

WEARABLE STORAGE

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Degree project for Bachelor of Fine Arts in Design

Main field of study in Industrial Design

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ISRN: LUT-DVIDE/EX--24/50673-SE

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ABSTRACT

This project is about challenging the traditional concept of a backpack. They tend to be designed around the carrying of objects, moving them comfortably on the body from A to B. This product focuses on the stationary use when the collection of objects are next to the user and when they take things. The final design should be able to stand upright, or on its side and display the contents like a shelf or storage box rather than a sack. This encourages a smoother interaction which means that the user is not interrupted from their task and at large this makes the task, and switching between them, more accessible.

BACKGROUND PHILOSOPHY

This project takes inspiration from one of my earlier projects, EMPT-EASE. In that project the design was intended to promote a new relationship with an existing product, the backpack. It is meant to enable you to quickly switch the contents of the bag to suit your current activity. This stemmed from the realisation that a smoother interaction with the backpack would also lower the threshold to biking or walking instead of taking the car.

When the interaction is streamlined, even by these relatively small steps, it is a step towards making that sustainable alternative more available. The packaging is also adapted to bringing home strapped to a bike or carried as a backpack. Everything should be adapted to this active and sustainable lifestyle.

This was the start of a continuing experimentation of the way we organize and categorize the objects around us to more easily focus on the activities we actually want to spend out time on.

Focus on the interaction with the bag that is not about carrying things, but about having them close at hand by your side.

Instead of focusing on transit you focus on the stationary state when the bag is not on your body, but by your side. The interaction with the bag when the users thoughts are occupied by another activity.



GOAL/BRIEF

Design a backpack where the contents are both organized and easy to access to enable a comfortable flow between activities.

Design a backpack like a portable furniture that readily presents the content you are looking for without hassle.

Challenge backpack conventions by experimenting with unconventional materials.

RESEARCH

Survey

To learn more about the habits of back pack users, I made a survey asking people about what activities they do on a daily basis, and how they transport themselves between these places. The survey was structured to let the answerer plot out a typical day in their life and the objects they bring around.

The survey was published on different social platforms. First published in Facebook interest groups and then later also onto r/sweddit and r/sverige on Reddit. Different links were sent out, making it possible to compare the results between the platforms. In total 60 people responded to the survey, 44 from Reddit and 16 from Facebook.

Reddit users had drastically lower attention span, with an average time to complete the survey being 3-6 minutes. This is compared to 9-15 minutes on Facebook groups.

Facebook users spent much more time filling out my charts and thoroughly listing their daily routines. While Reddit users might have skipped some steps, they took every chance they could to send comments and opinions in the comment section on the platform.

EXAMPLE ROUTINE WEEKDAY

- Home
- Breakfast
- Bike
- School
- Lunch, Ready-made
- School/work
- Bike
- Grocery store
- Bike
- Home
- Dinner, homecooked
- Bike
- Sport activity 1
- Bike
- Home

In one part of the survey, the participants were asked to block out a typical day in terms of activities and preferred transport (as seen on the image to the right).

With this I got a lot of feedback and perspective, such as the insight shown above. In the end I decided to not compile most parts of the survey since they can't really be used to draw objective conclusions with this small dataset, especially on because of the open-ended questions. But looking at them all still gave me some direction and inspiration.

Common to shop groceries directly after school/work.

- Breakfast
- School
- Lunch, restaurant
- School/work
- Grocery store
- Home

Groupings based on object properties and needs

In one part of the survey the participants were asked to list the objects needed for each activity. They were also asked to describe how they later store these objects when in transit and when not in use.

The resulting objects were then grouped together based on their properties and storage needs.

This is all the contents people in the survey weekly carry between activities. I then tried to see how these could be organized in a backpack. This was not meant to be a suggestion on the appearance of the backpack, but a way of figuring out what objects could be clumped together and how to meet the requirement on the backpack.

“If you need to move around to other bags you often forget something. Like the passport or a charger.”

This quote was written by one of the survey participants and is a good example of the problem. Some items are more important to remember than others, forgetting my laptop charger or passport might ruin my day, but these are also the kind of items we are more likely to put into various separate compartments to protect from damage and to “know where they are”.

Objects	Needs
Computer,	Thin squares, not be damaged when accessing, padded and separated preferred
tablet, note book, Books	
lunchbox	
Clothes, shoes, water bottle, resistance bands, handduk, schampoo	Separated from rest, sometimes in connection to school/work, sometimes not,
pens, diverse object, medicin, make-up, tampons,	Need to be contained into a smaller space. Might be a good idea to separate these objects into different compartments/baggies, modular ”necessär/pennskrin” might be beneficial.
Phone, Wallet/cards, Keys, Glasses, jewellery	Might need to be put away when training, but still kept safe
headphones, computer mouse, chargers	Often just stored loose
Other, Extra storage (Totebag, plastic bag, backpack)	
Other	

Needs to backpack

Based on the needs and objects discovered I have decided to simplify the backpack into three modules. I call them modules but the backpack should not be modular in the sense that you should be able to detach or attach the modules from the backpack. But the modules will be distinct and distinguishable from each other that all caters different needs and can be accessed individually.

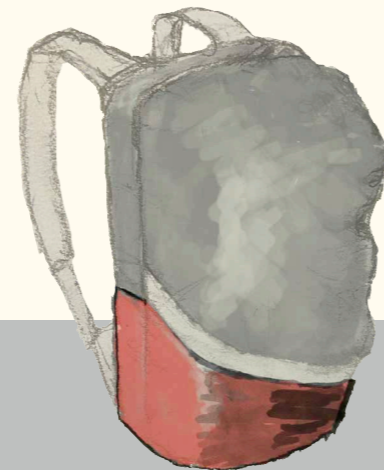
There is a balance between helping the person by creating structure, and to limit how you can use the object. I have therefore chosen to avoid having too many compartments.

Objects	Needs	Color indicates category and relation to other category
Computer/Tablet	Thin squares, not be damaged when accessing, padded and separated preferred	Blue
tablet, note book, Books		Light Blue
Lunchbox	Separated from rest	Red
shoes, Clothes, resistance bands, innebandyklubba, handduk, schampoo		Light Red
Various objects (headphones, computer mouse, chargers)	Might need to be protected from each other.	Purple
smaller objects pens, diverse object, medicin, make-up, tampons,	Need to be contained into a smaller space. Might be a good idea to separate these object into different compartments.	Light Purple
Important object Phone, Wallet/ cards, Keys, Glasses, jewellery	Secure pocket inside bag. Might need to be put away when training, but still kept safe.	Light Grey



“Sleeve”

- Located closest to the persons back
- Store anything square and thin, laptop, tablet, notebook etc.
- Needs to be padded



“Base container”

- Access from side
- Food container, shoes etc.
- Rigid build, makes it easy for the bag to stand upright



“Pouch”

- Versatile storage
- Easily expandable
- Have compartments inside

How to access the backpack

To be able to easily access the backpack it is important to think about how and where we access it. The first question I asked was: Is it more important to access the backpack while I am on the move or when it is stationary.



While it is nice to be able to access the backpack while on-the-go, this isn't the most important aspect since the bag's primary access point should be when arriving at specific locations and having to access/store location specific items.

This led to me focusing on accessing at these three stationary points: while hanging, while on table/desk and while on the ground.

Wall/hanging



Hanging the backpack makes it easy to access the backpack at a comfortable height. It also makes sure the backpack isn't in the way and creating a tripping hazard.

My previous EMPT-EASE could also be a good companion piece to the backpack, creating a permanent base for your backpack at home.

When the backpack is hanging it is important that it can be easily opened without having items drop out.

Table/desk



Accessing the backpack on a table also puts the backpack in a comfortable height, especially if sitting down in front of the table/desk. Here it would also be beneficial to be able to have the backpack lying next to you when you are sitting at a desk doing an activity such as working. Then you could take items from the backpack when you need them and then put them directly back.

If you look at the image above, the person needs to use two hands to access the compartment, meaning they have to have their whole body facing the backpack.

For this reason it is very important that the backpack can be placed flat against the surface, or maybe the side, and being easily accessible using only one hand.

Ground



The backpack should be able to stand upright without tipping. If you decide to open the backpack, it should be able to stay open by itself. Should still be able to access the backpack with one hand, making it easy to access while it is standing next to you while sitting.

IDEATION



Dividing without limiting

Pouch prototype 1.0, Inner pocket

Convent Trashbag



- + Easy to pack,
- Impossible to structure

Modular Specialist



- + Good overview
- + Create own structure
- Requires effort to change
- Too specialized for all-purpose storage

Memory Game



- + Pre-determined, consistent structure
- Rigid structure
- Too many options
- "oh i have been looking for that key for a while, guess I didn't check all compartments"

Adaptable Generalist



- + Good overview
- + No hidden information
- + Easy to pack
- + Easy to structure

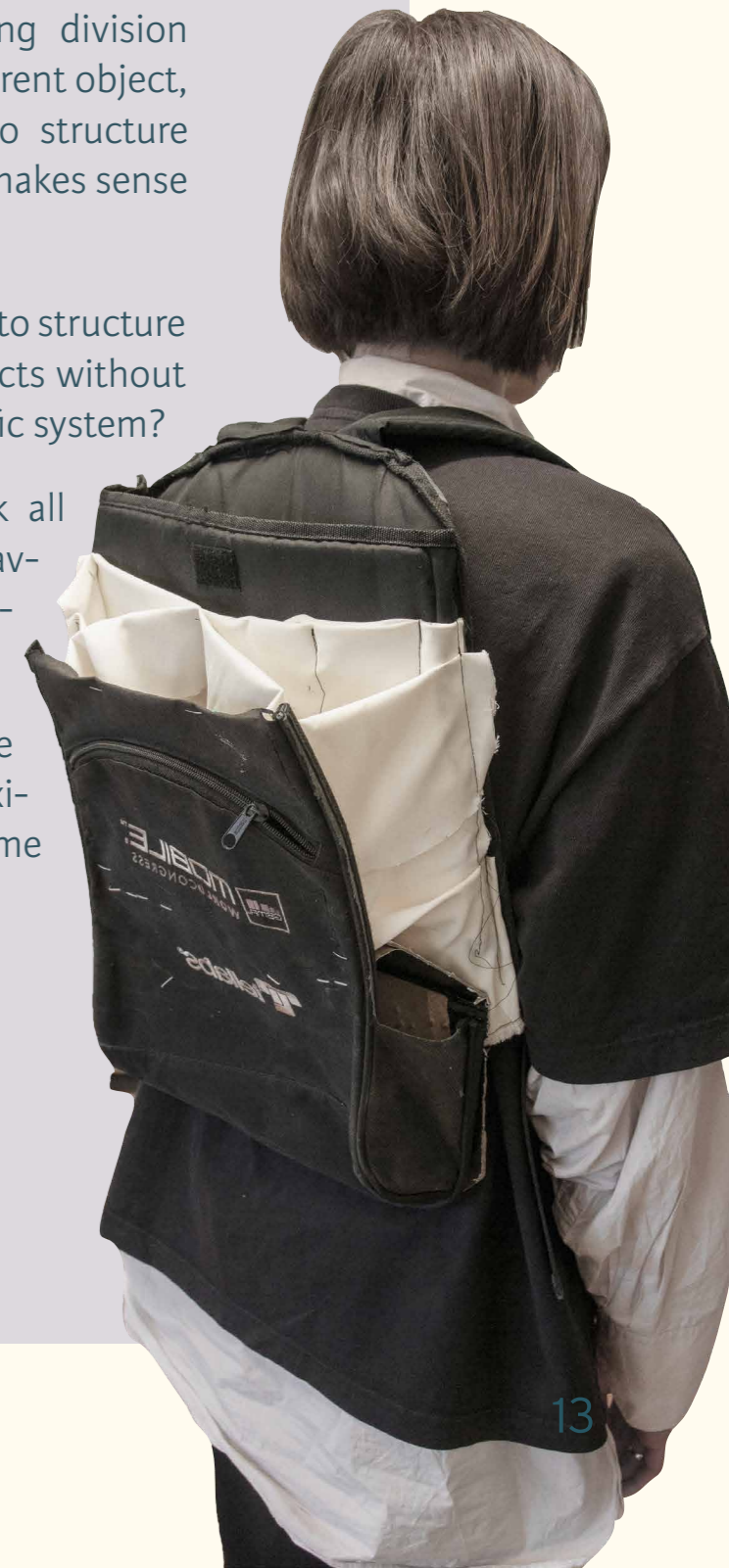
Goal of prototype

In this prototype i tried to find a balance between creating division and structure between different object, while also allowing you to structure and organize in a way that makes sense to you.

How may we add the ability to structure and compartmentalise objects without locking ourself into a specific system?

How can you easily check all compartments without having to check them individu-

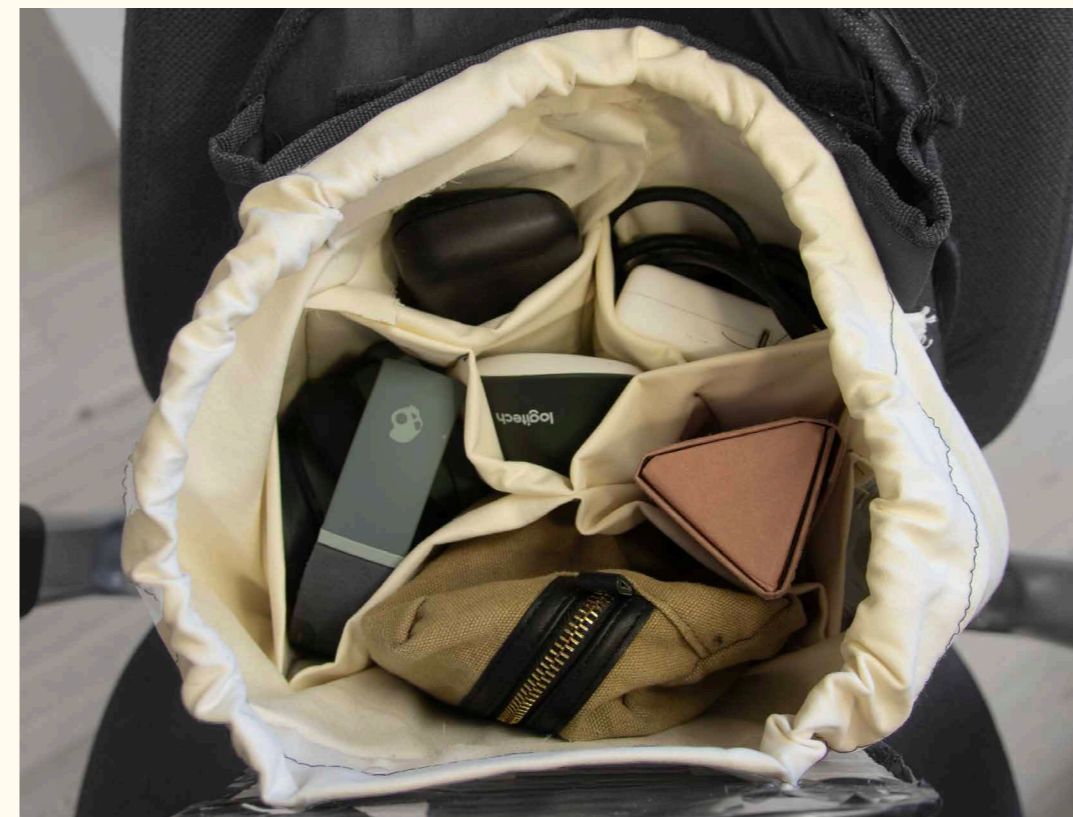
How can we divide and structure the available space without sacrificing the maximum individual object volume that can be stored?



To address this i created a pattern of stretchy fabric that divides the compartments which conforms and adapts to the objects surrounding it. The compartments are made in different sizes to address different needs, with smaller compartments placed alongside the walls of the backpack. The compartments on the side of the walls are great for elongated shapes, such as a water bottle, while the compartments located closest to your back are more shallow and therefore ideal for storing smaller objects, making sure they are easily seen and not forgotten at the bottom of the bag.

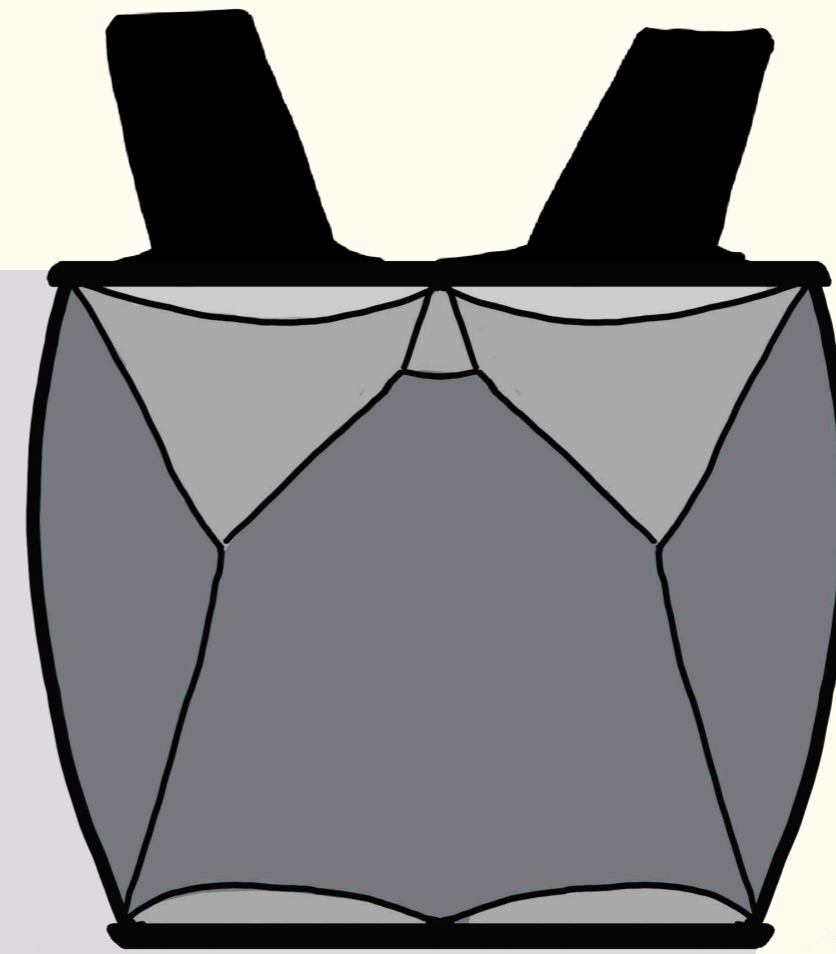
The elastic compartments also allow you to choose how much you store in each compartment. Maybe you need room for one large object in the middle? No problem, the compartment will expand and take up the space previously occupied by the other compartments. This way the compartments truly adapt to your need, without you having to actively modify the backpack in any way.

The fabric compartments also solve the problem of creating structure without hiding the objects, you can open the big compartment and directly see an overview of all the items, without having to open individual zippers or buttons.

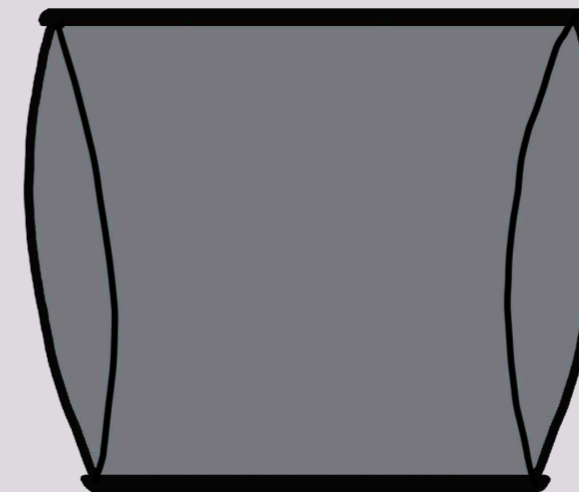


Finalized concept

After evaluating this first compartment prototype, the layout I plan to implement for the final version is very similar, but with some few tweaks, mainly a bigger centre compartment for bulkier or odd-shaped items and keeping the other compartments located around the sides of the backpack, as seen on the top-right image. The three shades of grey represent the depth of the compartment, with lightest being most shallow and stretching down around 1/3 of the total depth, with the slightly darker shade of grey reaching half way down.



Bag opening seen from above



Cross-section of bottom of bag



Opening mechanism

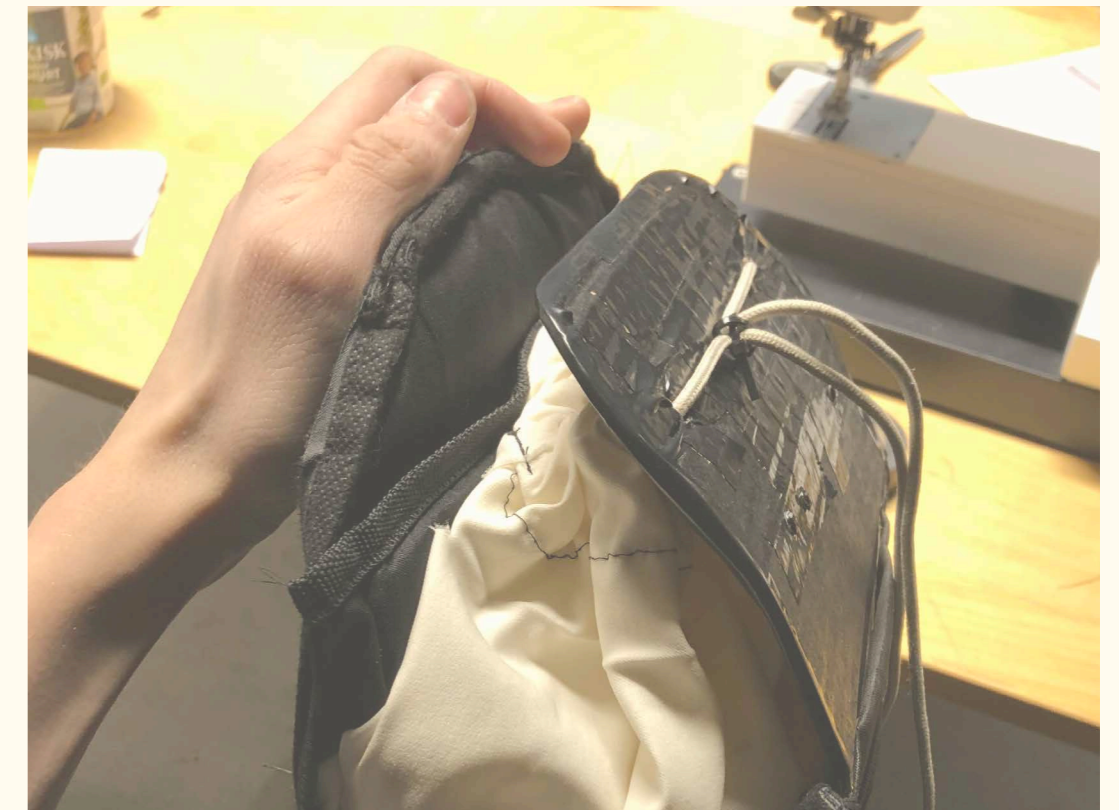
How can we simplify the opening/closing mechanism as to require the minimal amount of effort and steps to open?

My goal in this prototype is creating an opening mechanism that only requires one single movement to open, and one movement to close.

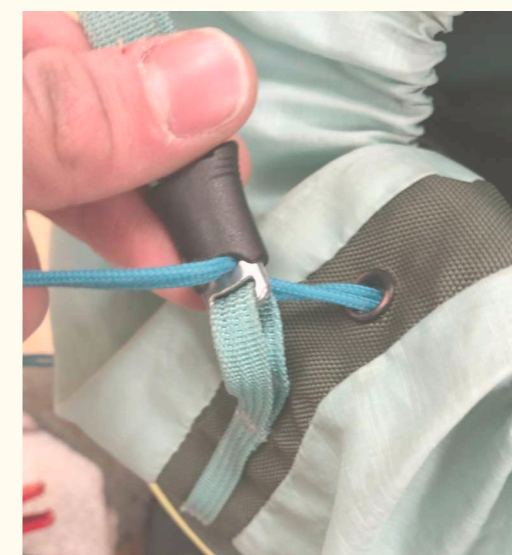
Using a zipper might sound like it only requires one motion, but for such a large and wide pouch you would first have to unzip, and then proceed to pull the pouch open. Moreover, zippers might be great for pockets and sleeves but not great for opening up a larger volumes.

I have therefore decided to secure the pouch by pulling on a cord, similar to the hood on a hoodie. The cord is then passed through a cord lock to make sure the mechanism holds.

When it comes to cord locks, I have found two types that fit my purpose. First we have the conventional push-down cord lock, it will release the cord when the button is pushed down, requiring you to pinch the lock itself. The other alternative, and the alternative I went with is the Cyberian/pull-up cord lock which releases the cord when the lock is pulled, the lock is attached to the bag. In the push lock mechanism you would have two different actions, one pushing down the button and the other pulling the bag open. With the pull mechanism we can simplify this by having it all be one action, pulling to open both the lock to release the cord while at the same time pulling on the bag itself. The Pull-up mechanism also doesn't have to be pulled by gripping the mechanism itself, because of the possibility of adding an extra flap to hold on to, making it easier to get a good grip and don't require the same dexterity. It also means I can design my own flap, and possibly hide the whole mechanism from sight.



Push-down
Conventional cord lock

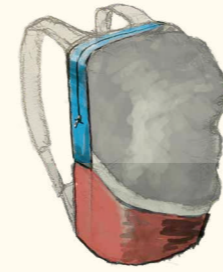


Pull-up
Cyberian cord lock

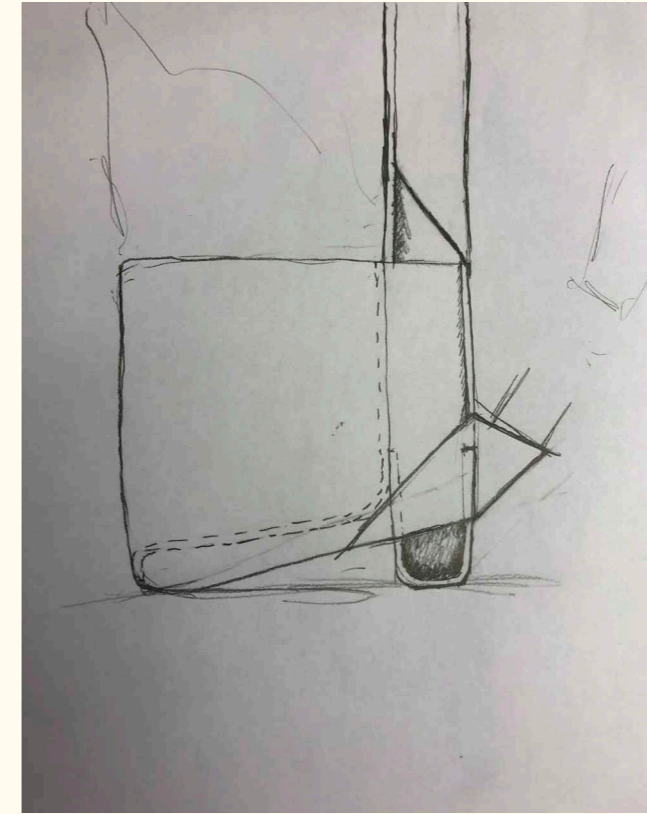
Now we have a opening mechanism that allows you to hold onto the backpack with one hand and pull open the pouch with the other. The next step is then figuring out how to keep the pouch open wide, and how to make it stay open by itself. To accomplish this a stiffer material were added to the outside of the backpack, now the top of the pouch can be sewn alongside both the back and the outside structure.

L-shape

Sleeve and base



The sleeve itself will be conventional in design, and I therefore didn't spend any time on it in this part of the process. However, the Sleeve and base combined is vital for creating the structural stability the bag needs.



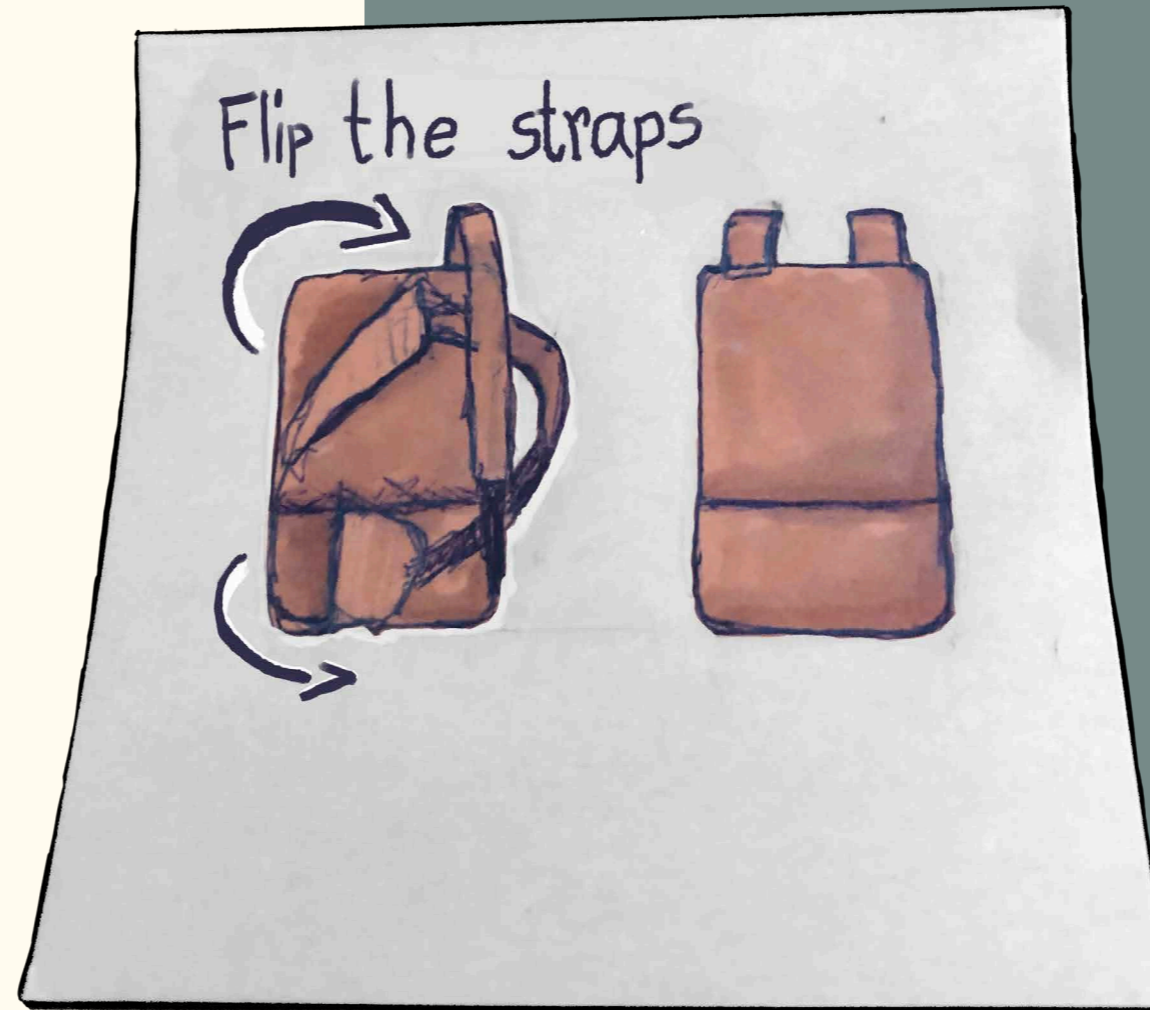
Testing

straps connected to opening

One idea was that by flipping the straps to the other side, the bag could easily lay flush against the table/floor. Especially if having the bag lying next to you on your desktop, it could be beneficial to have the straps not be in your way.

The straps could also help constrain the backpack when on the move. This could also be used as a way of preventing accidentally forgetting to close the compartments before wearing it. This is because you would have to close the compartment to be able to put on the bag.

The concept has some interesting potential benefits that I thought was worth exploring. In the end I scrapped the idea of flipping the strap around because of the added complexity, the idea is at least an interesting gimmick but in my limited testing not a practical solution to the addressed problems.



Opening mechanism

Prototype 3.0
Opening mechanism



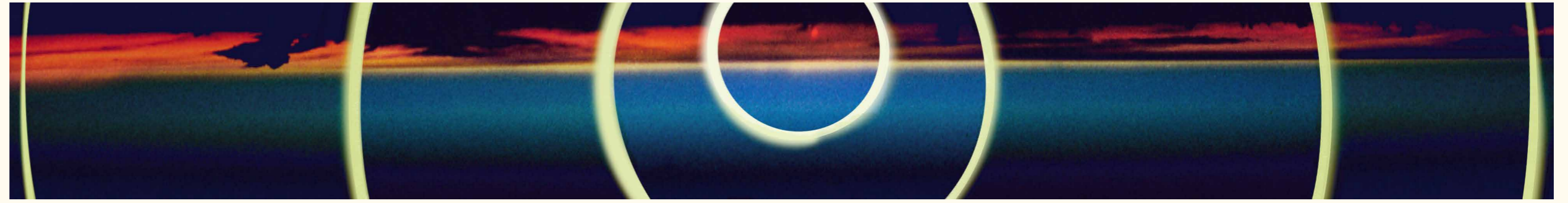
Located to one side, opens up with a pull-mechanism.



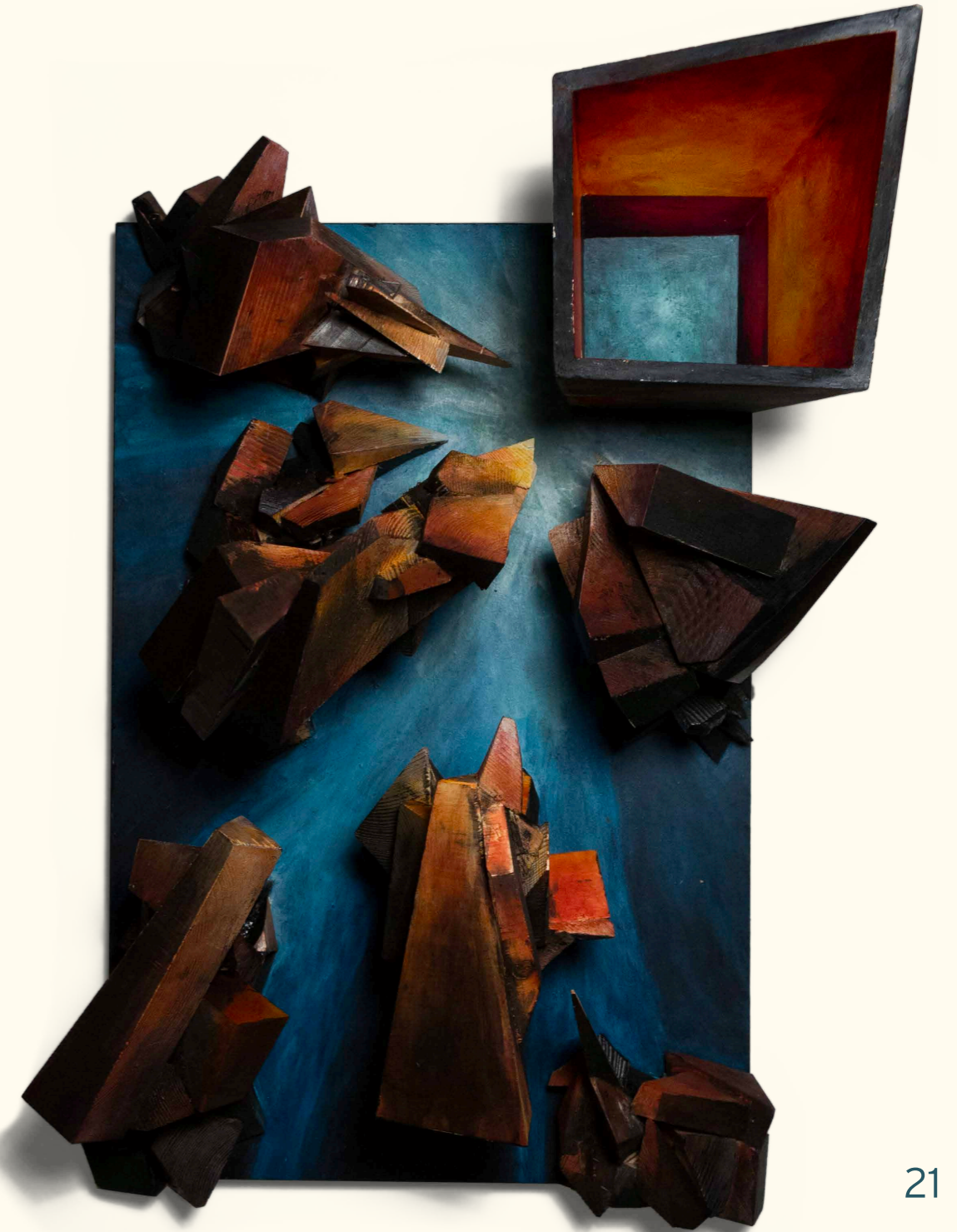
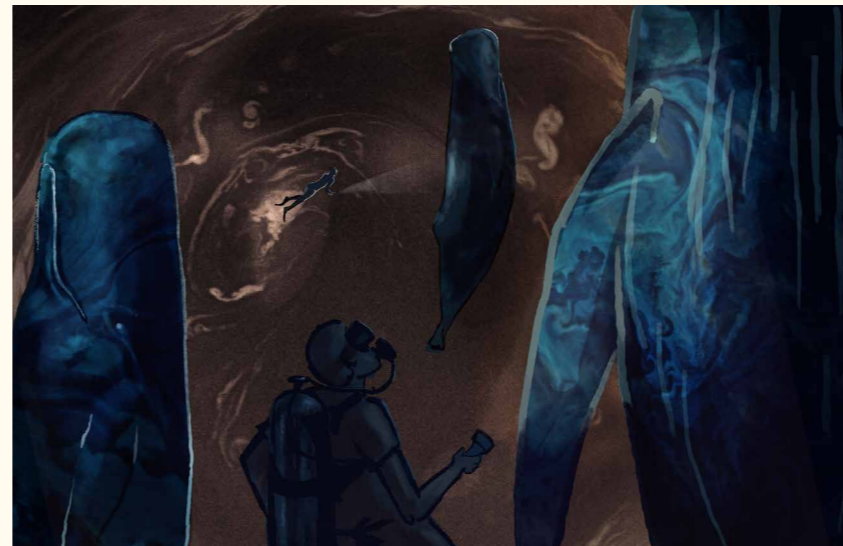
STYLE DIRECTION

Style reflection

Moodboard 1, my own artwork

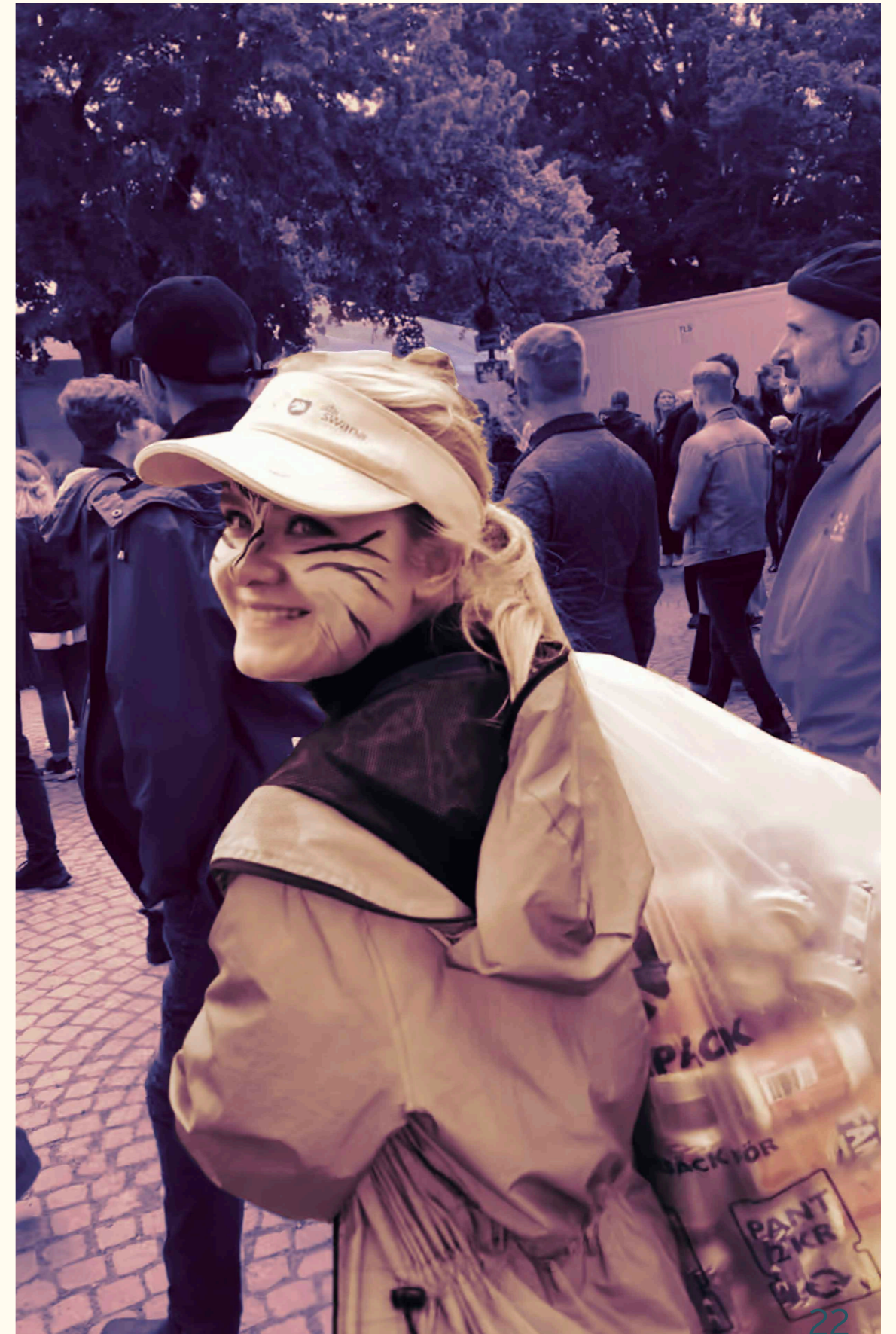
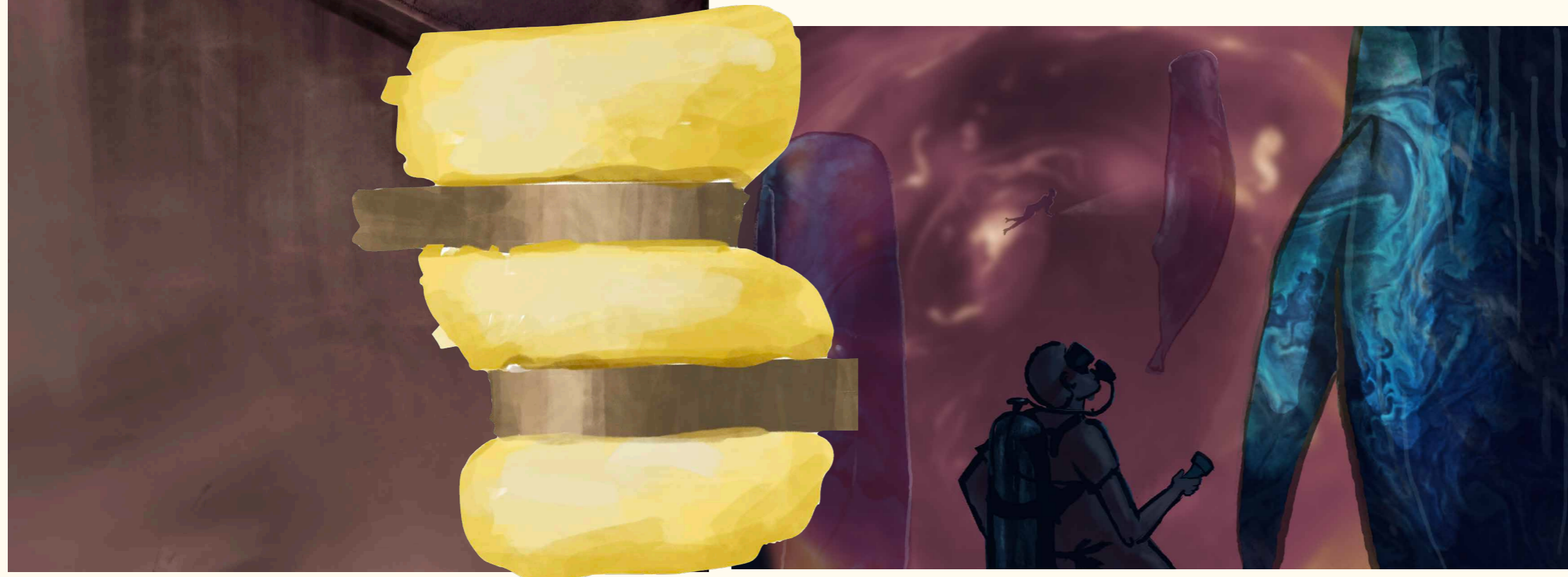


Emotional intensity



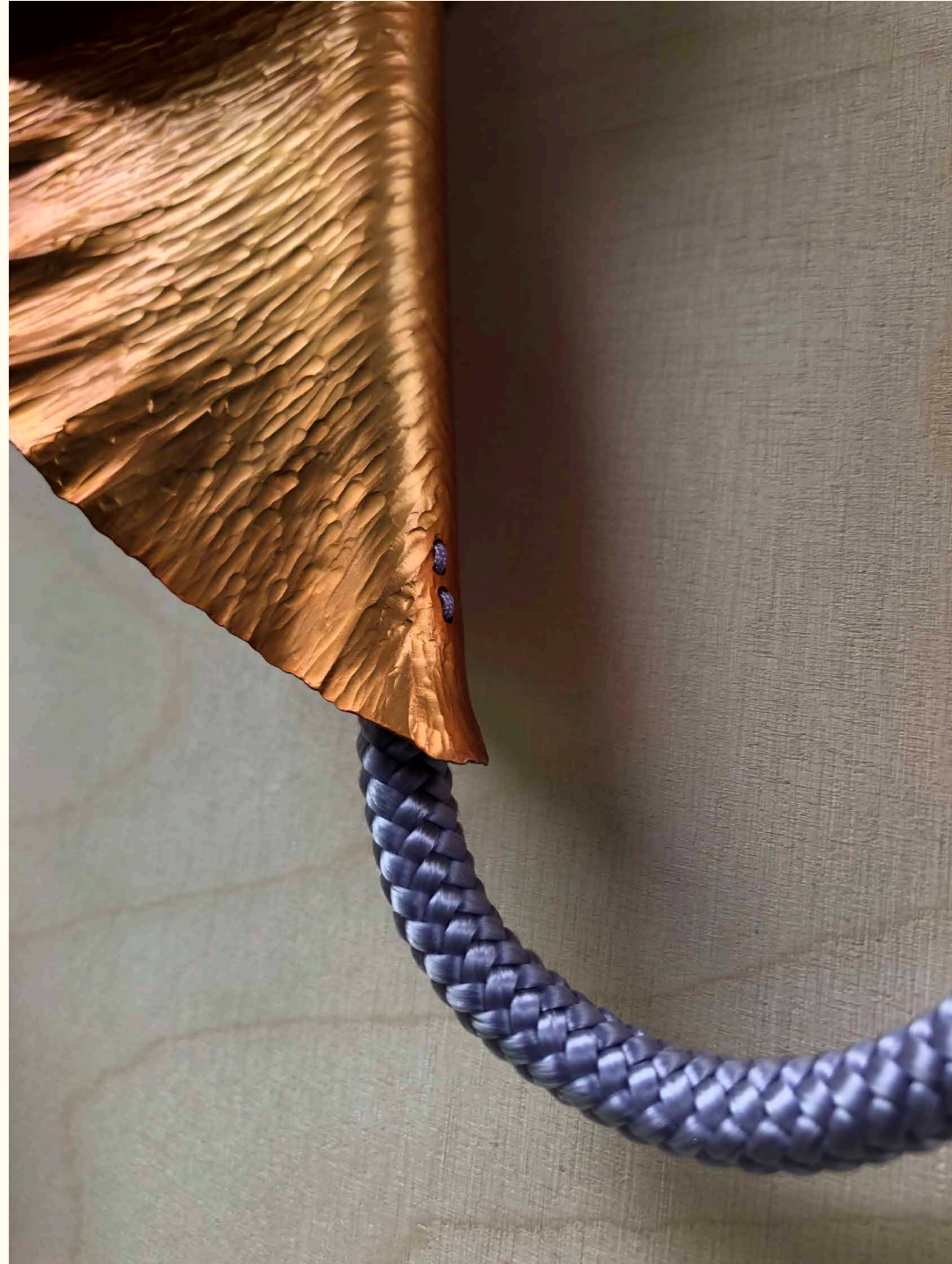
Style reflection

Moodboard 2, my own artwork



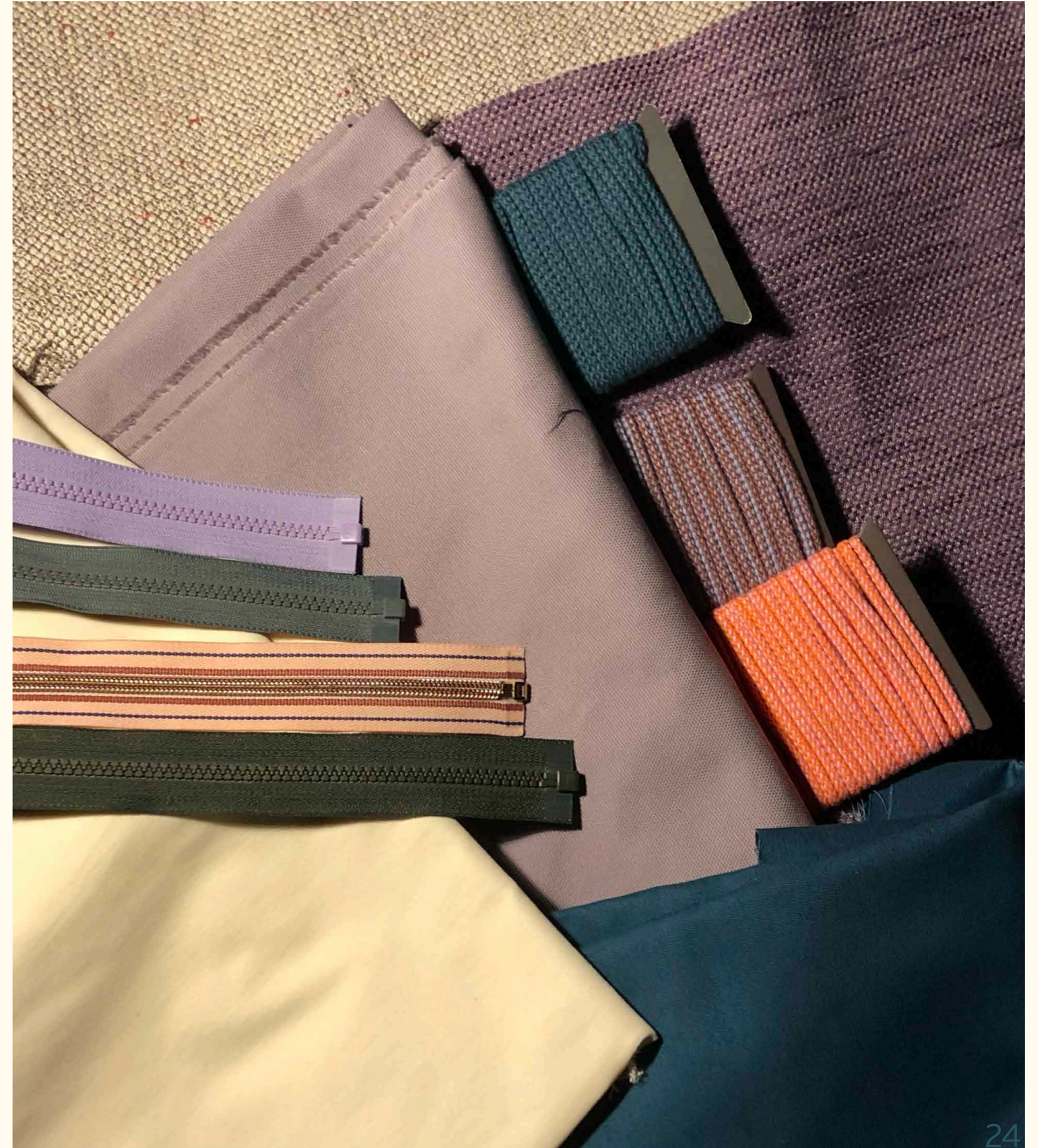
Inspiration

Moodboard 3, Other artworks



First try

After looking at personal inspirations and reflecting freely about general color direction I acquired some fabrics to start as reference.



INDOOR AESTHETICS



After reflecting over the functional properties of the backpack being more akin to a portable storage furniture I decided to enforce this sentiment by trying to create a cohesive style that takes inspiration from furniture and try to capture the atmosphere created in some indoor environments.

Viability of working with carpet

After deciding to actually focus on creating a subtle “interior furniture” vibe I used this moodboard to start think about all the different expressions i could explore in different ways.

In the early stages i experimented with taking different fabrics meant for indoor use and covering them in beeswax. This could be a great way of weatherproofing fabric and could make some unconventional fabrics viable all of the sudden. However, this idea was abandoned in favour of using carpets.

The carpets will be used in combination with softer fabrics as well, especially for the interior.

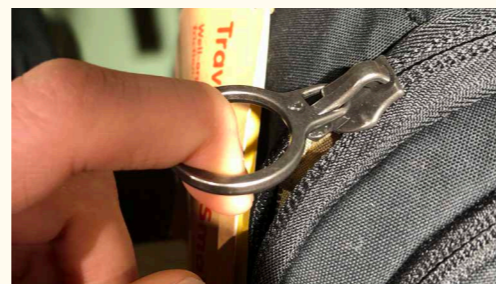
Soft, fluffy, carpet



Jewelry, sleek



Jewelry, ornate



WORKING WITH CARPET

Carpets from Dahl Agenturer

In collaboration with Dahl Agenturer, some excess carpets were donated to this project. I decided to use this as the foundation for the final prototype and will be used in combination with softer fabrics that fits the “interior vibe”.

I am limited to the carpets I managed to procure from Dahl Agenturer. This means that I need to find out how I can make something fitting my own vision in terms of the cohesive style. Of the carpets available I chose to focus on three of the carpets: The lighter fluffy carpets I chose because of their neutral colors and fluffiness. This gives me the freedom to color the fabric myself to my liking. This also means that I don't have to worry that much about locking myself into a specific color combination at an early stage and gives me an opportunity to focus on form and color as separate stages, instead of having those two be completely dependent on each other.

I will however have one green carpet in the mix. This green fabric has a woven construction with greater stiffness and durability and will be used in key parts such as the bottom. This woven fabric is great for creating structural integrity and would be used even more in the final creation if I had access to other colors. My first idea was to only use the fluffy carpets on parts directed towards the wearer, since they are soft and comfy, but a bit too water absorbent to be a great choice for the outer case. However, on the backside of all the carpets are a layer of some kind of water resistant glue which means that contents inside the bag will be protected from the weather. And I also think we all can benefit from some extra fluff in our life.



Color tests made by soaking the white fluffy carpet in acrylic paint mixed with water and medium. This worked out way better than I expected, my first plan was to test with acrylic paint first and then buy specific fabric dye for the final prototype, but after testing I will just keep using acrylic wash since it seems to stick well to the fabric and gives me very good control over the final result.

Connecting one decision to the whole system

Here is an analysis all decisions and considerations I took before deciding to use this specific carpet. All the decisions made should be in support of my core goal of presenting an alternative way of approaching the task of creating a backpack in a sustainable and humane way.

The carpets used was donated to me by Dahl Agenturer, a company that sells carpets for offices, stores, public spaces etc. They collect and store old their old used carpets, left over carpets from old collections and left-over carpet from new installations. They are currently storing the carpets with the hope of finding a way of making use of this resource.

Inspired by interior design *Communicating to the end-user*

To emphasise that the product should be primarily accessed and used indoors as a desk companion, I want the language and general feel to be more akin to a sofa rather than a rugged all-weather backpack.

This connects back to the core philosophy of behavioural change and helps the person using the product to realise that they should approach this product differently than they would a conventional backpack.

This led to me looking into contacting suppliers of indoor fabrics of different kinds, finally leading to Dahl Agenturer and introducing them to another market.

End-cycle *Life-cycle of product*

Synthetic materials derived from petrol are often seen as a less sustainable option compared to organic alternatives. *However, when it comes to textiles these polymer composites might actually be easier to process and recycle compared to organic fibres which can't be extracted without losing their original properties leading to down-cycling at best.* This could in theory lead to a product with a completely sustainable and closed-loop life cycle.

Accessible material *Acquiring and preparing re-used material*

For a mass-producible product, it is important that there is a steady supply of material. If I want to use re-cycled material in production it should therefore be possible to acquire enough material quantities reliably continuously.

Quality of the material is just as important. Even if the quantity of material is enough, this doesn't matter if it requires too much work to prepare the material. Do I have to spend hours cleaning the material? Does the material come in predictable sizes so that all backpacks can be produced using the same template and machines?

Dahl Agenturer already have a system in place for repossessing both their old carpets that have been in use but also left-over carpet from recent installations which were the ones I ended up using. Let's say we have a room that is 13m wide, and a roll of carpet that is 5m wide. This means that the construction crew will have to cut one of the carpets rolls to 3m the width, leaving a full-length, 2m wide carpet roll. This two meter wide carpet roll is too odd to use anywhere else. But when manufacturing the backpack this varied width this doesn't matter since all patterns will still fit onto the roll, and the fact that the carpet is neatly rolled up and in great condition means that it is ready to go.

Realistic production plan *Unconventional use of conventional manufacturing processes*

To make sure my project have the potential to be mass-produced, you need to be able to use conventional production techniques.

However, this doesn't mean you have to use conventional production methods for backpacks. My method here was starting with different materials and see in what industry they were used and what methods were suitable for construction.

It is possible to work with these carpets on industrial heavy-duty sewing machines, you can adapt methods and knowledge from other industries such as furniture upholstery or shoemaking. The specific machine I used was meant to patch leather shoes and was perfect for sewing details in a rigid 3dimensional object. Even though the final design might need to be adapted and re-iterated for mass production it doesn't need radically new manufacturing processes.

Usable and durable *Materials with the right properties*

The backpack should still be able to be used as a backpack.

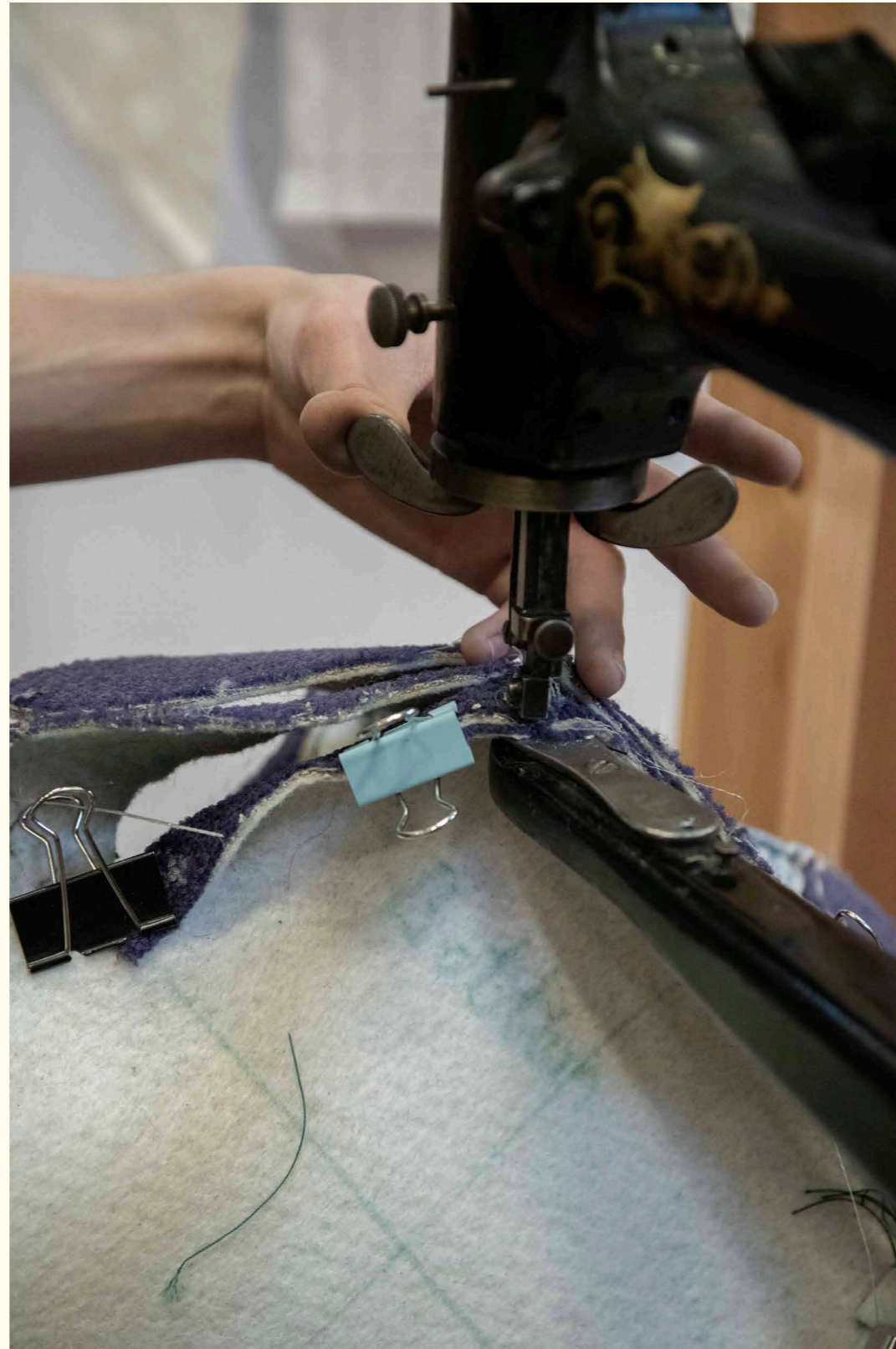
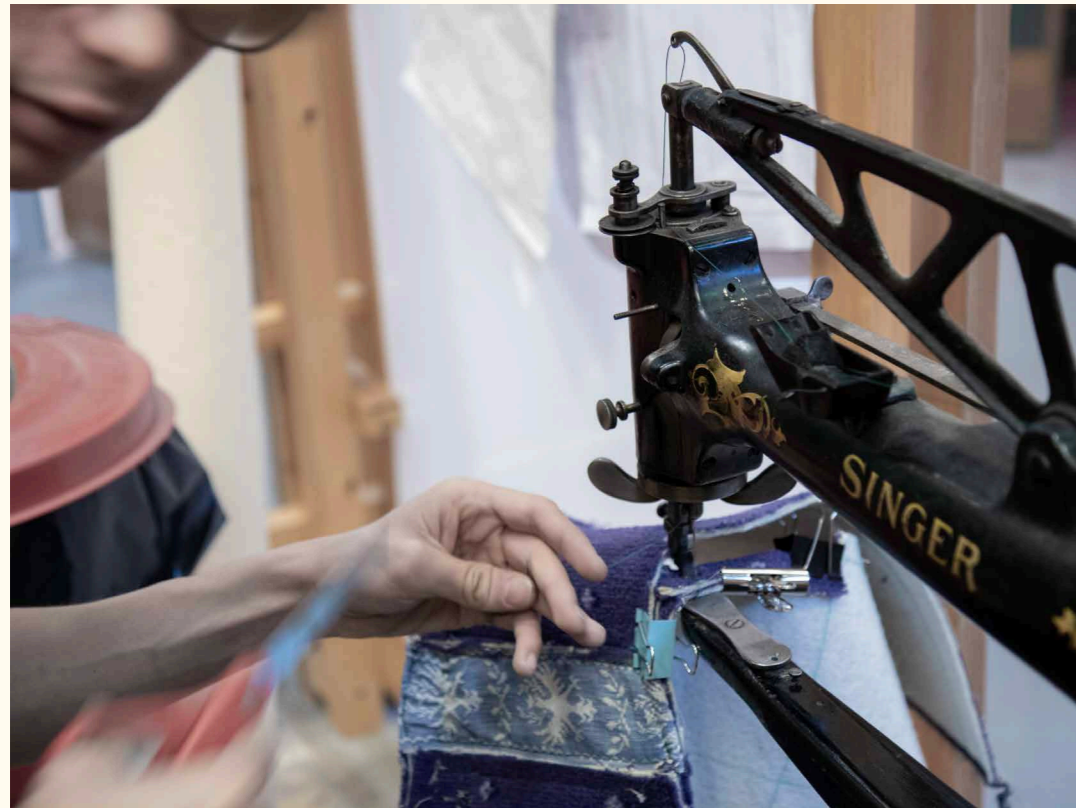
The ability to create structural rigidity and form to the backpack while still being light enough to carry was also a big consideration when selecting the main material.

The product should last as long as possible. However, to achieve longevity, it is just as important to make sure that people actually want to use the product as it is to make the product durable. If the product isn't practical or fun to use, then it is just as useful as a broken bag.

The carpet is soft and fluffy, but still meant to be placed in demanding places such as an office, public building or other environments where people might walk with wet and dirty shoes or spill coffee right on the carpet. The carpet material is naturally water repellent and the backside is completely covered with a waterproofing layer as to not damage the underlying floor, or in this case the items inside the backpack.

Viability of working with carpet

There are some constraints and challenges posed by the choice of working with carpet. Many of these problems were solved when i discovered this leather patchwork sewing machine at X-lab (a part of LTH).



Unexpected agility

This circle is sewn without rotating or moving the carpet at all, instead I can slowly rotate the foot of the sewing machine. The sewing machine was originally intended for patching leather shoes so this feature was vital for being able to insert the sewing machines base inside the shoe and then be able to move around in all directions without moving the shoe. This agility opens up a completely different way of working.



Joining carpets

X First stitch

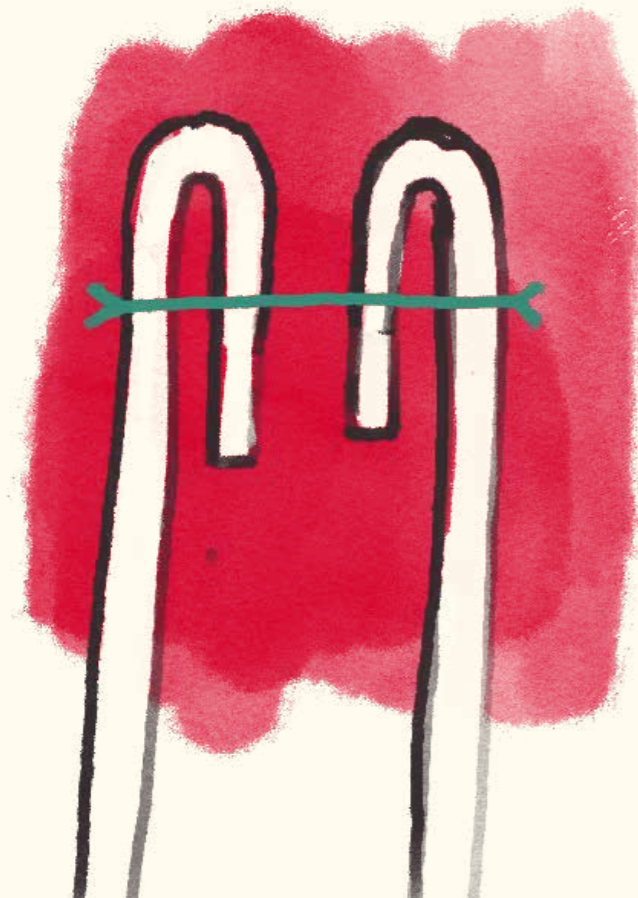
X Second stitch

Because of the thick carpets, great care needs to be applied when stitching carpets together.

The machine I use can only stitch together two layers of carpet, maybe three if you are determined. I spent a lot of time figuring out how I could get nice transitions within the thickness constraints.

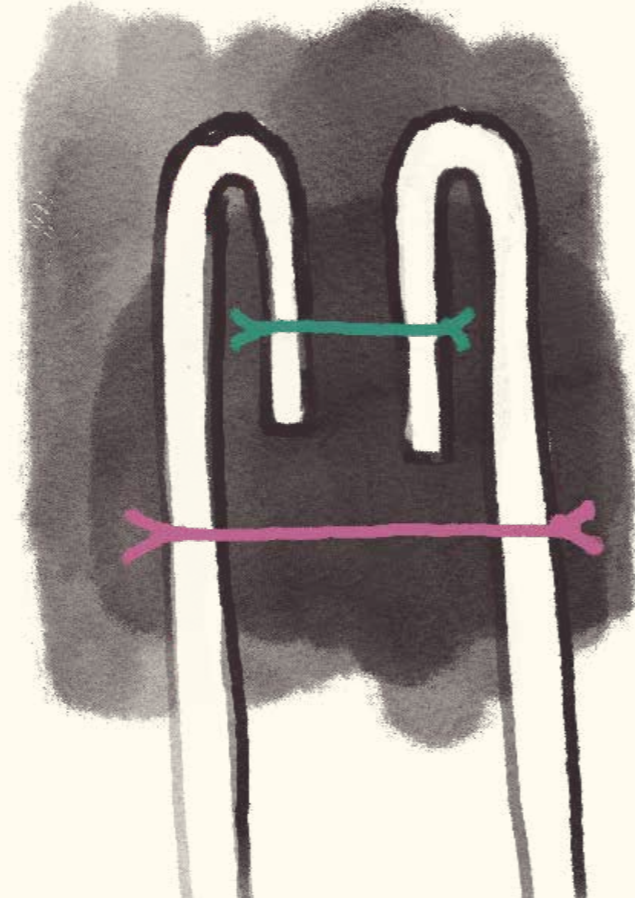
Single-step seam

Too many layers, can't be done in one go. Need to find a better way...

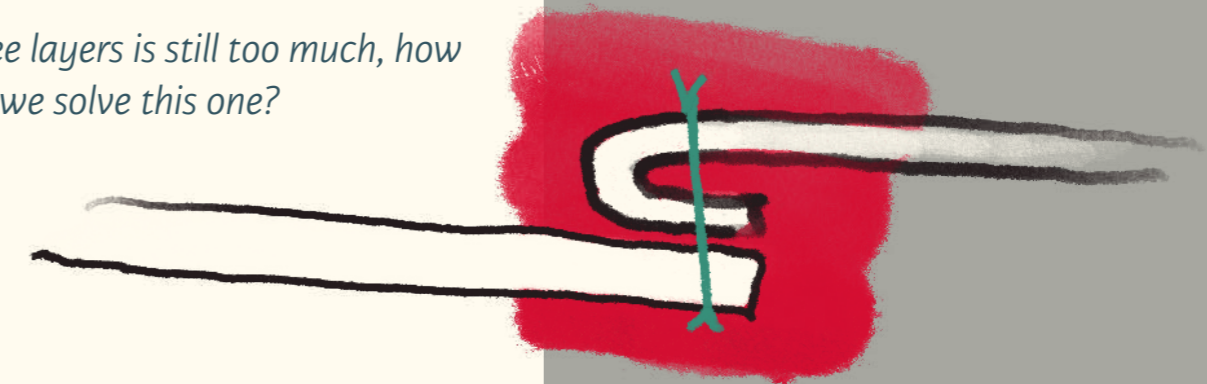


Two-step seam

Stitch together first, then turn the seam inside out and stitch a second time...



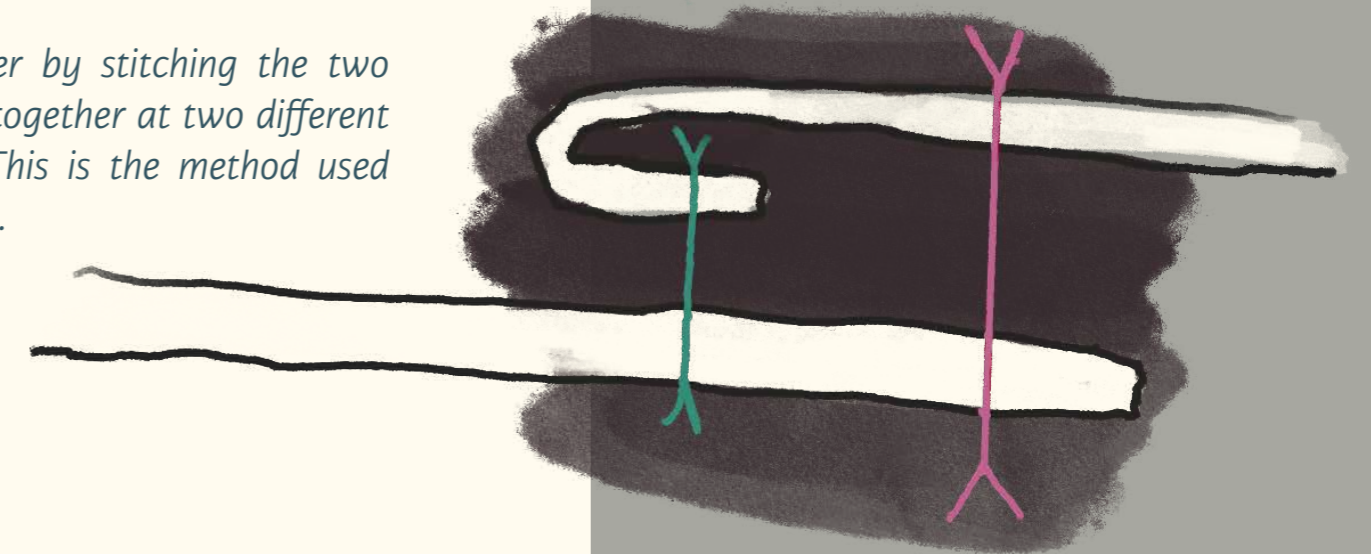
Three layers is still too much, how can we solve this one?



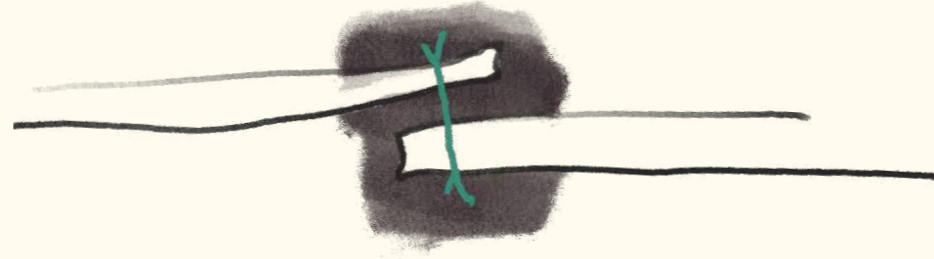
I found two good way of addressing this, one by stitching together the top to itself.



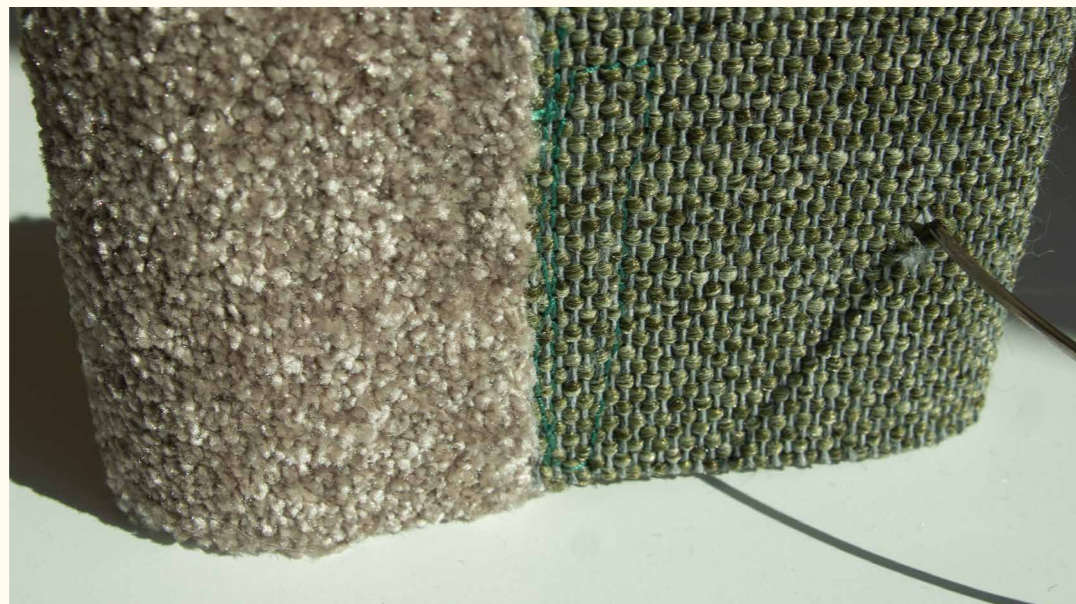
The other by stitching the two carpets together at two different places. This is the method used the most.



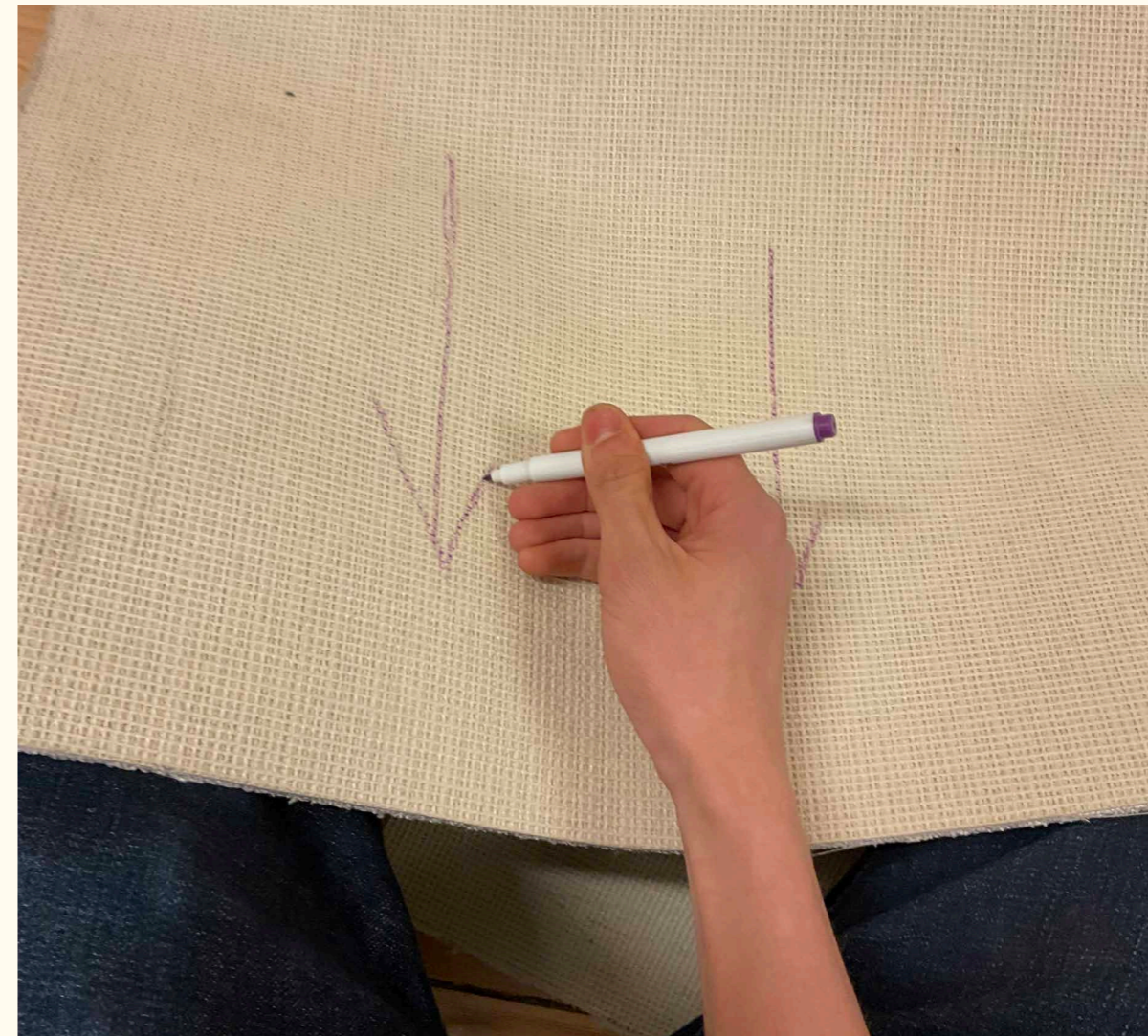
Smooth transitions

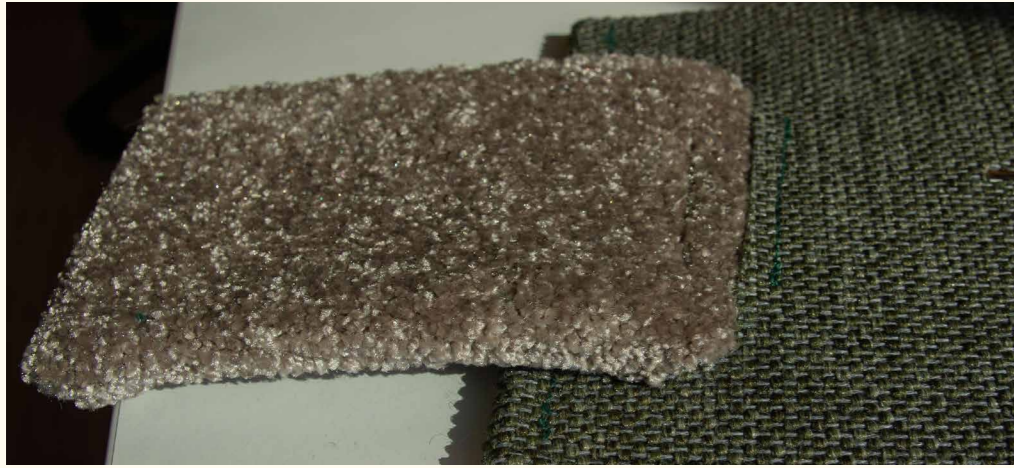


Another method I found useful was to use the most basic stitch, just one of top of the other. This would create a pretty visible edge. But if you have a fluffy carpet, you can hide the edge.



Similar to fur, this carpets yarn protrudes at a slight angle. This can be used as an advantage since it means that seams and transitions can be hidden if done right. For example, look at these two green pieces sewn onto the fluffy carpet. Both done in a similar fashion, with the only real difference being that the piece on the left is placed against the “fluff direction” (as indicated by purple arrow) which results in a smooth transition. Compare this to the example on the right where the fluff moves away from the green piece, making the sides of the green piece completely visible.





Another method I arrived at was meant to explore how we may be able to get the effect of one of the carpet seemingly appear out of the other. This is also the method I used for attaching the straps onto the shoulder straps.



Starting with two pieces of carpet, the bottom one wider than the top carpet.

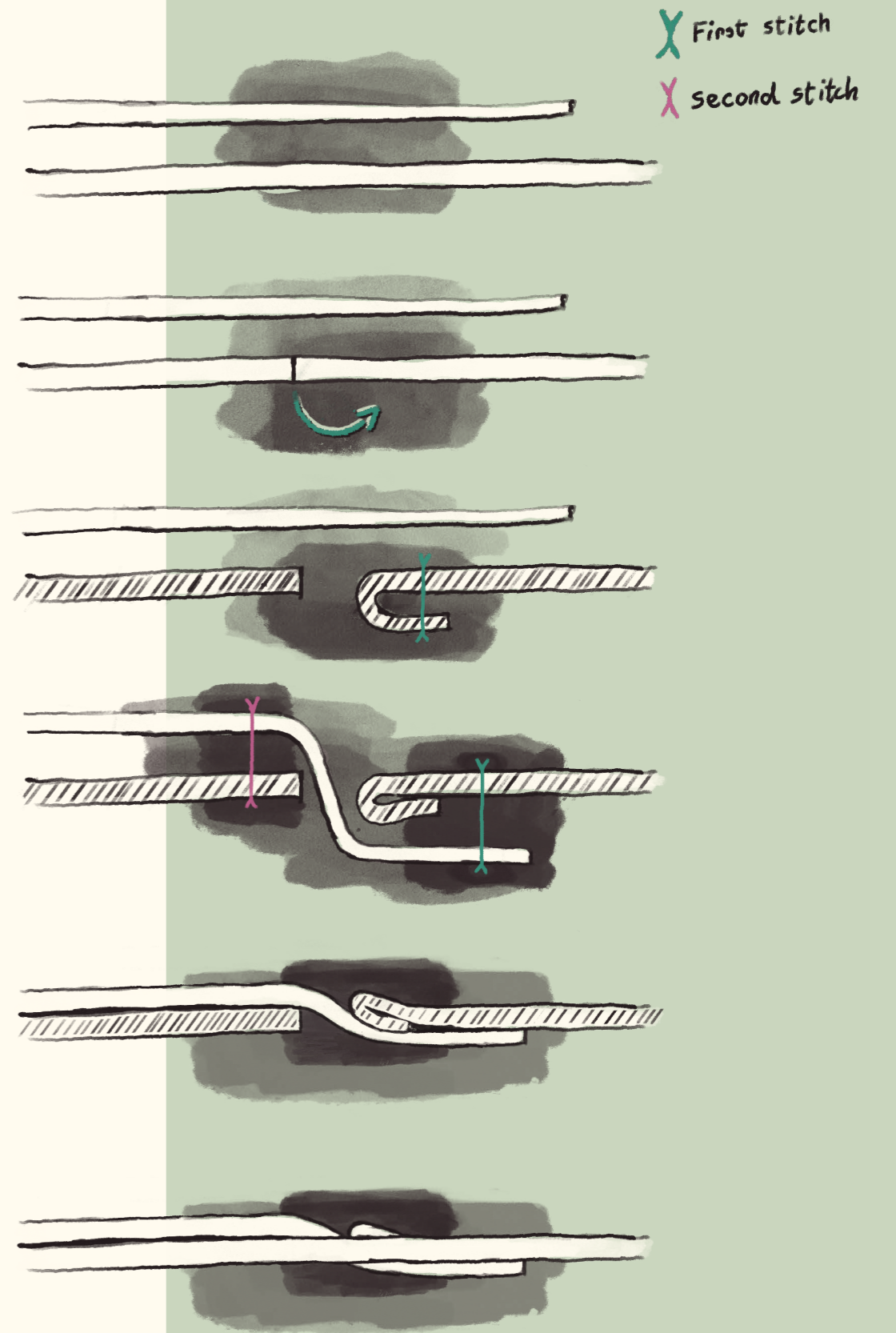
Cut open and fold a flap on the bottom carpet.

Stitch the fold
(Cross-section of bottom carpet)

Insert the top carpet and stitch into place on both sides of the opening

Final Cross-section view

Final side view



FINALIZING DESIGN

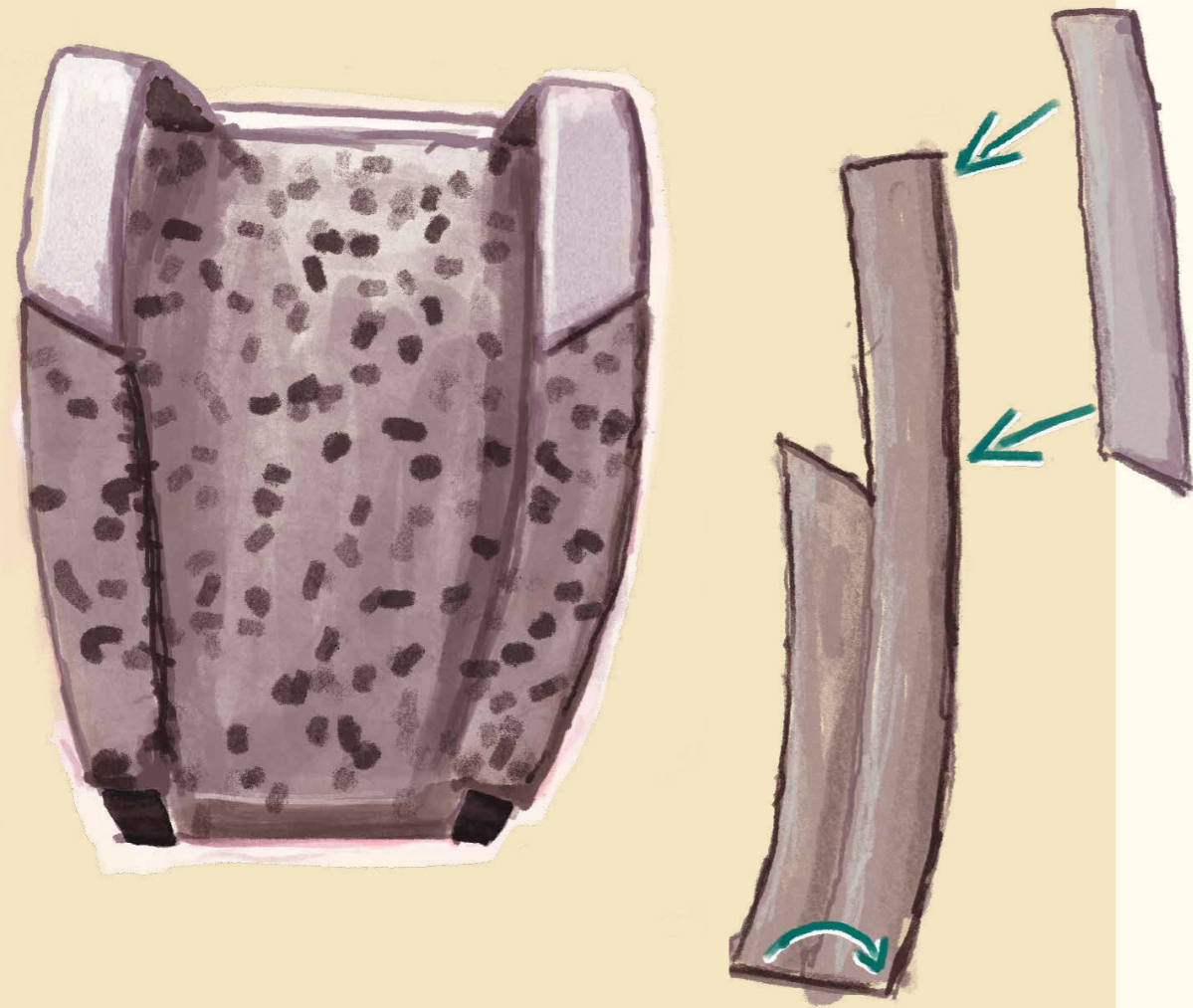
In this part I had to start figuring out how to combine all my ideas and express them as good as possible. The materials accessible to me and my inexperience in sewing was the main limiting factor. The most important aspect at this point for me was to showcase how I wanted the backpack to be used.





Straps

I wanted to have fluffy carpet on all parts that directly touch the body when worn on back. This includes the shoulder straps. My first thought was having the fluffy carpet only on the strap-side that touches the body.



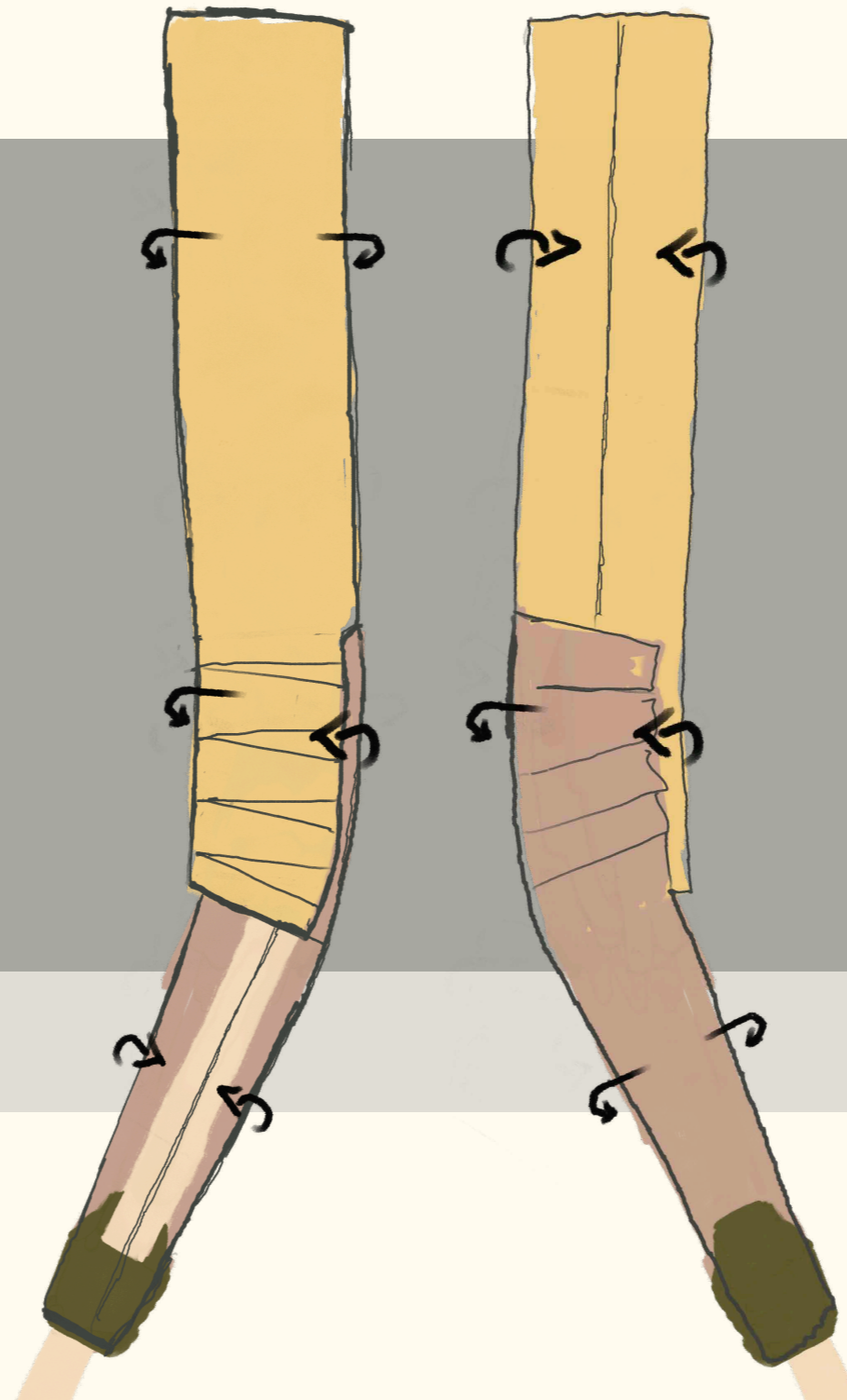
Folding the right shoulder strap

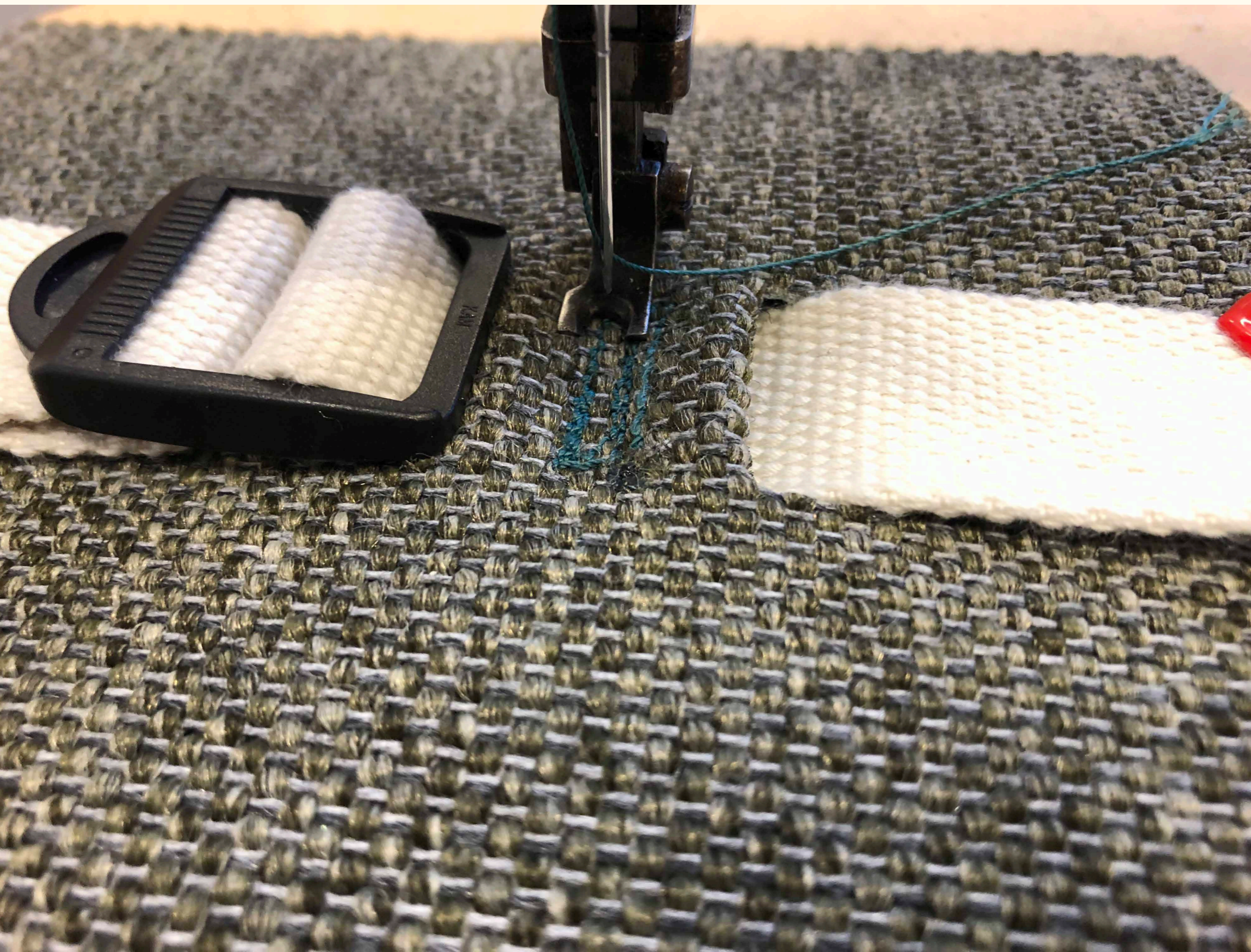
Wearers right, observers left



Front-view

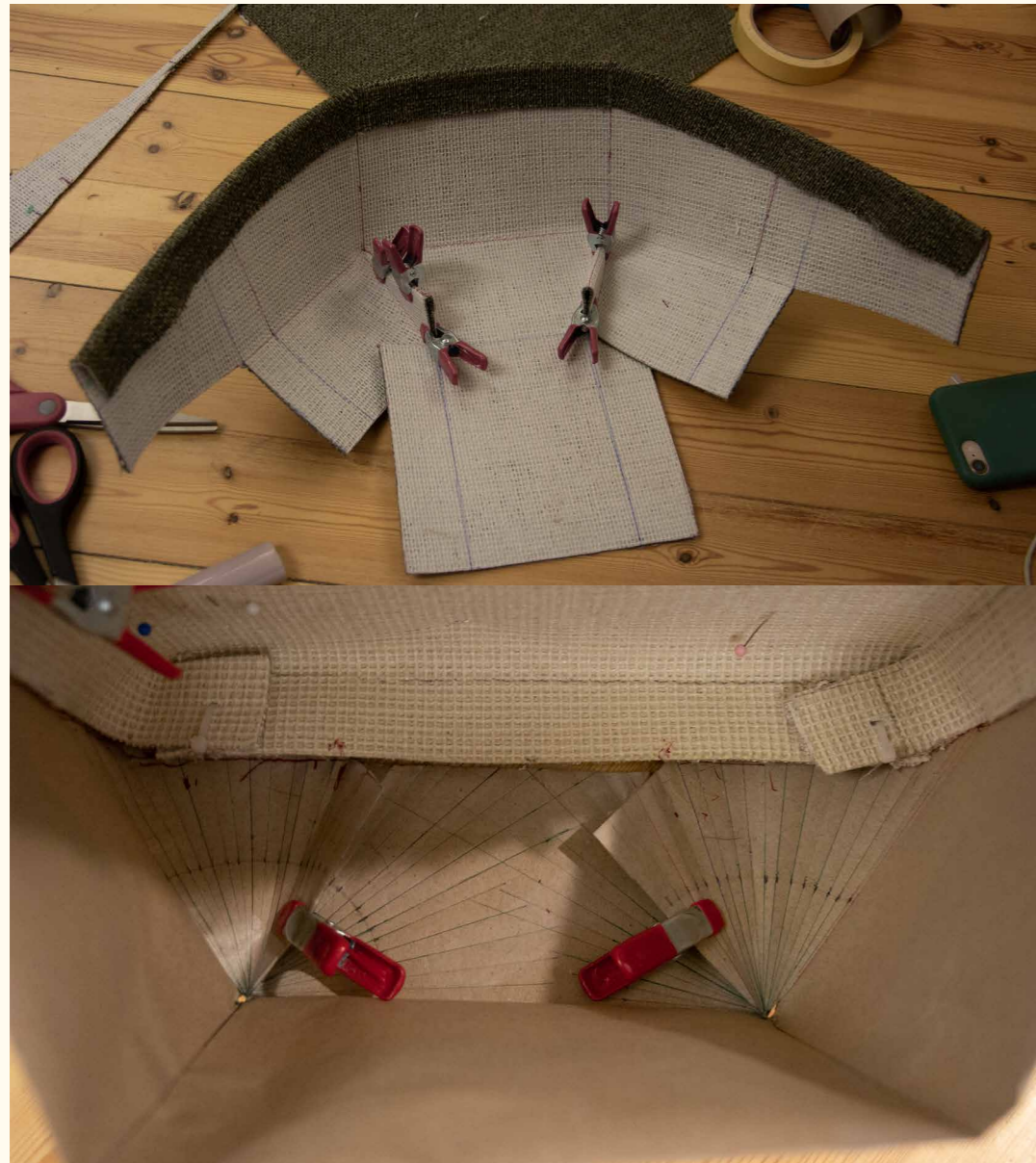
Back-view





base

I made the decision to not have a separate bottom compartment, instead having a rigid bottom piece that would make it possible for the backpack to stand upright. To create this base, it was important that I got all the angles right, i therefore made this template that could be used to easily test out different angles.



Sleeve body

The main volume was dependent on all other measurements and decisions and were therefore determined last, and underwent drastic design changes to make it possible to produce and to give it all practical functions.



Main volume

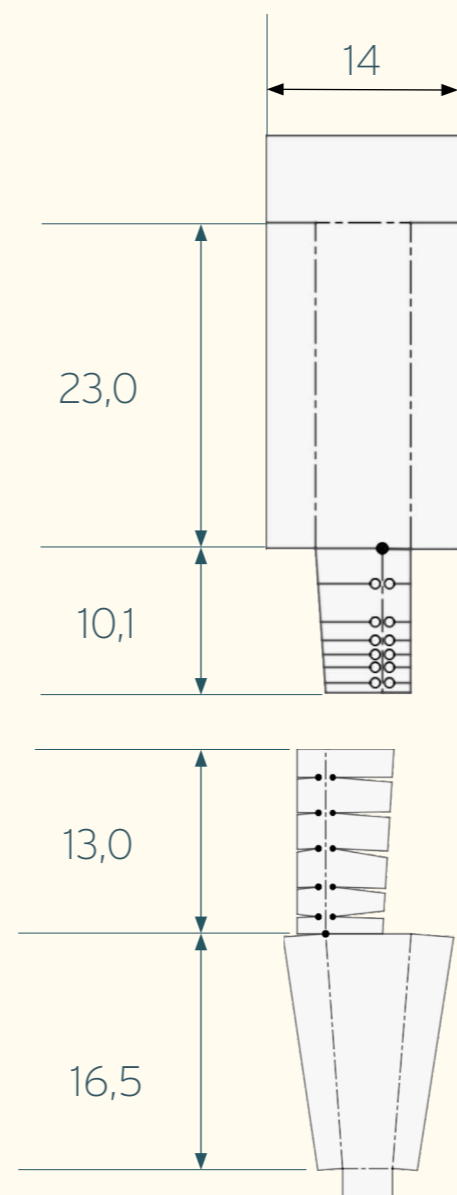
The main volume was dependent on all other measurements and decisions and were therefore determined last, and underwent drastic design changes to make it possible to produce and to give it all practical functions. Because of the iterative nature of the main volume body, any final measurements were not able to be produced, since I changed my measurements multiple times in the end-stages. However, all other measurements are precise on all other parts are precise.



FINAL DESIGN

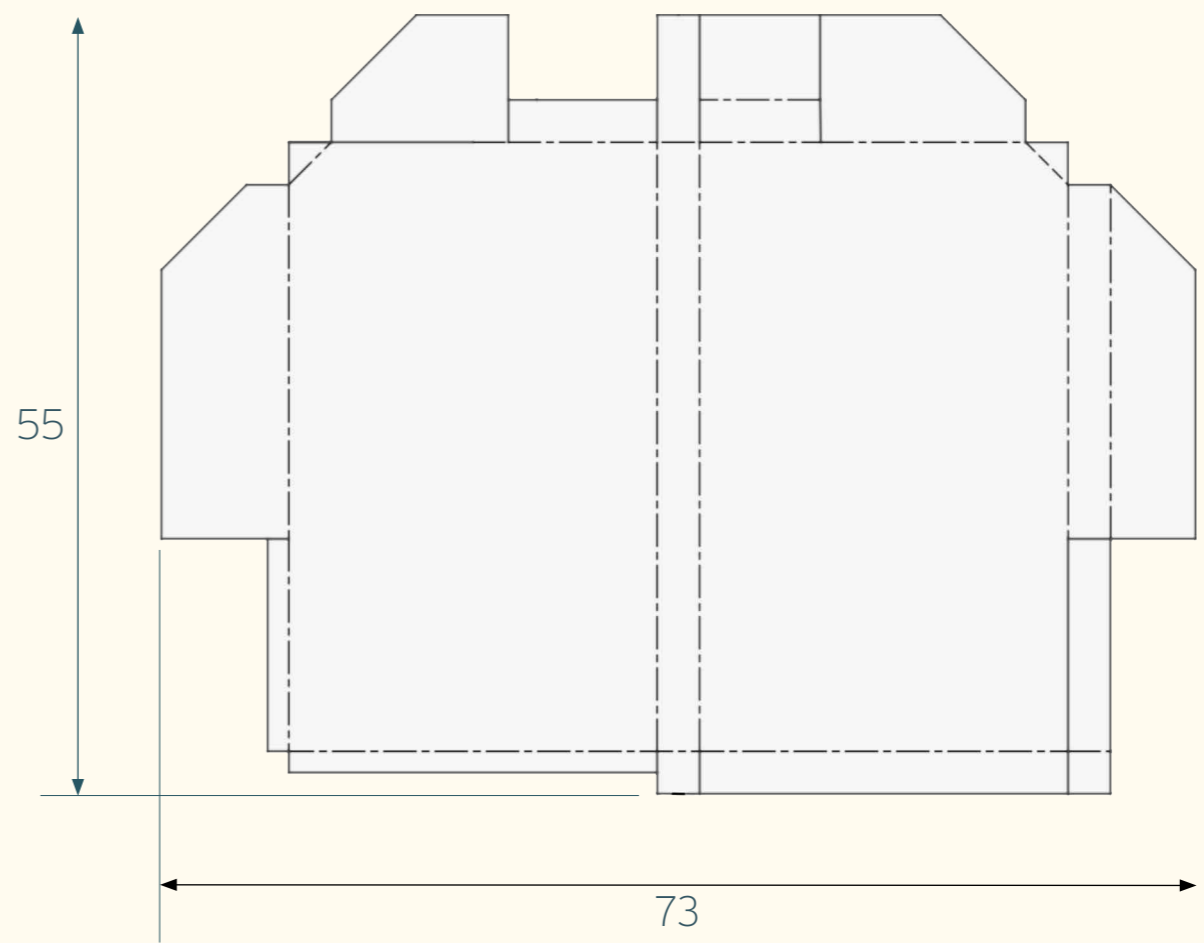
Final strap design

(cm)
Not to scale



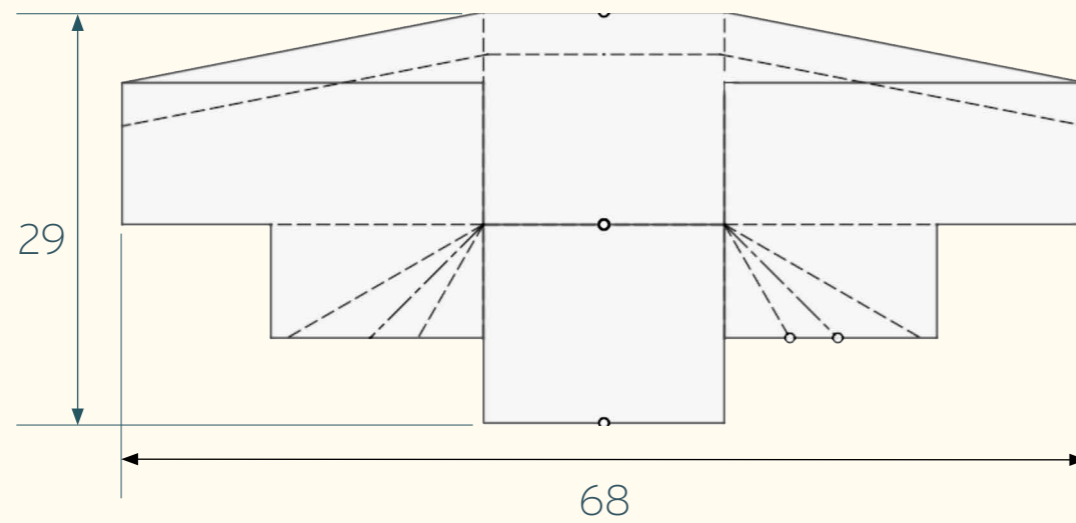


Sleeve design

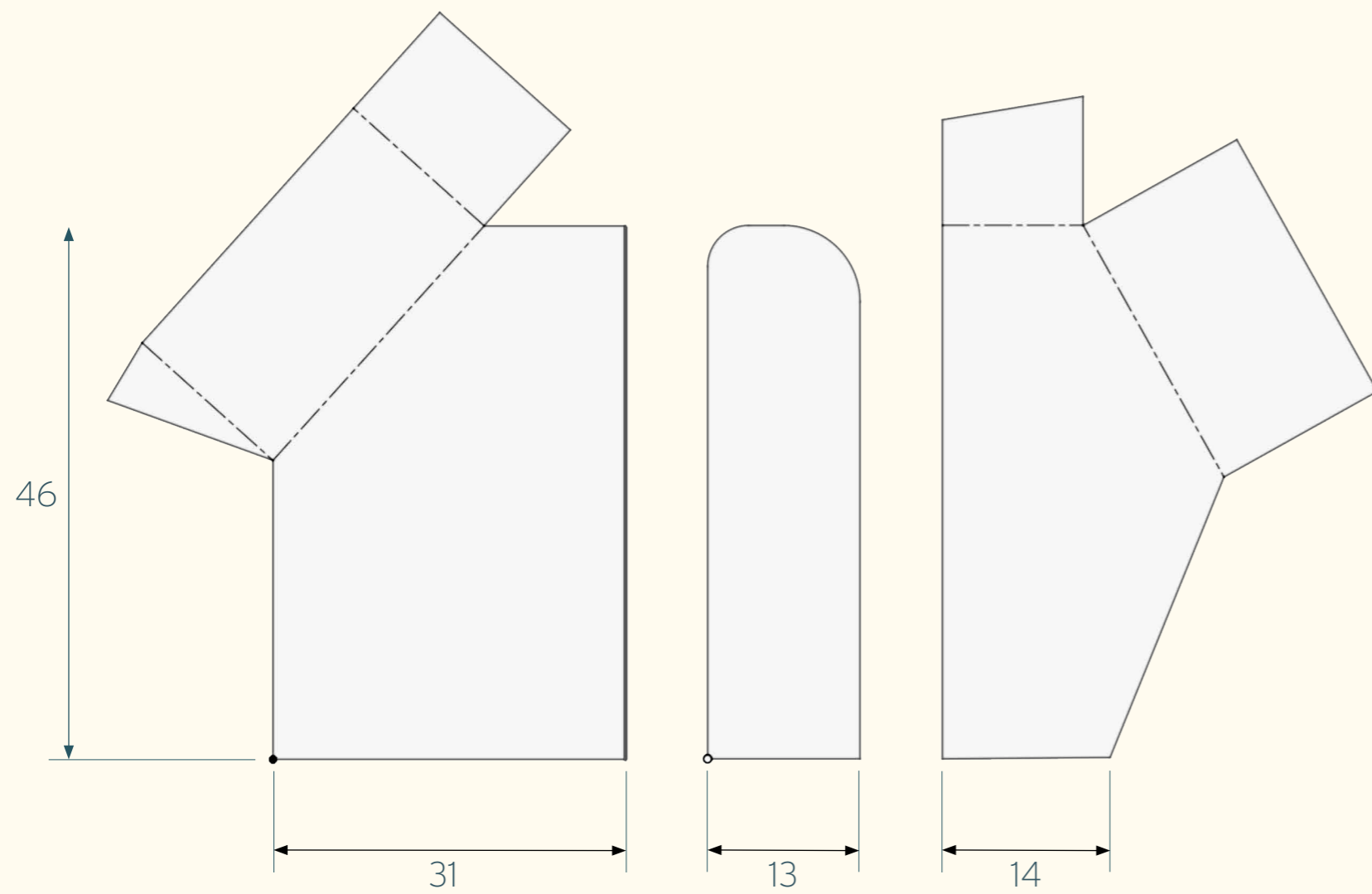


Base design

(cm)
Not to scale



Inner lining

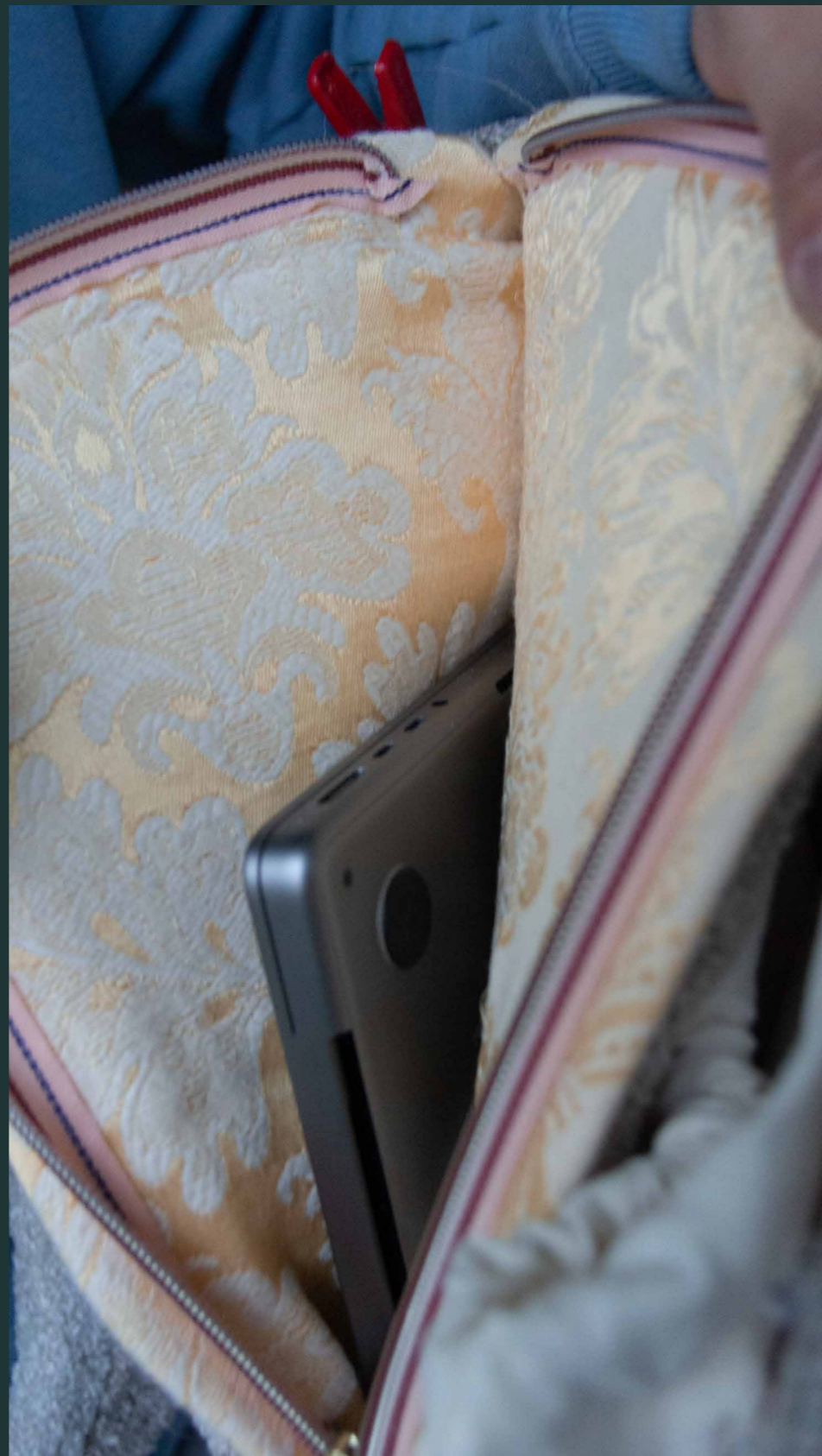








Quick access



By your side







