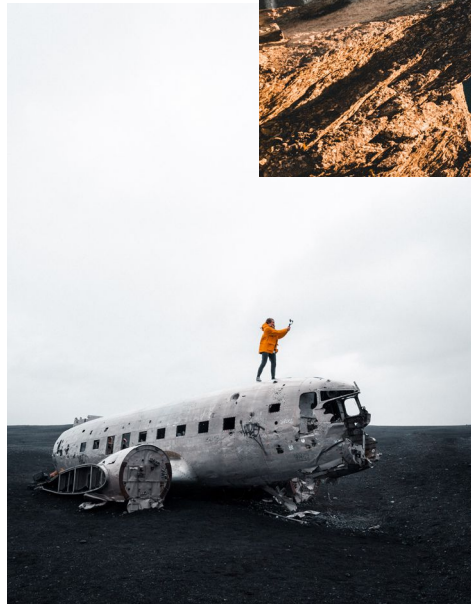
The startup became an overnight sensation after launching their first product, the FlowMotion ONE smartphone stabilizer, on the crowdfunding platform Kickstarter. The project raised \$1.3 million USD in just 50 days, selling more than 5,500 products. At the time of writing this, the project is still 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.



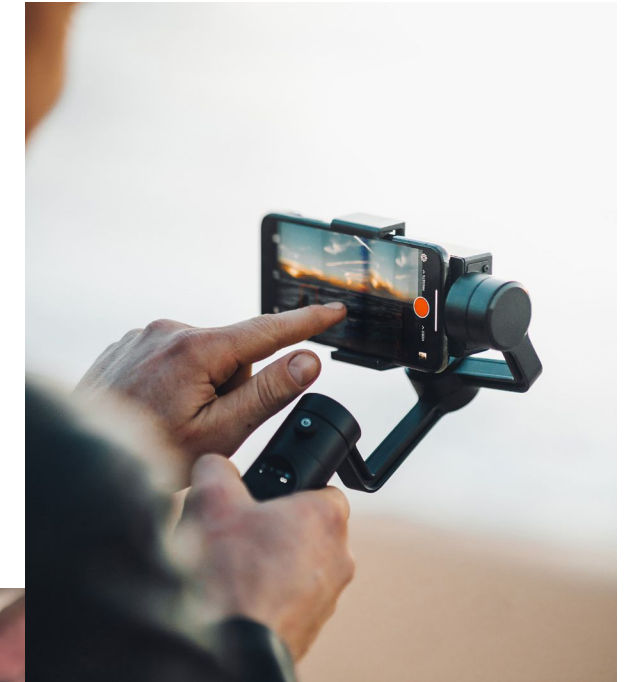
Scandinavian



Adventurous



Professional



Premium

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).

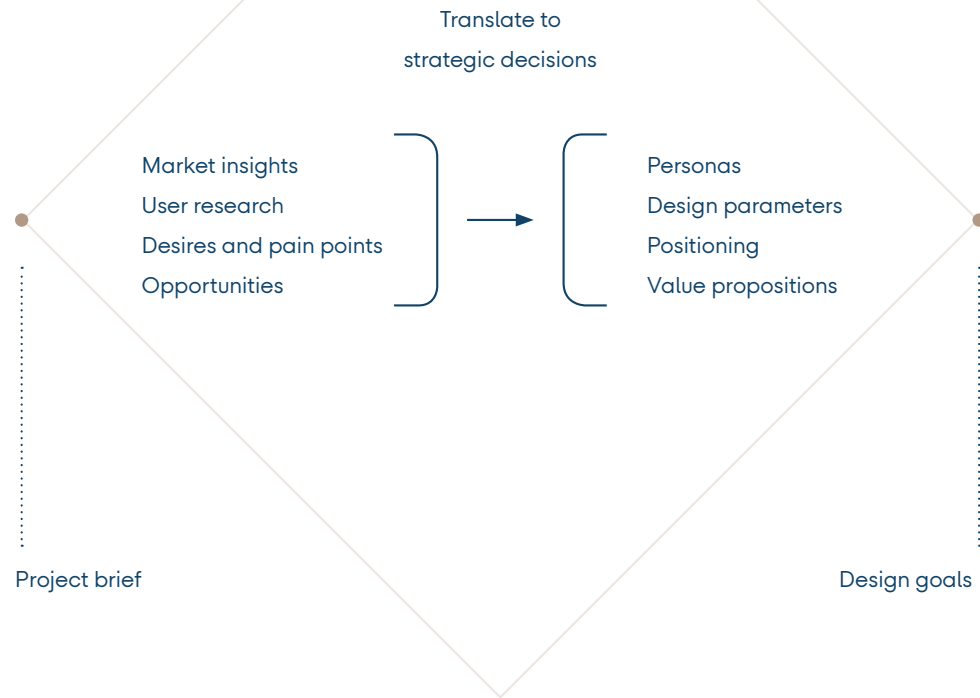
From the concept of this model, my process might appear very orderly and straightforward. In practice, the workflow has been more organic. As new development has been made, it has been natural and necessary to sometimes go back and revisit my previous research and work. Inherently, my design process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



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.

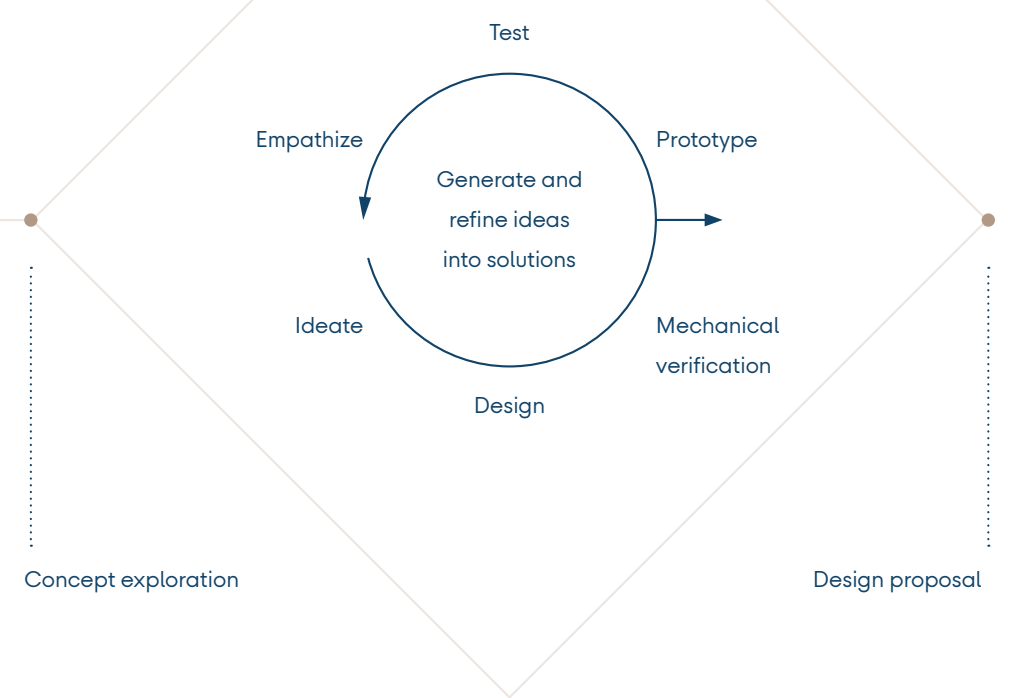
The third phase is an iterative one where possible solutions to the design challenge are generated, evaluated,

Develop

Think, make, test, repeat

Deliver

Putting everything together



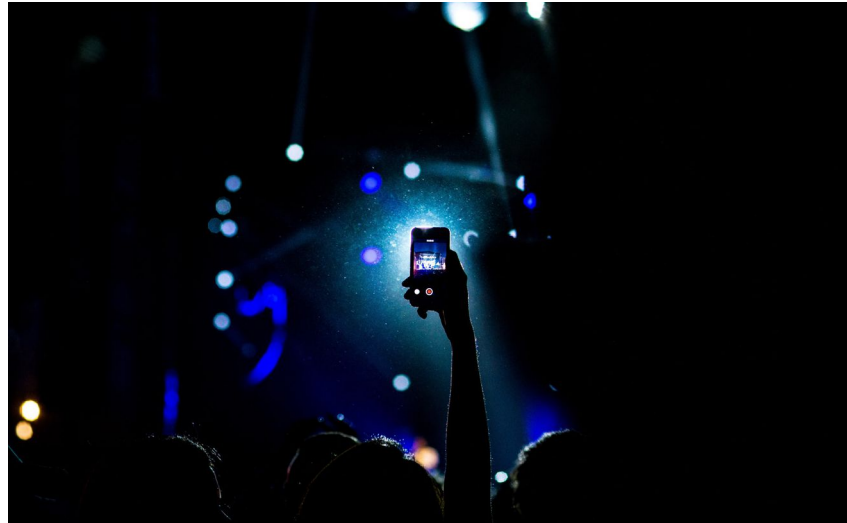
and improved. Because I intentionally focused on physical results and user testing, there is an emphasis on the development phase in this project.

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.

What is a smartphone stabilizer?



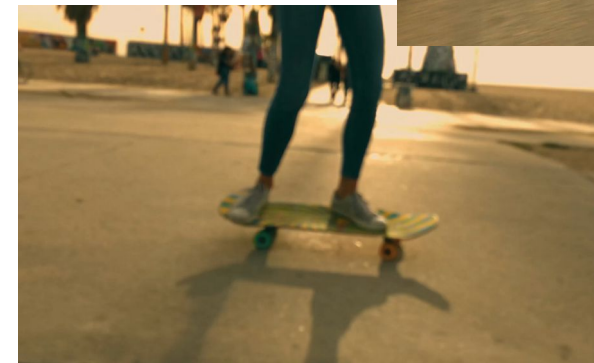
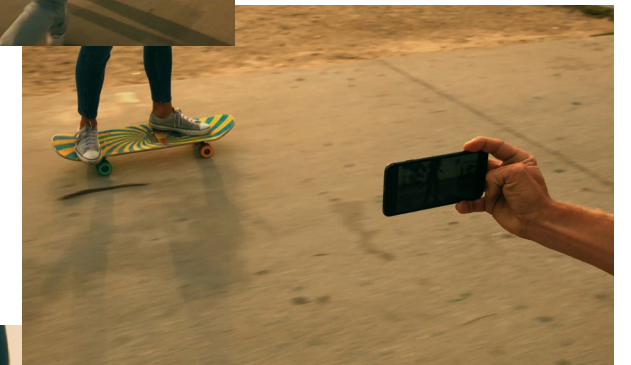
The best camera is the one that is always with you. For most people, that is a smartphone. Modern phones have incredible cameras but they were never made to replace traditional cameras — they were made to slide nicely into your pocket and be your second brain. The phone is difficult to hold steady and 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

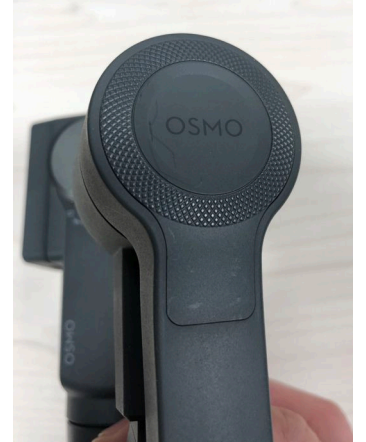


Not suited for activities

Poor grip and operation



Shaky videos/
blurry photos





FlowMotion ONE

DJI Osmo Mobile 2

Freefly Movi

Zhiyun Smooth 4

DOBOT Rigiet

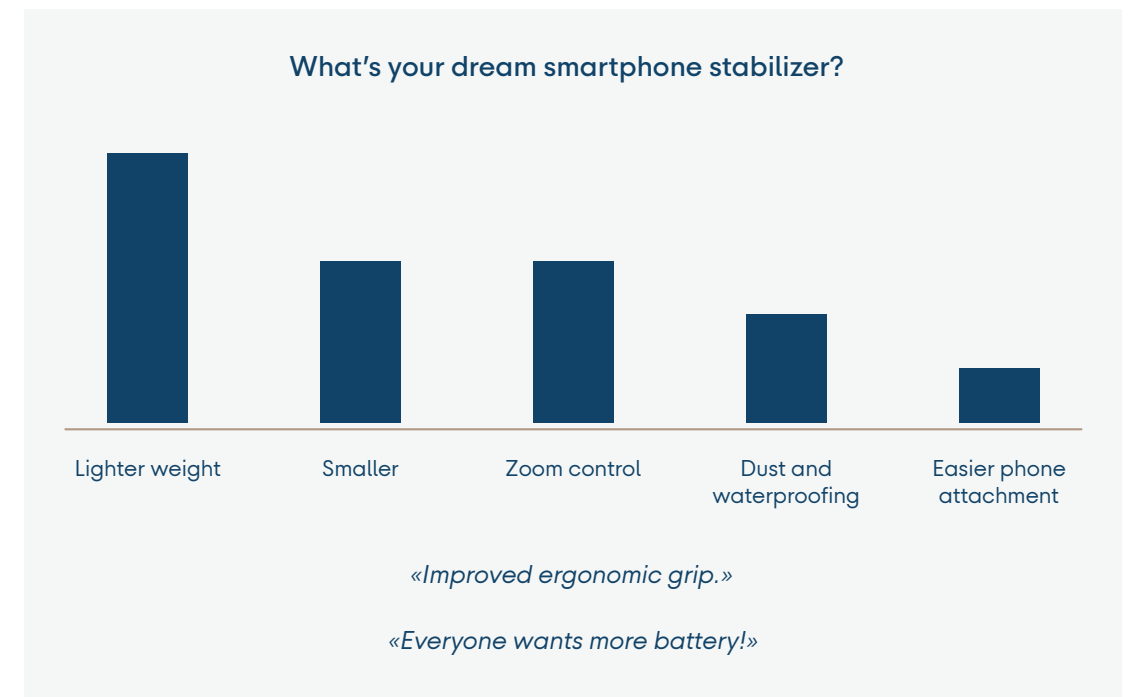
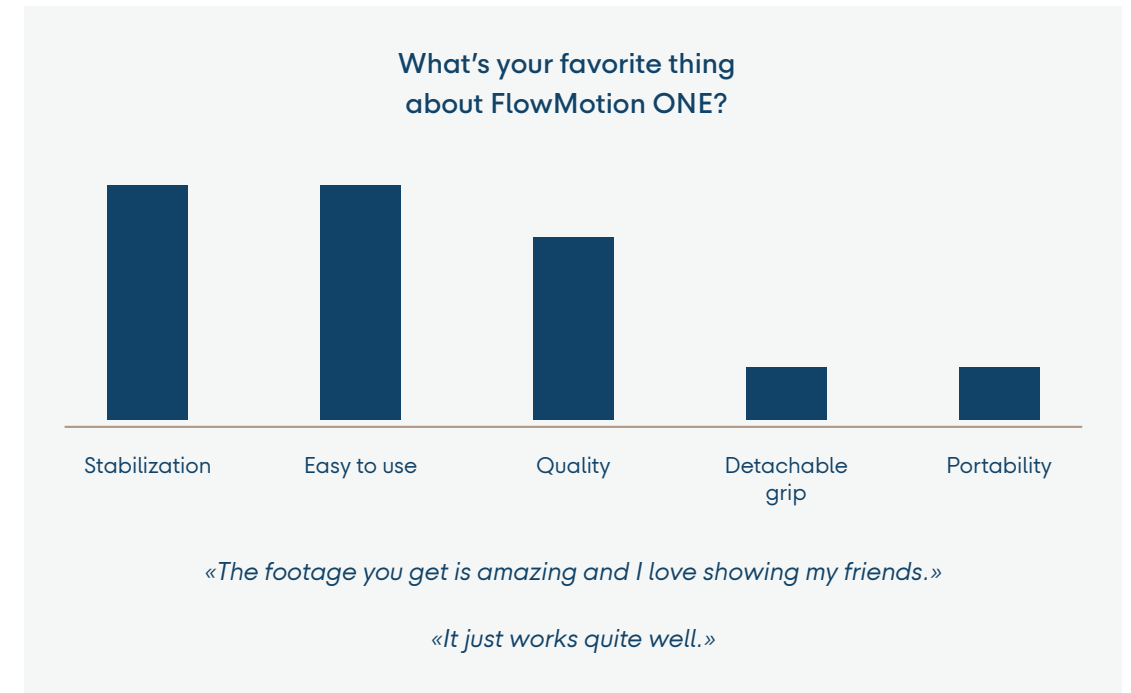
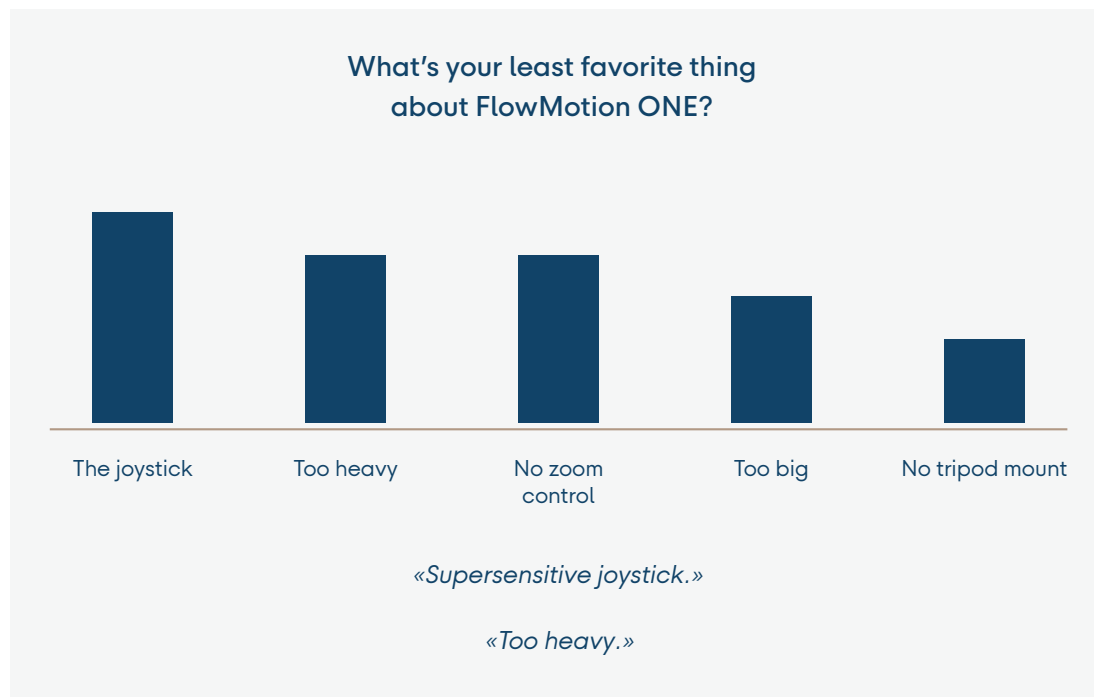
Feiyutech Vimble 2

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 understandable	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 intuitive, per session	Slow, set it once	Slow, per session	Slow, set it once	Slow, set it once	Quick, but imprecise, 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, nothing 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)

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.





Riley Burkard

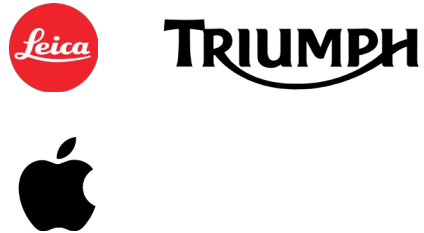
35 years old
Stunt coordinator
Engaged
Los Angeles

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



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



Goals

- Build an inclusive online community around yoga, healthy food and urban living
- Share inspiring and educational videos of her yoga practice, 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

Design parameters



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.

DEFINE

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

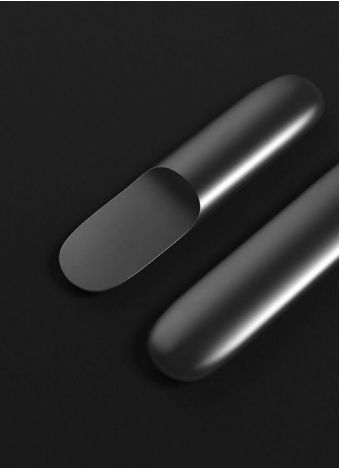
Won't

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

Communication



Silhouettes



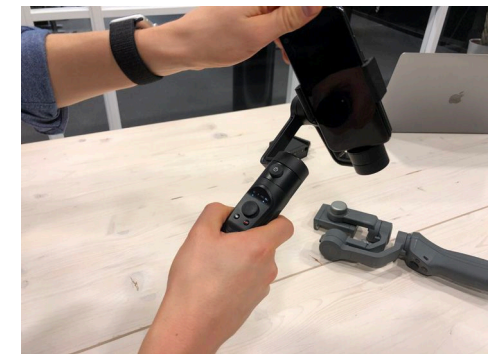
DEFINE

User test 1

Findings

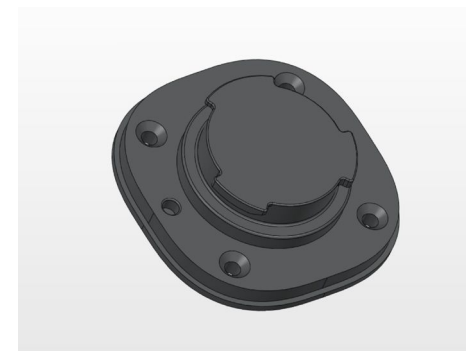
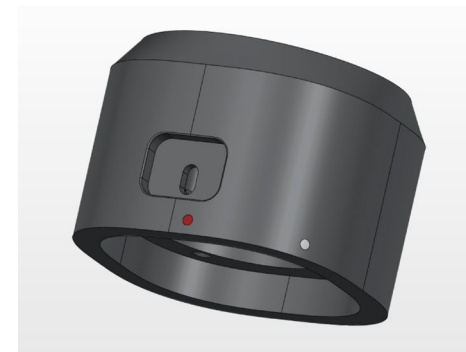
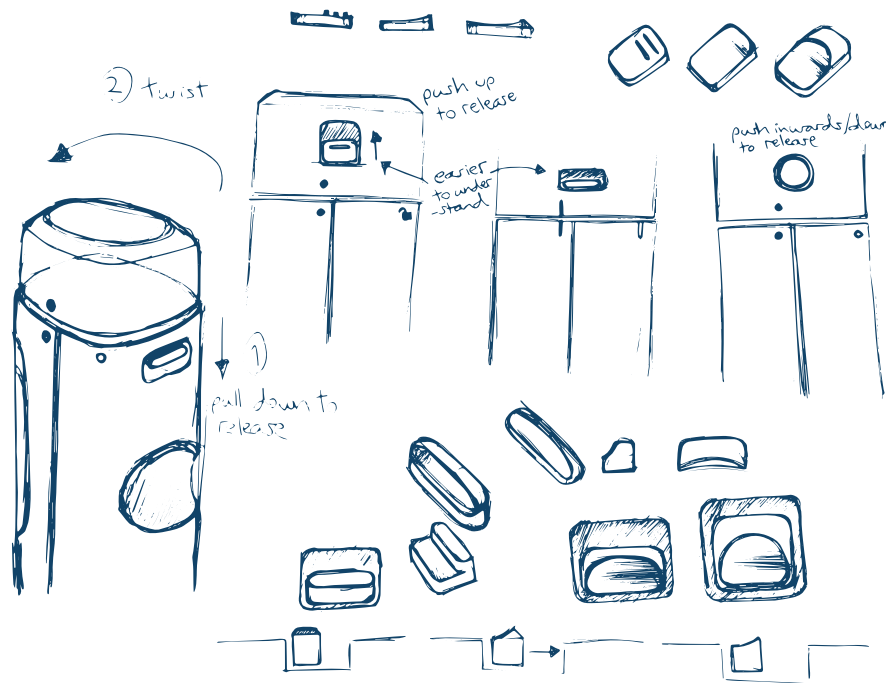
Portrait mode

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.



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.



User test 5

5 participants
60 minutes each

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

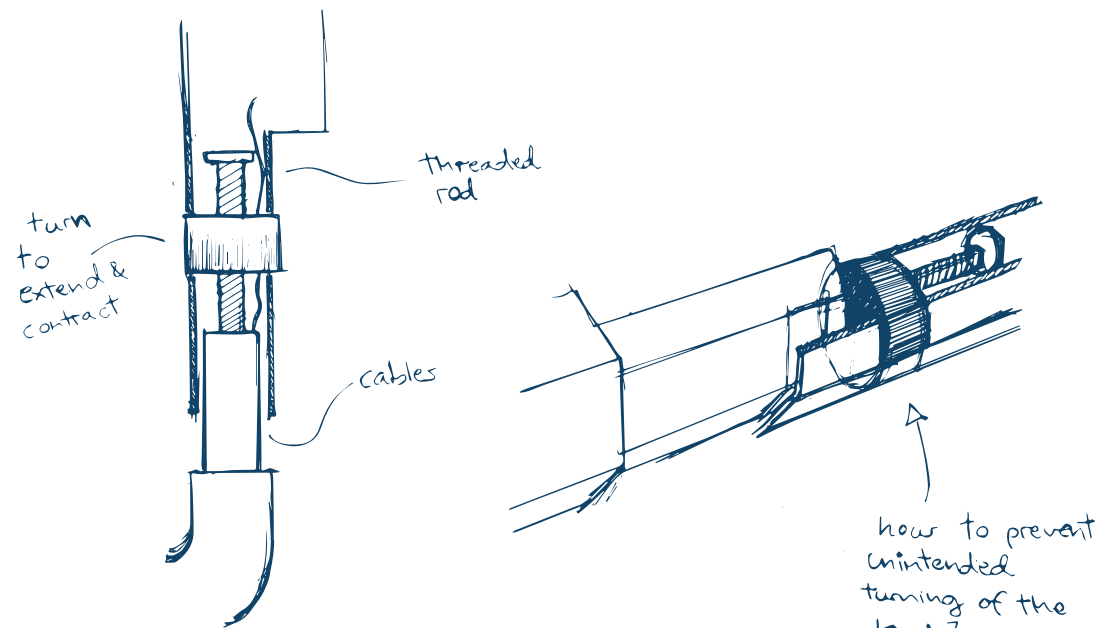
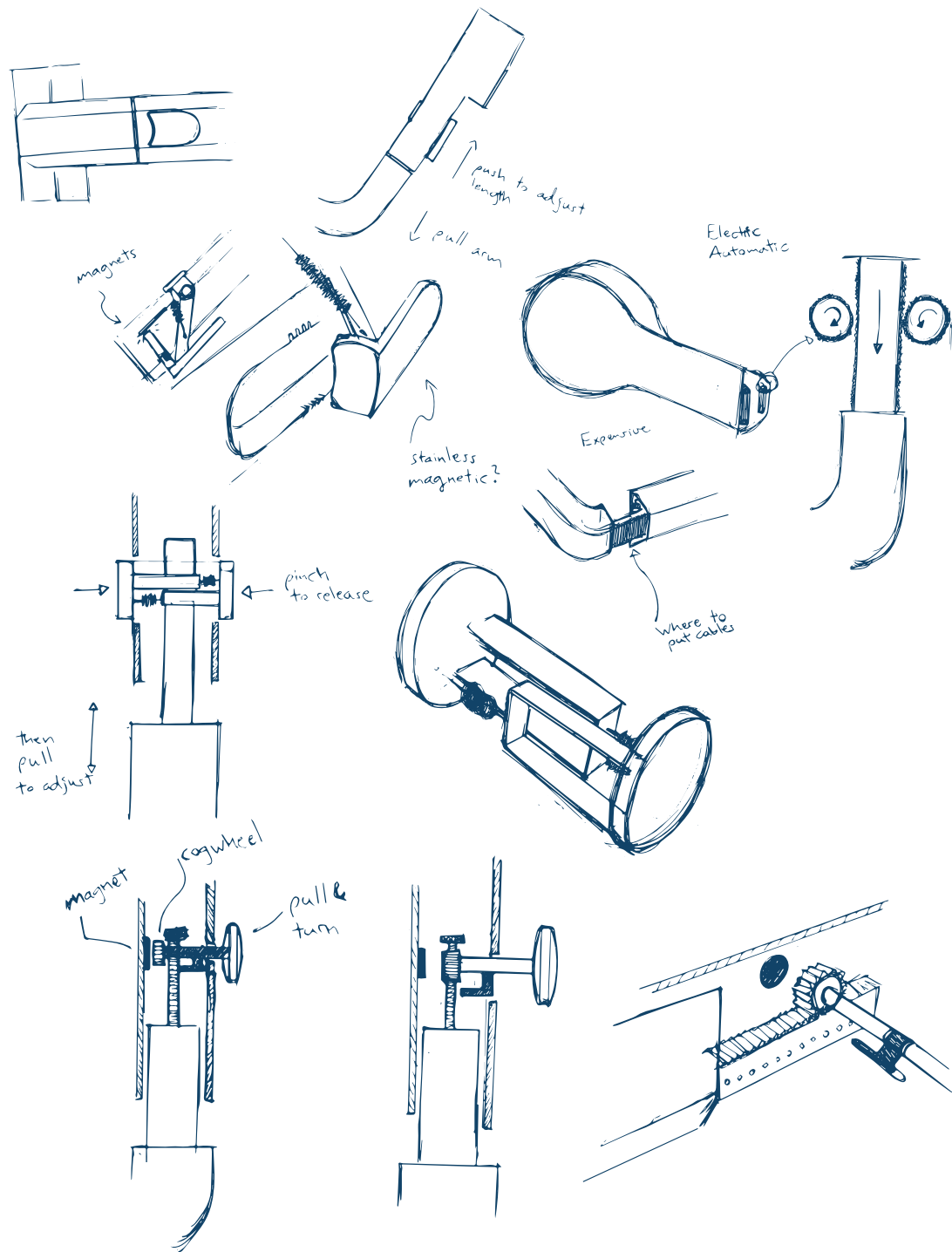
- What do users think about the improved grip?
- Which groove position do users prefer?
- Which groove texture do users prefer?
- What functions do you want to control from the grip? Why?
- What do users think about the improved detachable solution?
- Do users trust the camera lens concept?
- Which release 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

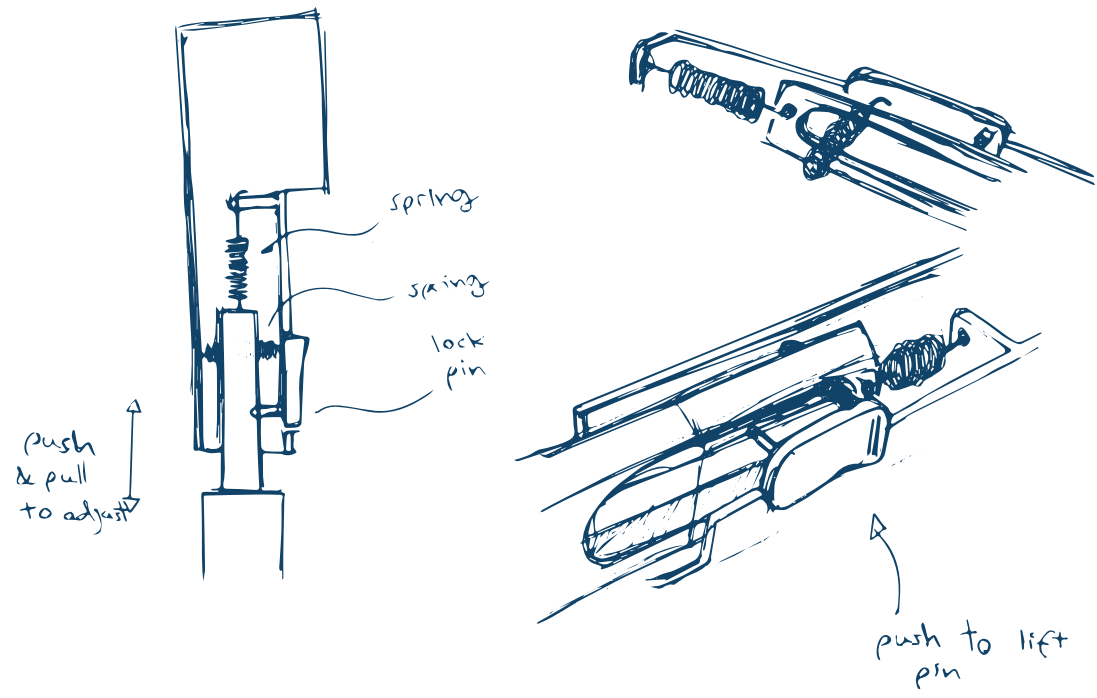
- Can users comfortably hold the grips?
- Which groove provides a more secure grip?
- Is the new groove smooth and comfortable?
- Does the grip feel too heavy? How is the distribution?
- Can users easily understand and work the detachable grip?
- Are the indicators easy to understand?
- Do users get 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



All of these concepts were deemed impractical to make.

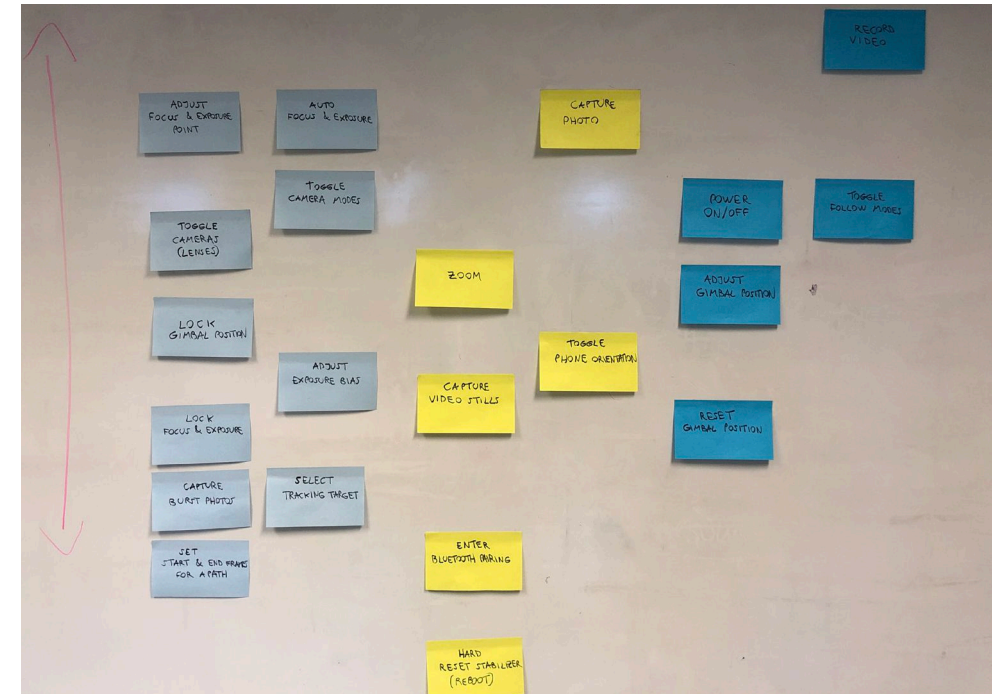


Function analysis

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

High
↑
↓
Low



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.

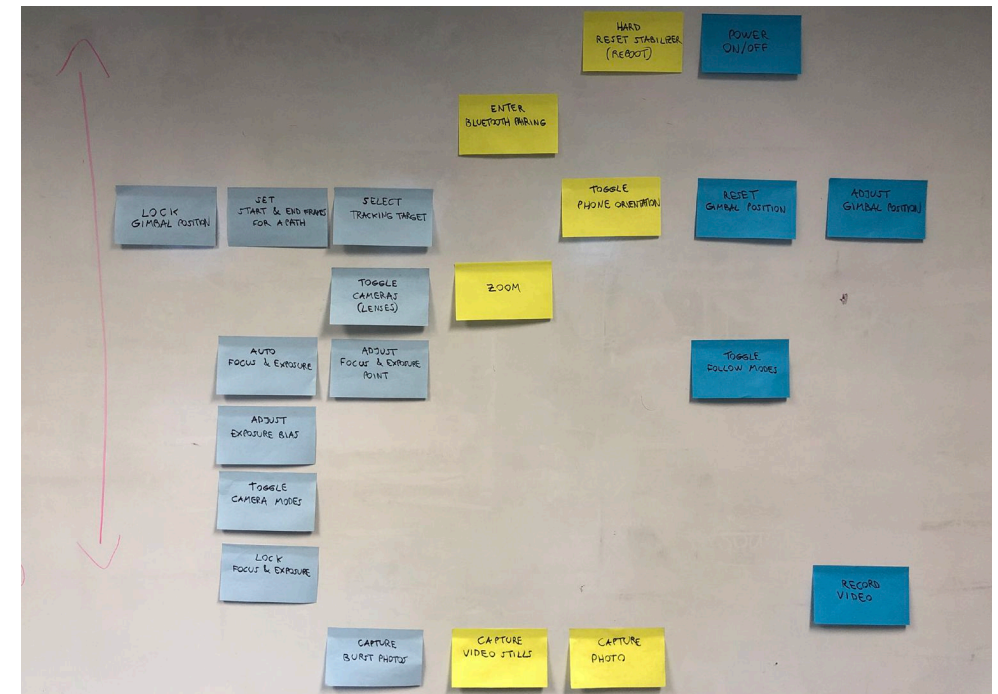
In my experience, not many users seem to know about exposure lock, which is a feature most camera apps have. However, whenever I have shown someone how to use it they have always responded positively and talked about how they will start using it. Like with the POI, it is unideal to execute on-screen 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.

Function analysis Risk

High
↑
↓
Low



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

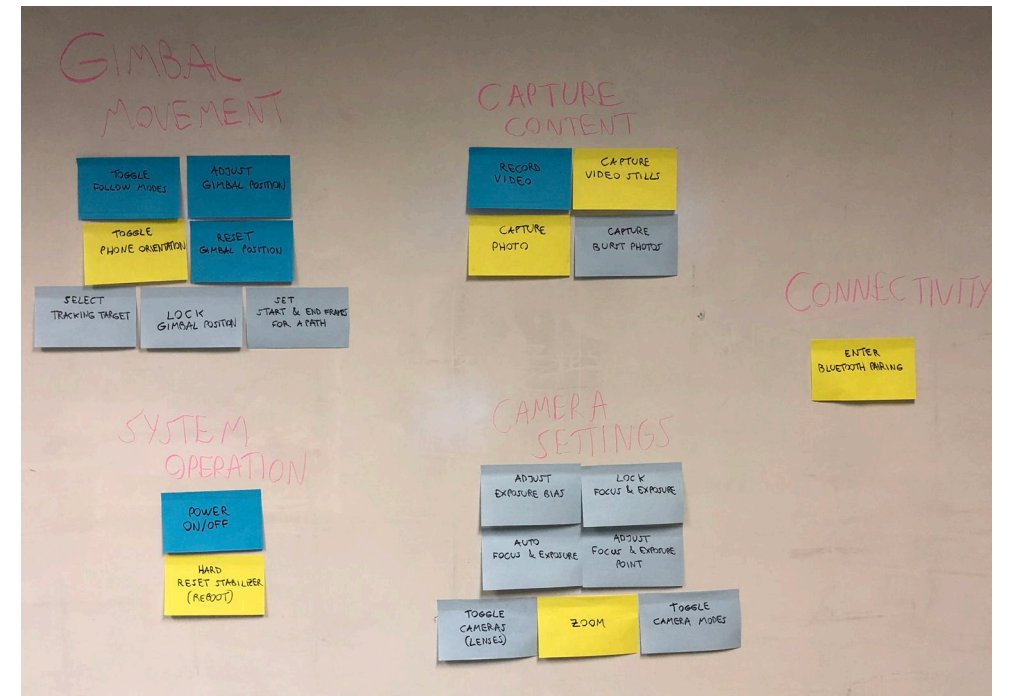
on but since it is no longer connected to the phone you would not be able to start or stop recordings from the grip, or perform other actions within the app. The third and fourth rows of functions in the diagram are also noteworthy. These functions may alter the framing of the shot or change the lens, which can also ruin the moment for the user. The other functions are less critical but, of course, frequently getting shots that are blown

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.

Function analysis Category



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.

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



Shutter button
 Half press for AF/AE
 Full press for photo or video stills
 Press and hold for burst photos



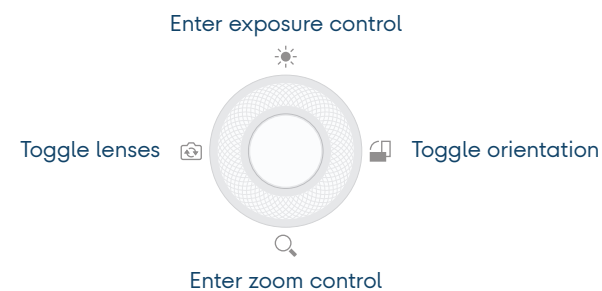
Record button
 Press for videos



Follow mode button
 Single click to toggle modes
 Press and hold to temporarily lock position



Camera mode button
 Single click to toggle modes



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

Color and material

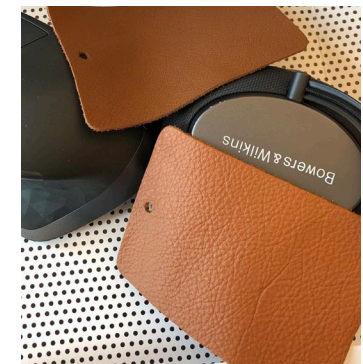
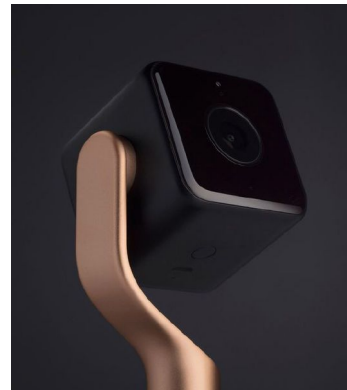
One of my intentions with the design is to make it unobtrusive — to push the technology to the background and let the user focus on the act of creating. After all, we don't really love technology, we love what it can do for us. However, that does not translate to dull colors or the absence of color — 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



FlowMotion TWO
A premium smartphone stabilizer



DELIVER