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Modular Sneaker

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Abstract

Shoes today regularly use glue to hold the parts together, this makes it hard to restore the shoe when needed. So, instead of repairing the used shoe we buy new ones once it gets a little worn or tattered, even though the majority of the shoe is in good condition.

My product has been developed by the principle of design for disassembly, to easily take it apart and recycle it. The modularity also enables the user to reuse and change worn out parts of the shoe, which prolong the lifetime of the shoe and benefit the environment. The upper toe box is made wider for better ergonomics as well as minimize tear on the material. The sole is made replaceable which gives the user the opportunity of changing it when it's worn out or when they want a change of style. Restoring shoes is most commonly done by a cobbler, which takes time and can be expensive. The modular shoe subtracts that obstacle with its user friendly agenda - anyone can change the sole.

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Introduction

Introduction

In our modern society consumption continues to increase rapidly with a variety of different items, products and materials being purchased. It is often easier and more tempting to simply pay for a new product and look the other direction, than it is to reuse and refurbish the old.

This project focuses on extending the lifetime. The product of choice is an everyday shoe. People often buy multiple pairs of shoes every year, they are also often made of plastics which do not really degrade. This means that the material has an extremely long lifespan, much longer than the shoe itself. This isn't a sustainable way of living, especially when most of the product isn't worn at all. My initial question was, Is it possible to prevent this either by prolonging the lifespan or finding new materials that can compete with to-

day's product in functionality?

Since I am no expert in chemistry and the materials being used are very developed and have very good properties for the intended use. I think I would take water over my head by trying to make new materials. So the question was changed to: Is it possible to prolong the lifespan of a typical shoe?

Motivation/background

My motivation of doing a project of designing shoes has been built up during these three years. When searching for industrial design education I always had a dream of designing vehicles of all types. This started to change when I first lay my hands on a sewing machine to sew in my fathers old fashioned oversized dress shirts with very high quality material that he didn't want. I sewed them into a more up to date style. First year I also remember I watched Tinker Hatfields episode of Abstract on netflix. (*Hatfield, 2017*) As a basketball player with somewhat interest in shoes, to see those two worlds come together in that episode did motivate me a lot. My new interest in sewing did also motivate me into thinking that I can make my own designed shoes for real. This interest in sewing and shoes has never

come to realization before this project because it has never fitted previous given briefs. But my projects show something different. First year I made a shoe display shelf in wire for sneaker enthusiasts. During this third year I made a backpack that has increased my sewing skills by a mile. So in the end it was the perfect project to end this education with.

Initial idea

Shoes will always become worn after time because of the friction and stresses it needs to withstand but also have good properties and qualities to be ergonomic for your foot. The sole for example needs to be a very good shock absorbent but also durable to withstand all the friction and stresses. One can assume that the sole is the part of the shoe that gets worn out first on the shoe. So my first initial idea is to make a modular shoe where you can replace the sole for example when it is too worn.

Research

Interviews

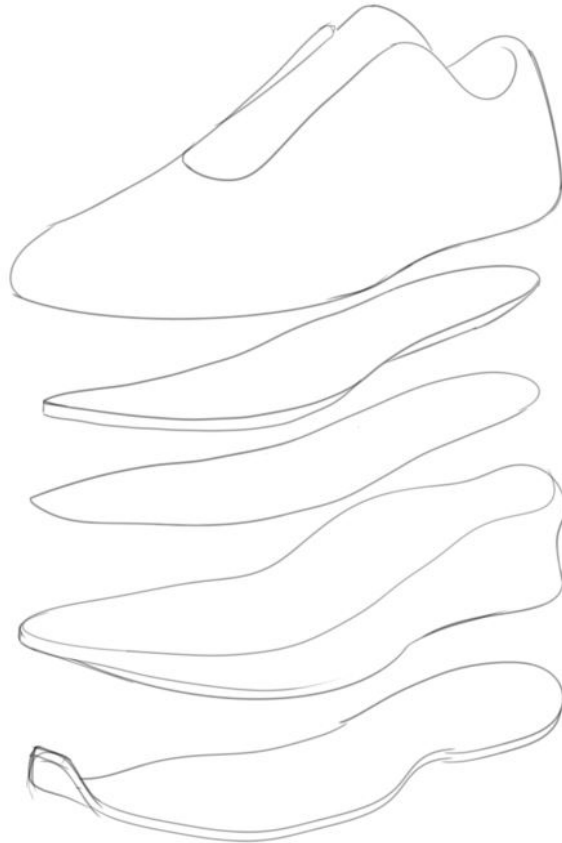
Because this project is about over consumption the information and habits about the users of shoes are crucial. Because of this, Interviews were made to establish a base to continue the research on later. The biggest findings during the interviews was that

- *People Bought new shoes because they were tired of the old or more common that the old was worn*
- *As assumed earlier the sole got worn out first*
- *Comfort, price and looks where important when buying new shoes*
- *Shoes are often to tight*

Of course the looks, comfort and price point are important factors when buying shoes. But why aren't durability, environmental impact also there with them. Especially today when those factors are getting more and more important but none of the participants answered that it was. This can have to do with the lack of information that is given. A customer doesn't get information about it and can therefore not have it in as a factor. (Young et al 2009)

Brief

By using design by disassembly, make a more ergonomic and long lasting shoe.



Shoe Anatomy

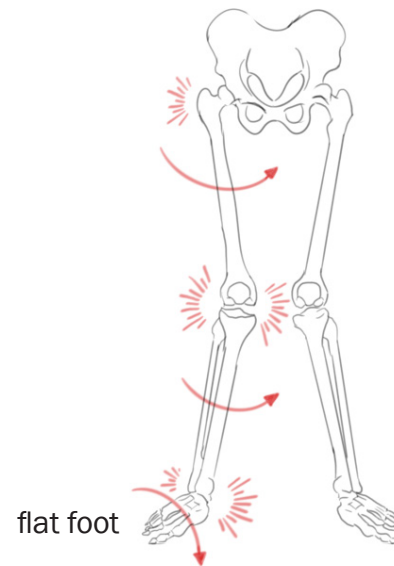
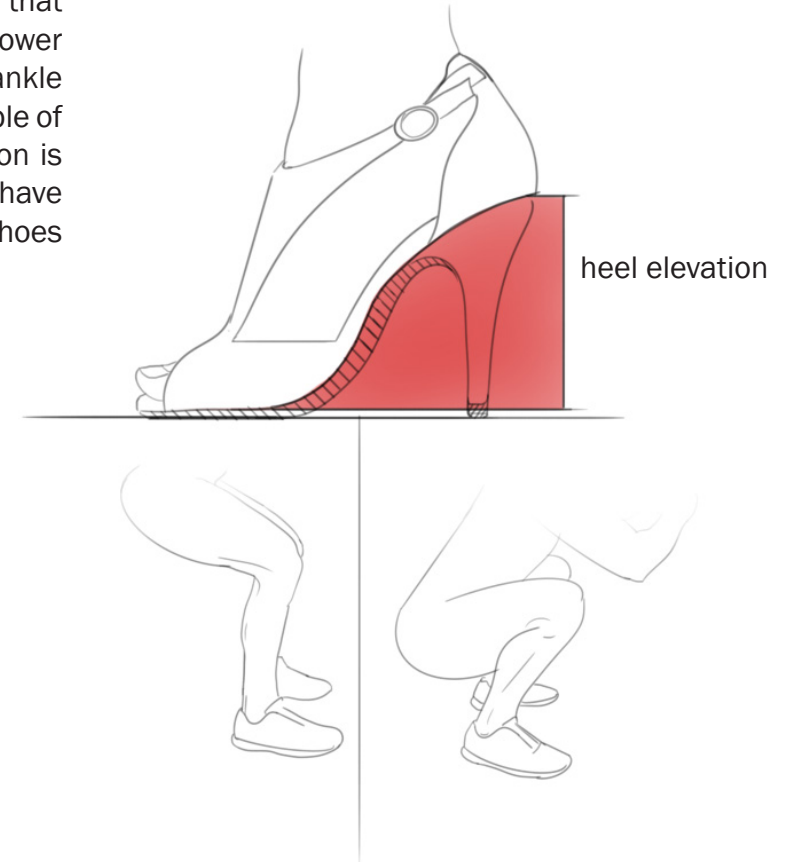
The shoe is usually built up by 5 parts with different properties for good ergonomics. Starting from the top we have something called an upper which is typically made out of some sort of fabric and usually provides the foot with some stability. The upper is glued and sewn to one of the insoles. This part helps the whole shoe to stay together. Then the midsole is usually glued and sometimes sewed to the upper and insole. The midsole provides the foot with shock absorbent for more comfort and prevention of injuries. Underneath the midsole some shoes have an outsole that is more durable and can handle friction better than the midsole. Lastly we have another insole that is put into the shoe that also gives the foot some shock absorbent but also stability for the underneath of the foot. This insole can be replaced depending on the need of the user. For example if the user is flat footed a insole with a higher arc and another angle might be appropriate. (Kuchinsky 2020)(Business insider 2019)

Ergonomy

The ergonomi of a foot are very complex because of the 28 bones, 56 joints and 38 muscles it possesses. But you can simplify this by looking at the foot as a unit and common foot problems that can be caused by footwear. Because of this complexity of the foot there are a lot of foot problems that can occur. I've listed 17 common problems and marked with red the ones that can happen because of ill fitting shoes. A conclusion that was made is that shoes have a big part in our foot health both good and bad.

2017) (1177 vårdguiden 2022)

A big heel elevation in a everyday shoe can lead to less ankle mobility because wearing these types of shoes does not let you access the full range of motion in the ankles which means that when wearing the shoes you get can squat lower but after everyday use for a longer time the ankle starts to adapts and get more stiff. An example of shoes that usually have higher heel elevation is some running shoes, it can be beneficial to have heel elevation when running but those shoes should not be used as everyday shoes.



flat footnes does not occur by ill fitting shoes but it can get worse by wearing shoes because of the wear of the sole that often occurs on the inside of the foot which angles the foot even more. Flat footedness doesn't only affect the foot either, it can result in knock knees and problems with the hips and other parts of the body. (Silver, Murrel,

Athletes foot

Ingrown toenail

Blisters

Fungal toe infection

Bunions

Plantar wart

Corns

Stone bruise

Plantar fasciitis

Flat foot

Heel spur

Mortons neuroma

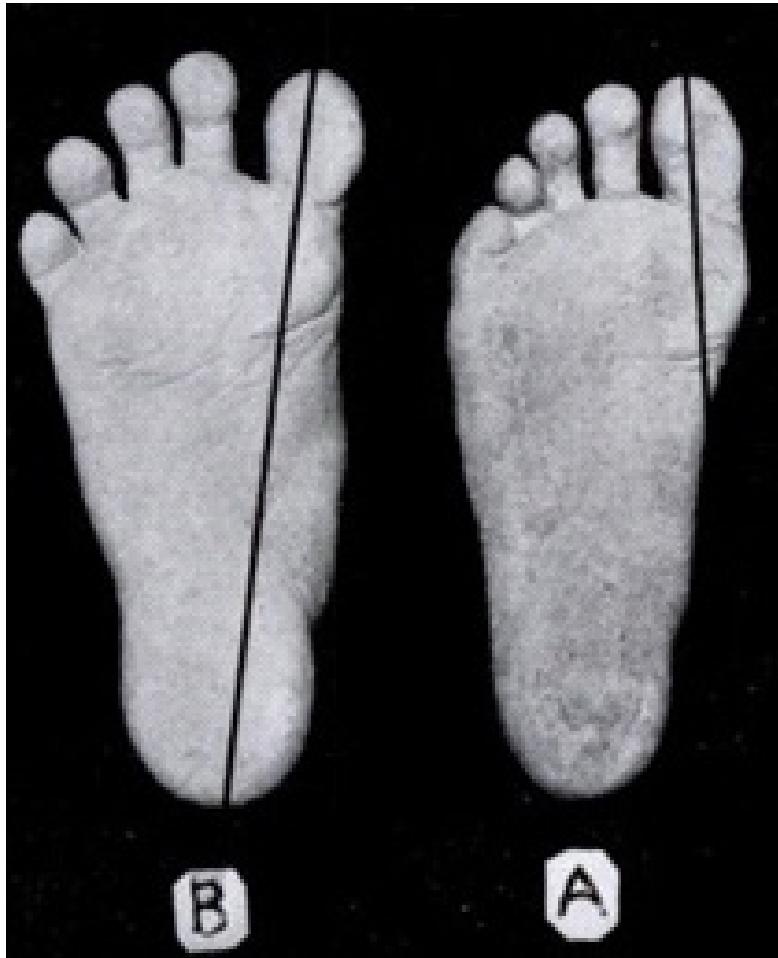
Claw toe

Sesamoiditis

Mallet or hammer toe

diabetic neuropathy

Gout



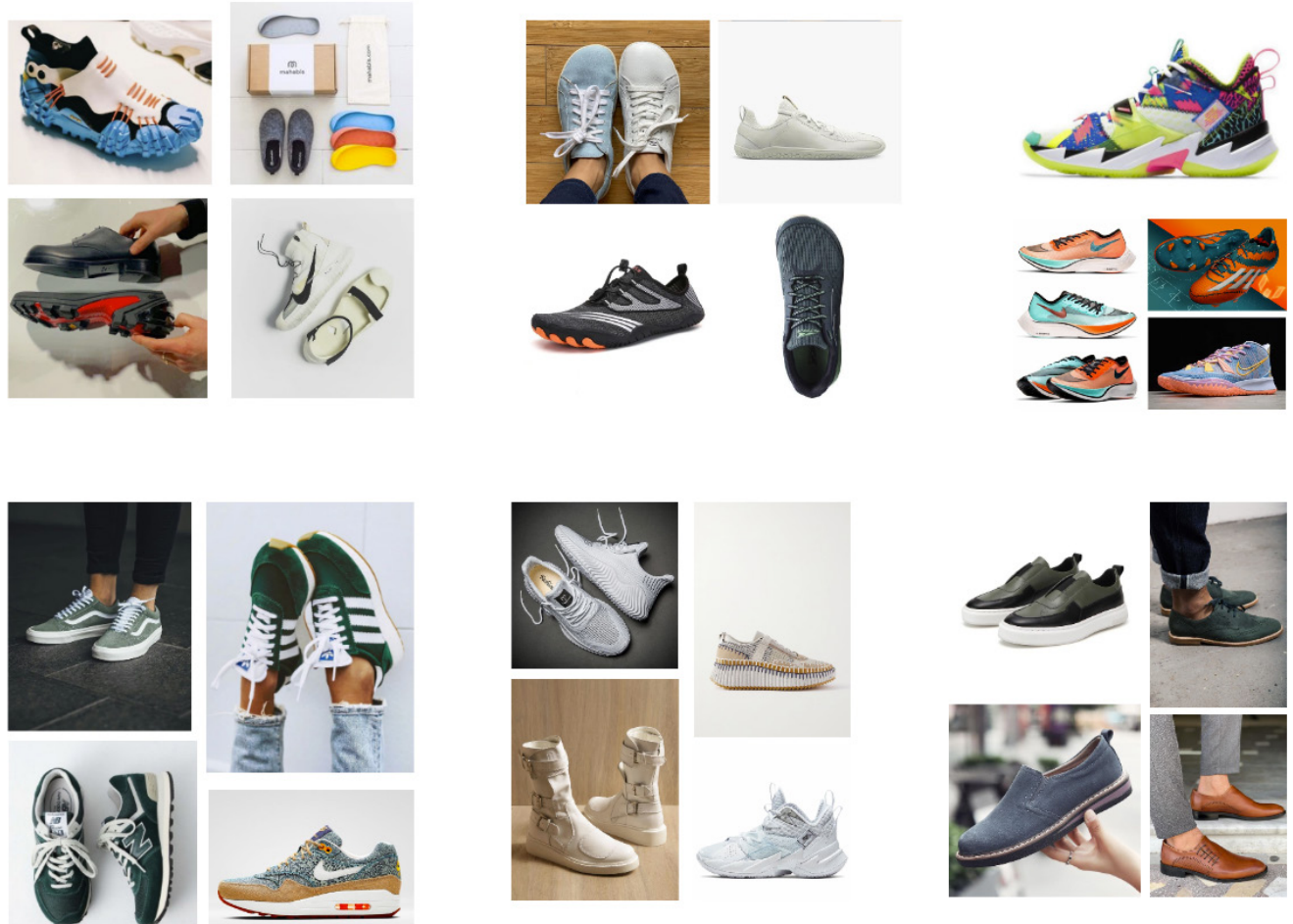
Picture 1: [natural feet].

This is a picture of one foot, first before conventional shoe wearing and then after six weeks of conventional shoe wearing. Shoes today form our feet, and I have never seen a foot like the left one in real life. And the right one feels more like a normal foot to me even though the left one is more natural. Because of all the health issues shoes give us, the left one is probably more healthy also. The skin underneath is probably also thicker and doesn't get affected by the ground as much. A lot of shoes deforms our feet and give us a lot of foot conditions. Why aren't more shoes shaped after the foot? I found a category of shoes that is called barefoot shoes which is very minimal with a very thin sole and barely no stability in the foot but a very important part is that they have a wider toe box so the toes can spread like the left foot. They are shaped by the foot and not the opposite.

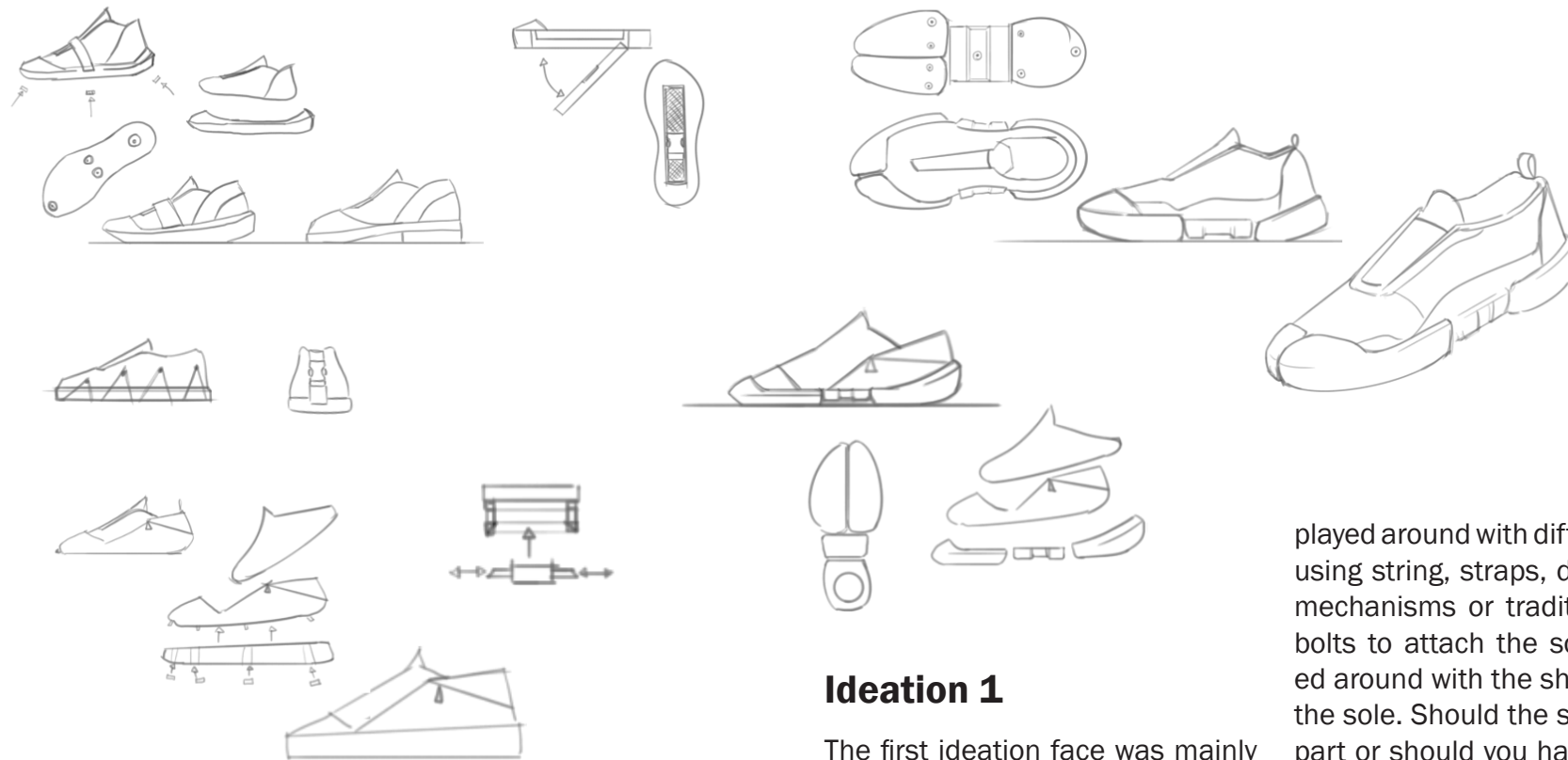
Market Research

I did some market research to get a clearer sense of what is trendy and what qualities I want to get out of my shoe. Because it is going to be an everyday shoe the street style sneakers category was very appealing. But ergonomically wise I've learnt that some aspects of barefoot shoes are beneficial. The modularity speaks to my project a lot and shows that it is possible for me to make shoes that have modular soles. So a combination of these three categories are what I want for my shoe. The style and look from a sneaker, the ergonomics from a barefoot shoe and the modularity of the modularity category

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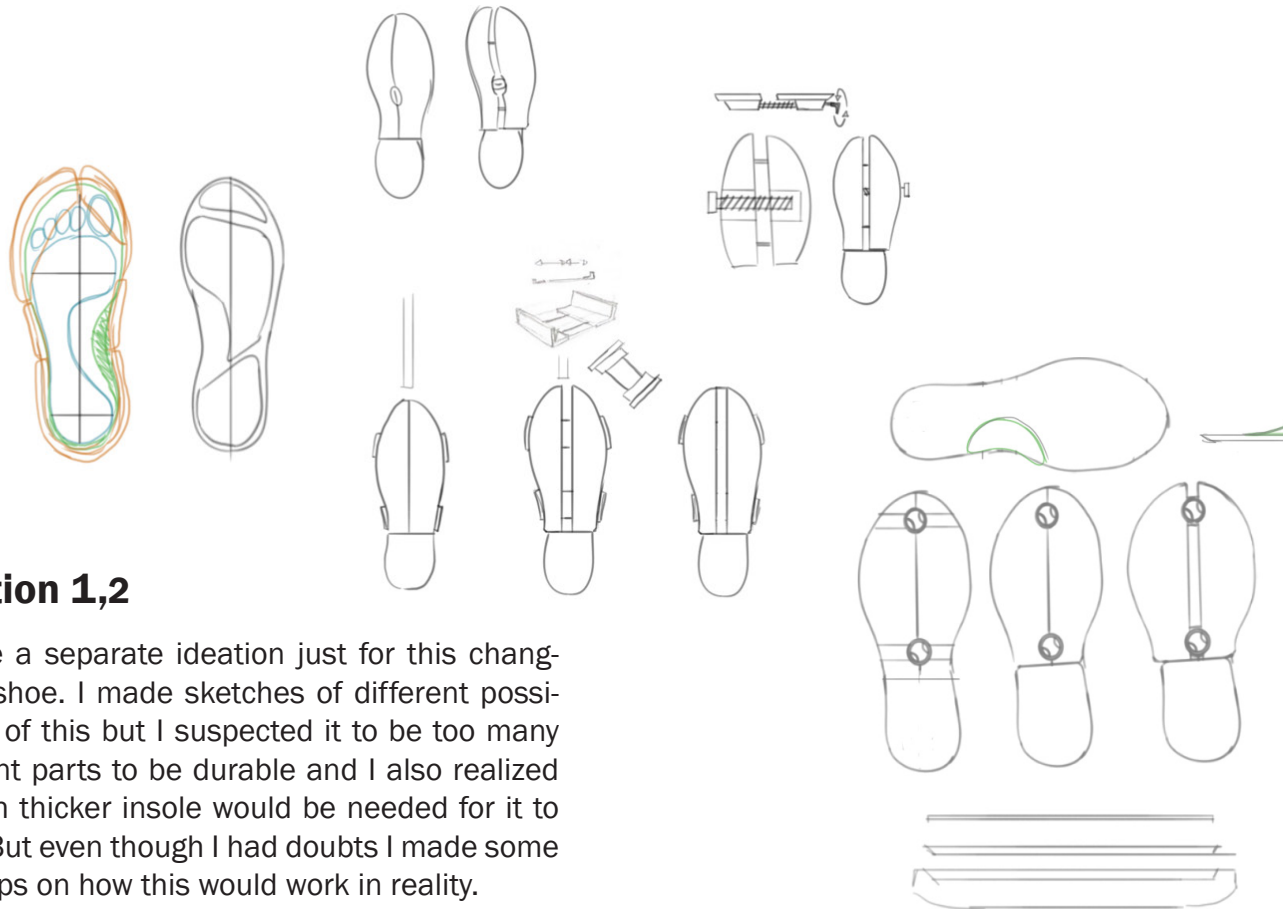
Shynthesis



Ideation 1

The first ideation phase was mainly focused on the modularity function. How the sole would attach and detach. Here questions like how often should it be changed? How easy does it need to be to do this task? How should the sole be shaped? Should you change the whole sole or just the outsole? I

played around with different ideas like using string, straps, different locking mechanisms or traditional nuts and bolts to attach the sole. I also played around with the shape and size of the sole. Should the sole be only one part or should you have the ability to just swap the parts of the sole that are worn out. With discussions with Claus we discussed the possibility of making a resizable shoe. A shoe that can change size which would be a very good idea for kids where the foot size changes a lot of times faster than the shoes get worn out.

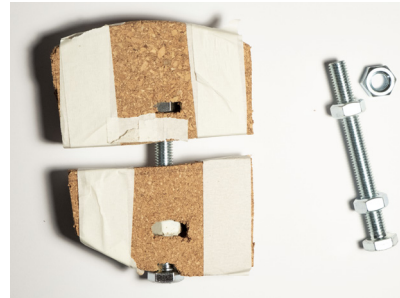
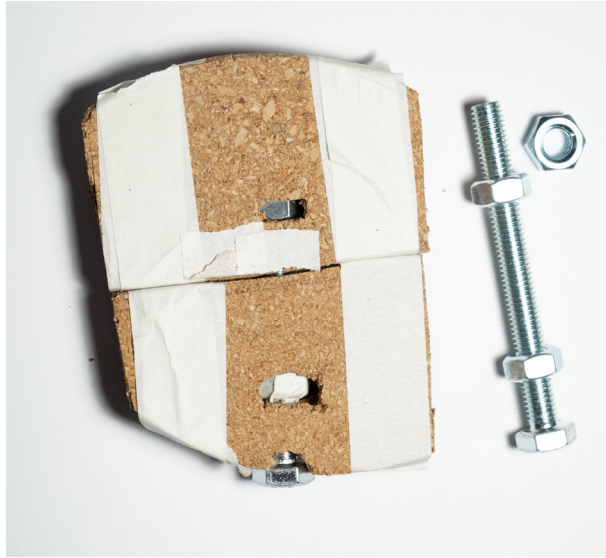


Ideation 1,2

I made a separate ideation just for this changeable shoe. I made sketches of different possibilities of this but I suspected it to be too many different parts to be durable and I also realized a much thicker insole would be needed for it to work. But even though I had doubts I made some mockups on how this would work in reality.

Mockups

After trying out different variants of this I realized that my suspicions were correct. The shoe will not become stable and durable for it to work. So this idea was scrapped and I continued with doing a layout of what properties I actually wanted from my shoe.



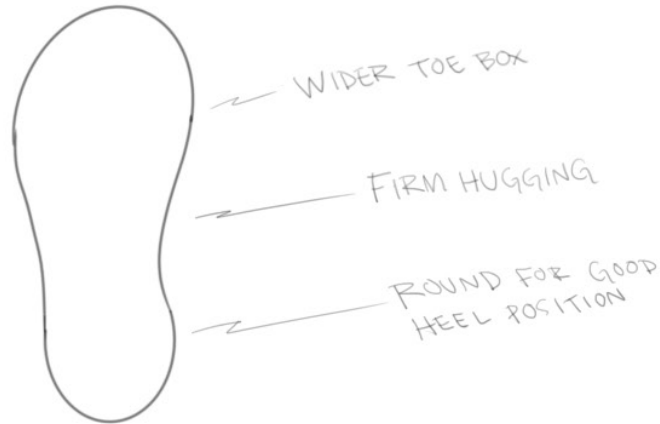
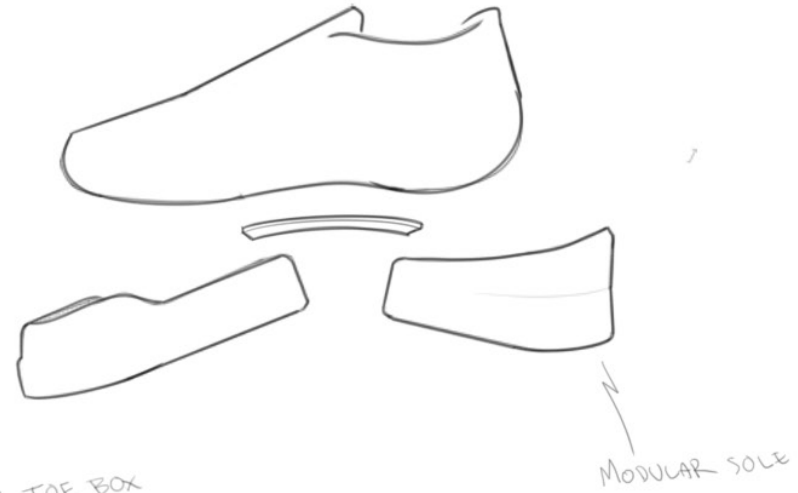
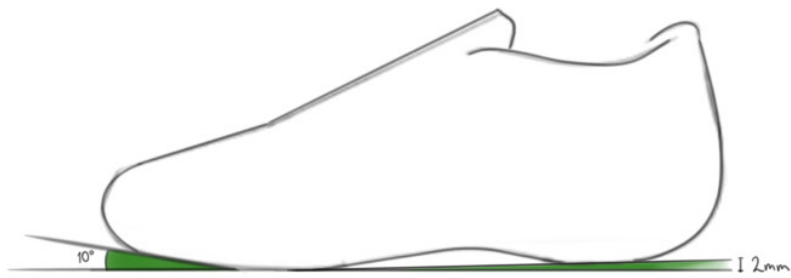
What I want to create

During my research I learned a lot about ergonomics in a shoe. This was having a big influence on how the shape of the shoe was going to be formed. It should have a heel elevation 2mm or less for continued ankle mobility. More and more people have problems with mobility in our bodies. Most people can't go down in a full squat, which is the natural resting place for us humans. There are many causes for this where shoes are one of them. For this very same reason I didn't want such a big toe spring. So my toespring which is the angle the front of the shoe points upwards are going to be not more than 10 degrees.

Because of the many foot conditions caused by tight fitting shoes, I've decided on a wider toe box in my shoe which gives the toes the ability to wiggle and spread out. This wider shoe might resemble a barefoot shoe alot but key differences are that my shoe still gives the user stability from

the upper and also has a thicker sole for better shock absorbing abilities. This shoe is therefore somewhere in between the regular sneaker and a barefoot shoe. A not so extreme version of the barefoot shoe. The wider toe box also does help to keep the shoe from getting worn out in the upper. What often happens in shoes is that they rip apart where the upper meets the sole. The cause of this is that the foot often is wider than the shoe which creates a constant pressure at those points which eventually makes it rip apart.

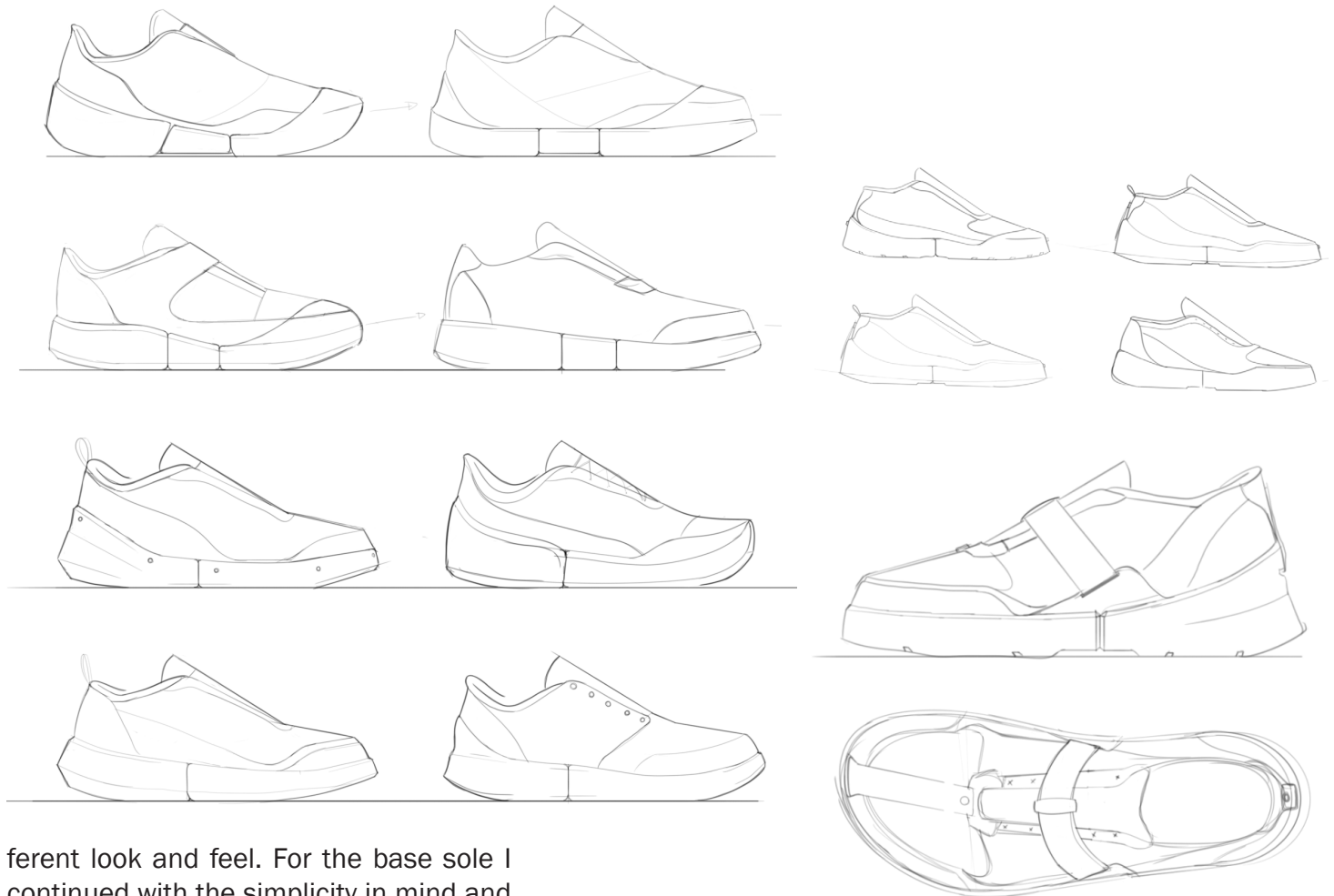
Last but not least the modular sole that can change when it has become worn out or just if you want a different style of the shoe. This so the shoe can be used for as long as possible. The sole is going to be in two pieces to give the ability of just changing the part that has gotten worn the most.





Ideation 2

After establishing what properties the shoe should possess I started the ideation 2 face where I looked more to the style and look of the sneaker. During this face I was highly influenced by today's street style. Even though I tried different directions I had the idea of wanting a very clean and simple design for the upper, which then resulted in the sole getting even more room to change the look depending on its shape. This would mean that when you would get tired of the style of the shoe you simply just change the sole to give the sneaker a completely dif-

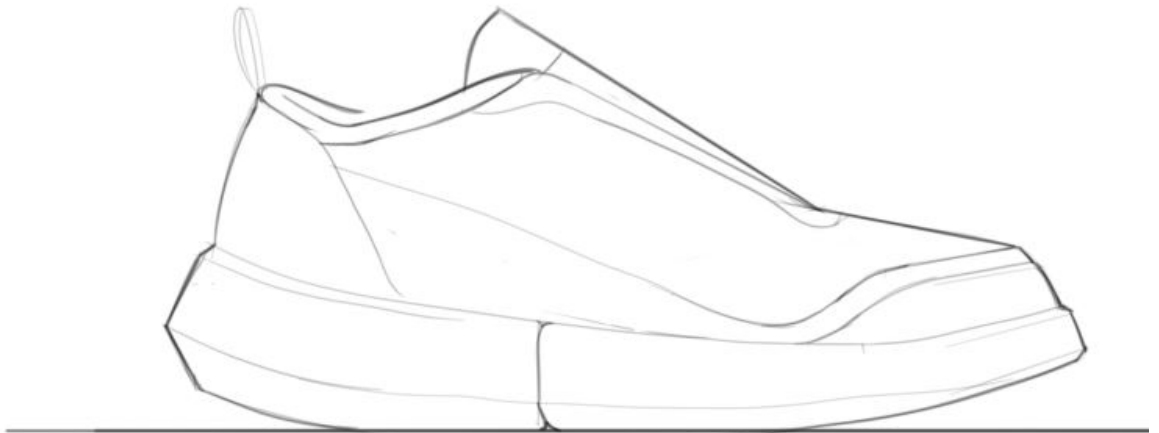
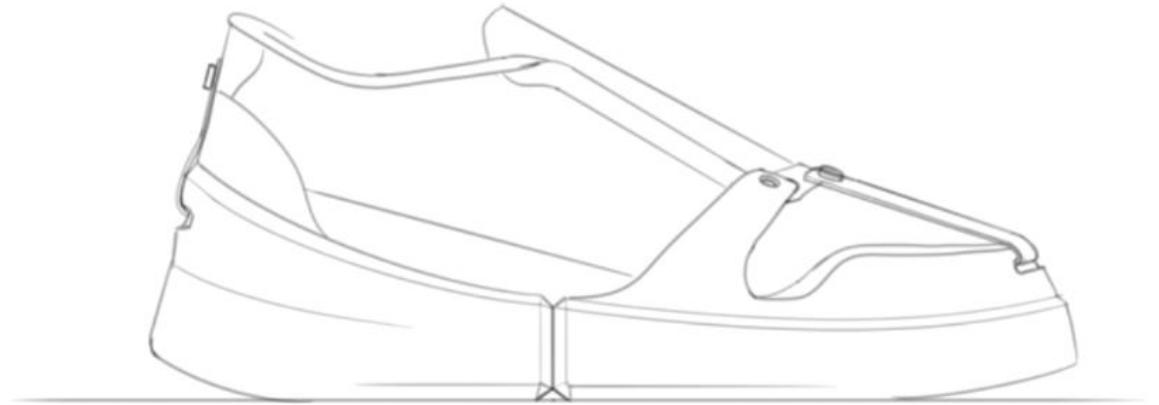


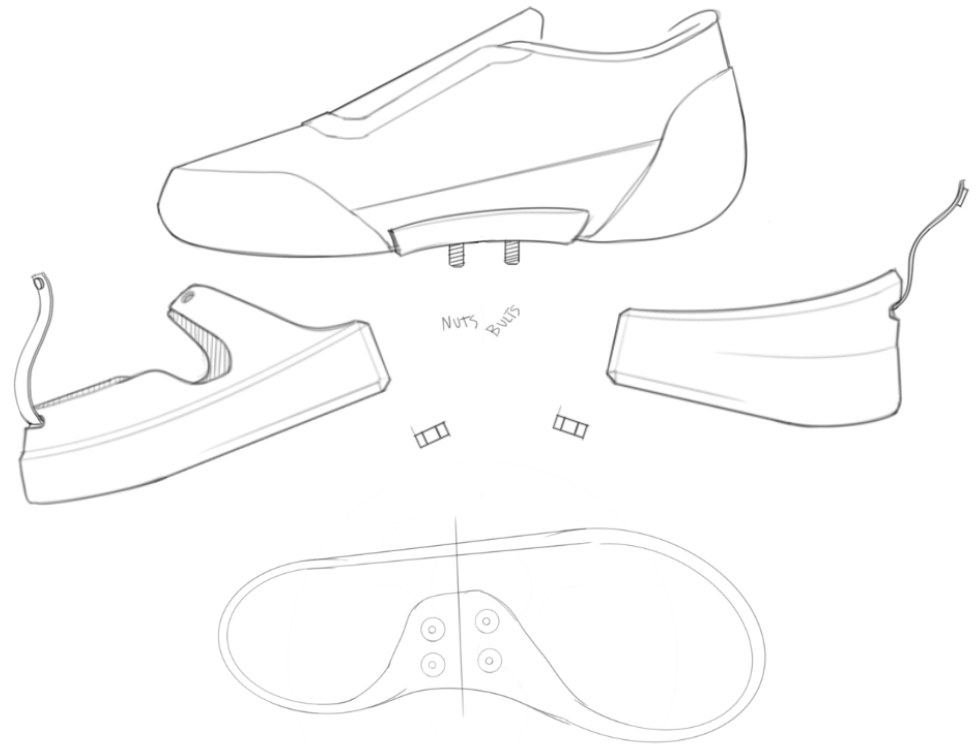
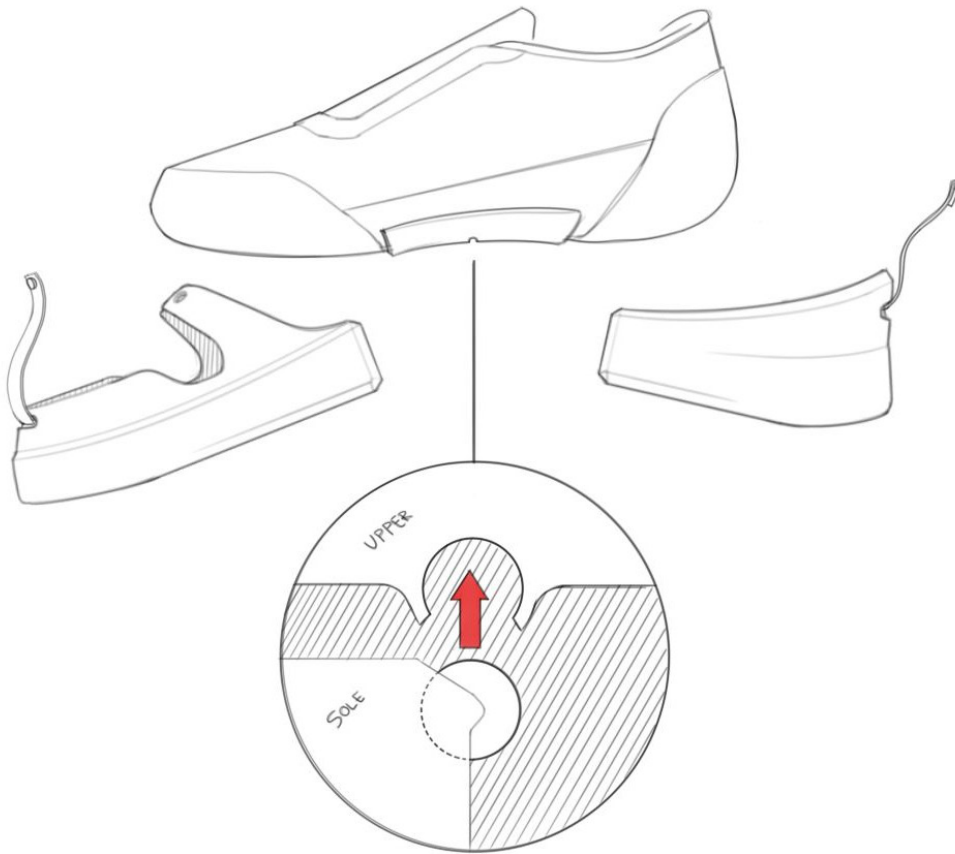
ferent look and feel. For the base sole I continued with the simplicity in mind and came up with two final versions of the final product.



Concept

I chose two concepts to continue with, the main difference being the sole where one has an extended part to the laces to ensure it fits the upper nicely and snugly. The ideation 1 was about the function and the second about the form and look of the product. Now I needed to combine these two ideation faces to make a complete product.

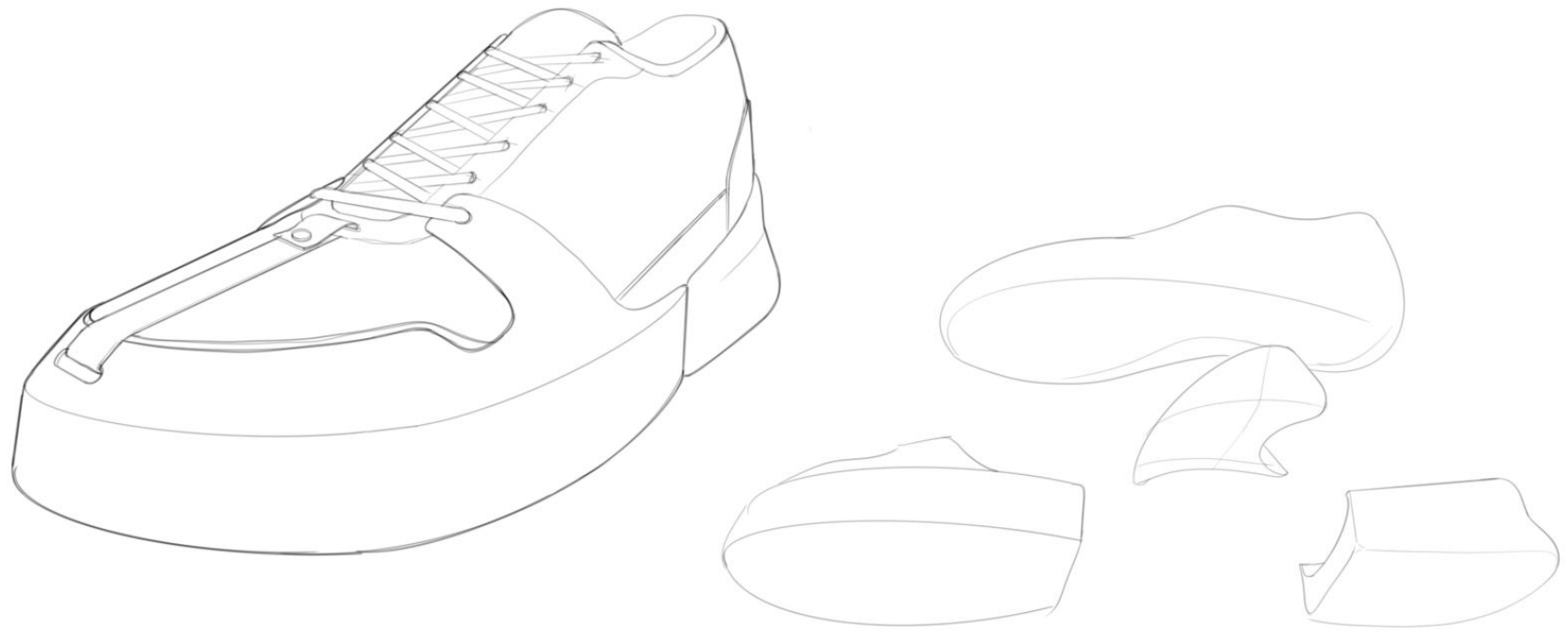




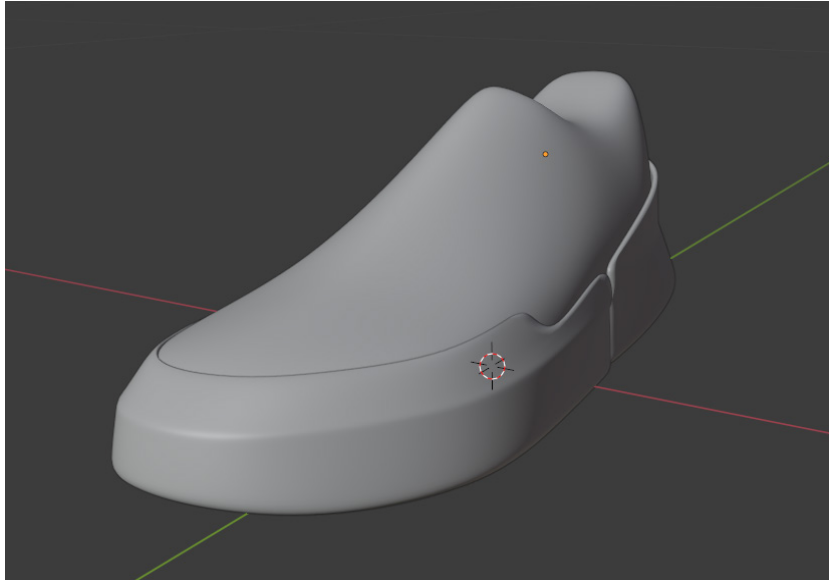
How it works

Two concepts of the attach/detach function were chosen, one where you just clamp it on and the other one using nuts and bolts underneath. The question here is still, how often should it be changed? And how sturdy is it going to be? Deci-

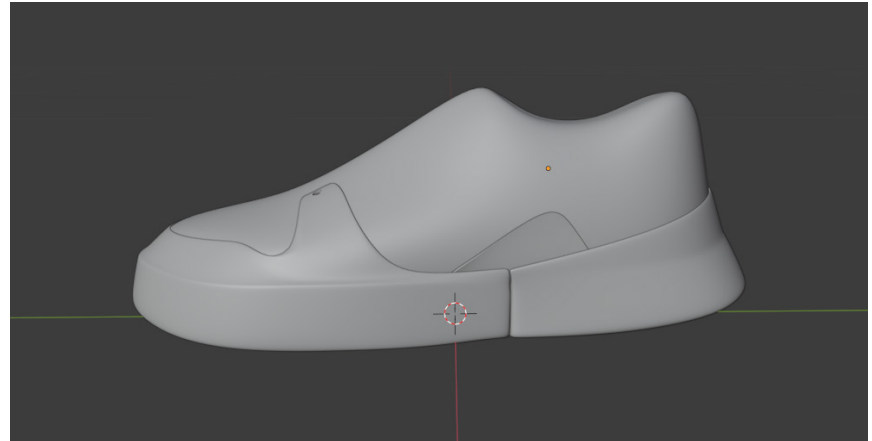
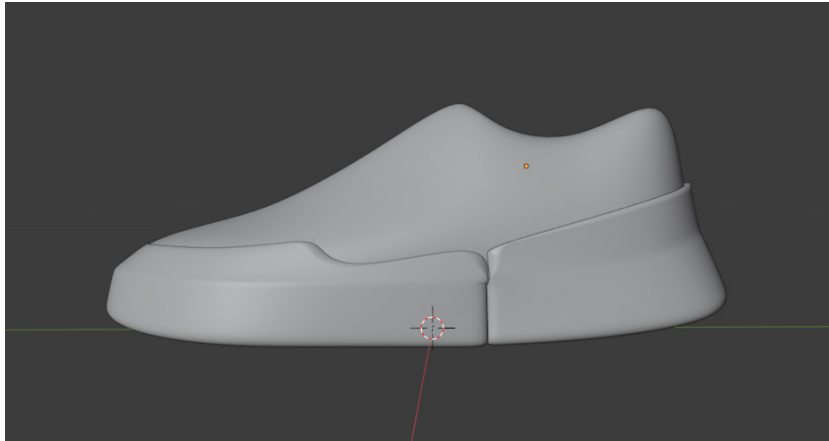
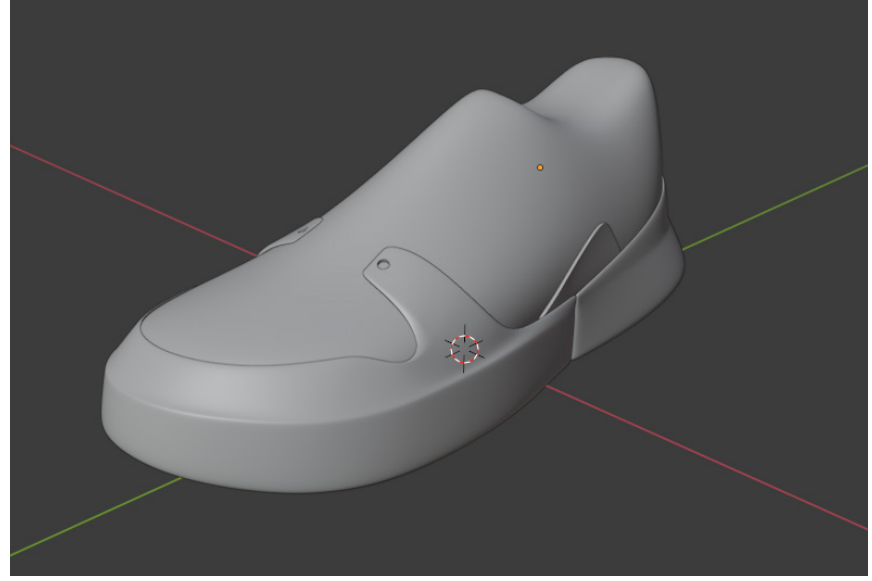
ding on that it shouldn't be changed that often and because I also want a more durable solution. I decided on using the right option with nuts and bolts.



1



2

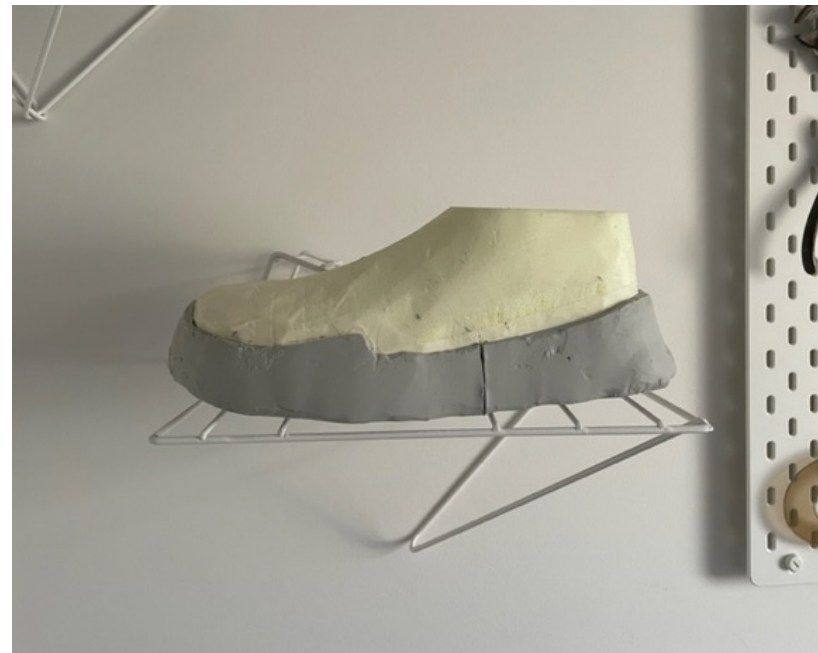


Realisation

Mockups

I started making mockups of the sole in modeling clay to get a deeper sense of the shape and form. While doing this I realized that having the extended part to the laces made the sole much wider in the widest part which for me doesn't really work because the width of the shoe already was extremely wide. The other concepts without these extended parts were then chosen.

The pattern of the upper was made by drawing on the taped last. The tape was detached from the last and patterns were then cut out.



Material Choice

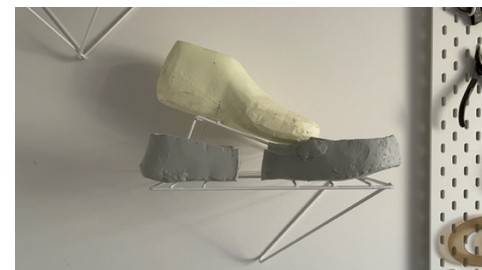
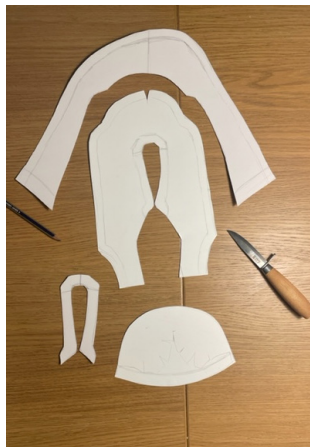
After a vast amount of research of what material would fit my shoe I had in mind I wanted as few materials as possible I still wanted the best properties for each part of the shoe. For the upper the most I had the most freedom of choice. Here most types of fabrics or leathers can be used. I knew I didn't want newly produced plastic for the upper which sorted off a lot of materials. After looking through some knitted fabrics, hemp fabric, leather, cotton I found a company called up fuse that heat presses recycled plastic bags to use as a material to create more durable bags. After this I found a sneaker company named thaley which uses this same material. This was very intriguing for me to be able to recycle plastic and at the same time get a very cheap material for my

project. For the sole, there are some very established materials that I will not question. From these materials I choose PU-foam which has good shock absorbent properties and is quite more friction resistant than EVA-foam. And for the insole I will use EVA-foam for its very good shock absorbing properties. (Better Shoes Foundation)(klaveness)



Material testing

A test piece of the heat pressed plastics was made for further understanding and feel for the material. After a successful trial, bigger pieces of the material were made. The material felt very sturdy and durable and perfect for my shoe.



Making the shoe

The upper pattern was cut out and fused together, after this it was attached to the last to join it with the insole. After making the upper the sole was again made in modeling clay.

final product

Mockup Model



Picture 2: [lidl shoes].



Picture 3 [Off-white ikea collab]



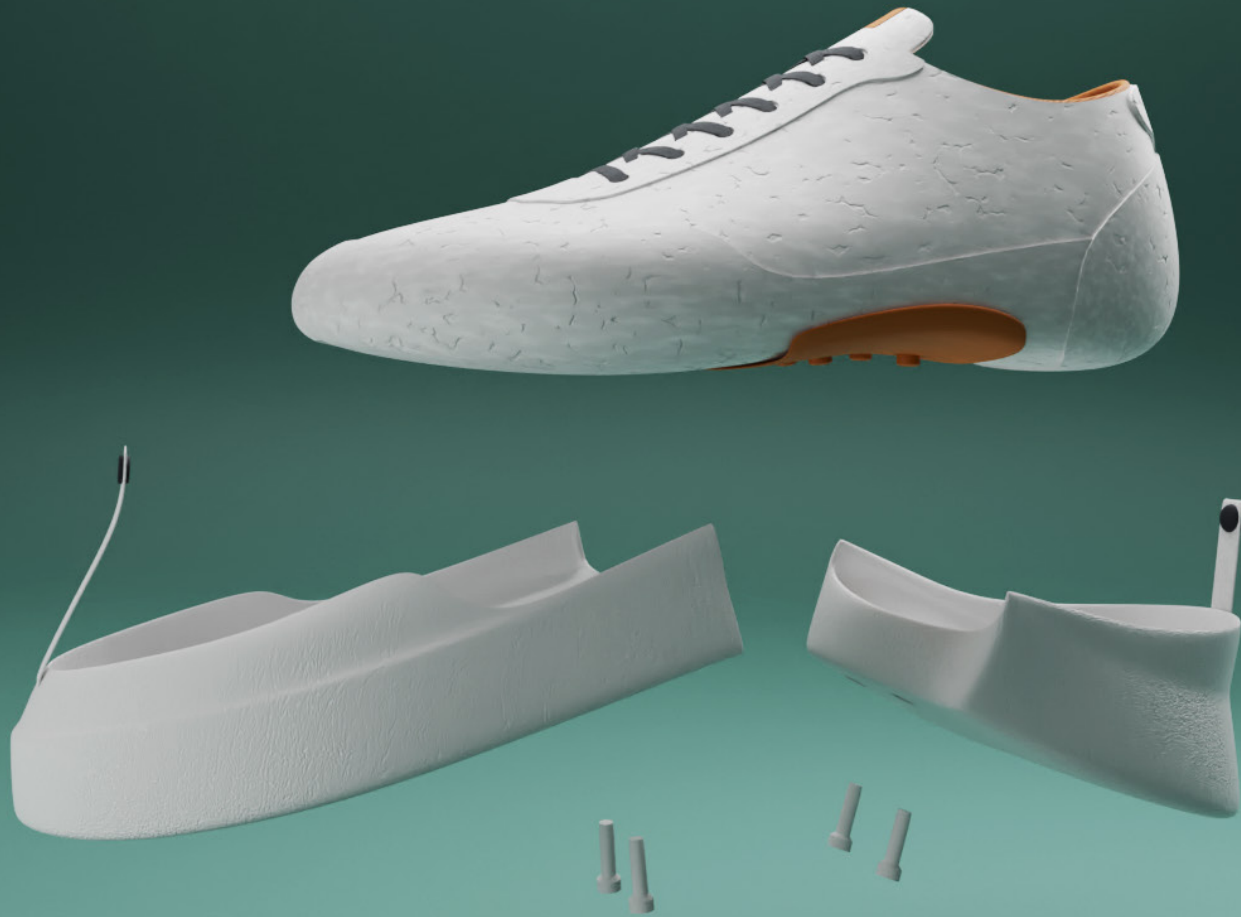
Picture 4 [IKEA bag shoe]

Opportunity

The material for the shoe was made out of system bolaget bags and because the graphics on the bags I was made to involve the graphics in the design which worked beautifully. I became really happy with the result of the upper and it shows the potential of collaborations with a lot of companies in a cheap way. To do merch for companies has been really successful in the past for example lidl shoes, and different IKEA collabs. (IKEA)(King, Williams.)

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Result

It is a very clean simplistic sneaker that can change in style and or get renewed life by changing the sole. It should be a good ergonomic fit for our feet by preventing less ankle mobility and more room in the toe box. the wider toe box also makes the upper material less likely to be torn apart.

final product model



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Style change



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evaluation

In this project I've encountered a lot of fun but also a lot of challenges. I switched projects mid project which gave me less time and much stress. Many things could have been done differently. For example, one thing that i would like to have done is been in contact with shoe makers and shoe designers to get further insight on the market today. But I also learnt a lot of new skills during this project. I developed my blender 3d modeling skills because of the complexity of a shoe, I got to go through the steps of shoemaking and I regained my sketching skills that have not been in use for some time. I realized it is possible that the sole needs some added straps to get a better fit to the upper to prevent rain or dirt from getting into the cracks. This can be something to look into in further development. Other alternative upper materials are also something I want to look into. Prevention of waste is better than to clean it up when it's created, this means that the ma-

terial used in the shoes today may cause more harm than good in the long run because it makes it more okay to use plastic bags. (*Zimmerman & Anastas 2003*) But for the project the recycled material was chosen for multiple reasons: it is a statement and hopefully creates discussion on plastic use and makes people think about their habits, it is a material that was very easy to create, it needs minimal energy use to be created and was very cheap which is very lockande for a student.

Thank you

Claus-Christian Eckhardt, Anna Persson, Jasjit
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Picture 2: [lidl skor]. (u.å.). Retrieved 15 may 2022, from <https://soundcloud.com/aquariusonprod/lidl-shoes>

Picture 3 [Off-white ikea collab]. (u.å.). Retrieved 15 may 2022 from <https://www.ikea.com/se/sv/new/maerk-markerad-pub039b6a31>

Picture 4 [IKEA bag shoe]. (u.å.). Retrieved 15 may 2022 from <https://solecollector.com/news/2017/05/ikea-air-jordan-1-the-shoe-surgeon>

