

chair family for Metropolia Arabia campus

Tekijä	Sini Mäkinen
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Ohjaajat	Pasi Pänkäläinen, lehtori
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tiivistelmä /

Opinnäytetyönäni suunnittelin tuoliperhekonseptin Metropolian uudelle Arabian kampukselle. Toimeksiantajana toimi Metropolian ammattikorkeakoulu, ainakin jollain tasolla.

Tavoitteena oli suunnitella tuolit, jotka sopisivat Arabian kampuksen tilaan sen arkkitehtuurin puolesta mutta myös sen kautta mihin suuntaan halutaan ohjata tilassa tapahtuvaa toimintaa. Taustana työlle toimi jo aiemmin Kampuskaluste opintojaksolla suunniteltu tuolikonsepti. Tämän lisäksi suunnittelua ohjasi julkisen tilan vaatimukset kalusteille, ergonomia ja mitoitus, valmistustekniikka ja luovan kampuksen piirteet.

Työn tarkoitus oli mahdollisesti suunnitella, jotain mitä kampukselle voitaisiin oikeasti toteuttaa. Uudella Arabian kampuksella on suuri merkitys siihen, miten Metropolian muotoilu ja luova puoli asemoituu kilpailijoihin ja alaan nähden. Pääaula ja moni muu alue on julkista tilaa, mihin voisi kuka tahansa alueella liikkuva tulla. Kyseessä voi olla turisti tai mahdollinen tuleva opiskelija, miksei tuleva työnantaja. Aulalla on suuri merkitys käyntikorttina siihen mitä osaamista Metropoliaa tulee. Se on paras näyteikkuna opiskelijoiden suunnitteleuille tuotteille.

Työhön käytetyt metodit pohjautuvat suurimmaksi osaksi itse suunnitteluprosessiin. Olen työstänyt ideaa piirtämällä ja tämän jälkeen 3D mallintamalla. Lounge tuolin ja pinoutuvan tuolin suunnittelu on kulkenut käsikädessä ja ne ovat ohjanneet toinen toisiaan. Mittasuhteita on testattu erilaisilla mockupeilla, sekä 1:5 skaalamalleilla, jotka ovat 3D printattu. Rungon prototyypin työstäminen antoi varmistuksen siihen, että tuolien taitokset onnistuvat, mutta herätti myös huolia tiettyjen kohtien kestävyydestä.

Aikataulutuksen vuoksi prototyypit tuoleista, eivät ehtineet valmistua ajoissa opinnäytetyön palautuksen aikataulun mukaisesti, joten niiden varsinainen testaaminen jäi tästä pois. Näiden työstäminen jatkuu tästä eteenpäin normaalisti.

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abstract /

The topic of my thesis was a Chair family for Metropolia Arabia campus. The client was vaguely Metropolia.

The goal was to design chairs that would fit to the new campus. Not only because of the architecture but because of how we want to direct the situations of use in the location. I participated to a Campus furniture course at the end of 2017 where I made a chair concept with two other persons. That chair concept worked as a background for the whole thesis project. Also, I had to consider the requirements a public space sets for furniture, ergonomics and manufacturing techniques.

The purpose of the project was to design something that could be manufactured to the location for real. The new campus in Arabia has a big role for how we compete in the field and if it will be seen as a creative campus. The main lobby and some other spaces are open to anyone. That person could be a tourist or a future student, or even future employer. That's why the lobby is like a business card showcasing what kind of skills the students have.

The methods I used during the project are mostly based on my own design process. I have been sketching and 3D modelling. Lounge chair and the stacking chair have been going hand in hand in my design process. I tested the measurements and proportions with 1:1 mockups and 1:5 mockups. Working on with the prototype frame structure gave a good belief for me that the turns and twists are possible to make but also raised some questions about the durability of certain points.

Because of scheduling problems, the prototype did not get ready for the deadline of the thesis. But I will continue working them after this and they will be ready during the following summer.

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01

INTRODUCTION

topic and goal /

The subject of my thesis is A chair family for Metropolia's Arabia Campus. My role is to design a chair family or a chair series. I will be in charge of the final design, testing and prototyping.

The chairs will be made for a specific space which will have a role in the design process. The tutor of this thesis is Pasi Pänkäläinen and Metropolia University of Applied Sciences is vaguely working as a client here. The overall goal of the thesis is to have a chair design that could be manufactured and placed to the Arabia campus for real.

Chair family for Metropolia Arabia campus.

relevance of the subject/

As a subject a chair is not new or relevant worldwide. But it is very relevant for the new campus in Arabia. The purpose is not to only make Metropolia's brand stronger but to create a strong status of the Arabia campus as a **creative campus** and to showcase what we can make in this university. It is important to make Metropolia design to be respectable competitor in the field of design universities.

The subject has also a relevant meaning for me as a designer – what am I as a designer and how well I can manage the whole furniture design process. I don't have strong experience from furniture design in my studies, so the lack of that will give me its own challenges.



the subject definition and the design challenge /

A chair family to Metropolia Arabia Campus. The thesis will be a chair family concept that is designed for Arabia campus. The concept will include at least a lounge chair and a normal chair and their variations. It will also include the 2D drawings and measurements and material guide. I will make the prototypes of a lounge chair and a normal chair if the budget is enough for that.

Most of the work will concentrate for the designing of the chairs. Designing the lounge chair and the normal chair will go hand in hand and one will direct the other which direction to go. The design process will consist of sketching, scale models, 3D models, 1:1 mockups and the prototype at least of one model. This will enable the real testing of the chairs. Also, the manufacturability will direct the design decisions as well as the possibilities inw industrial manufacturing of the chairs.

Overall making a chair is a huge challenge. A good chair is a combination of how it looks and how it feels. In addition to that I am also making the chair to a certain location. This won't only affect to the point of how well the chair fits to the architecture of the space but also how well it supports the message and the impression of the space – what is the message Arabia campus and the main lobby of the campus is telling and is the chair consistent with that. That will be a real challenge.

the research method /

My main research method will be the analyze of the first chair concept that was made in the Campus furniture course, benchmark analysis and my own design process. Also, the propositions and setups can be evaluated trough scale models and 1:1 mockups. The first prototype will make it possible to actually test the chair.





02

BACKGROUND

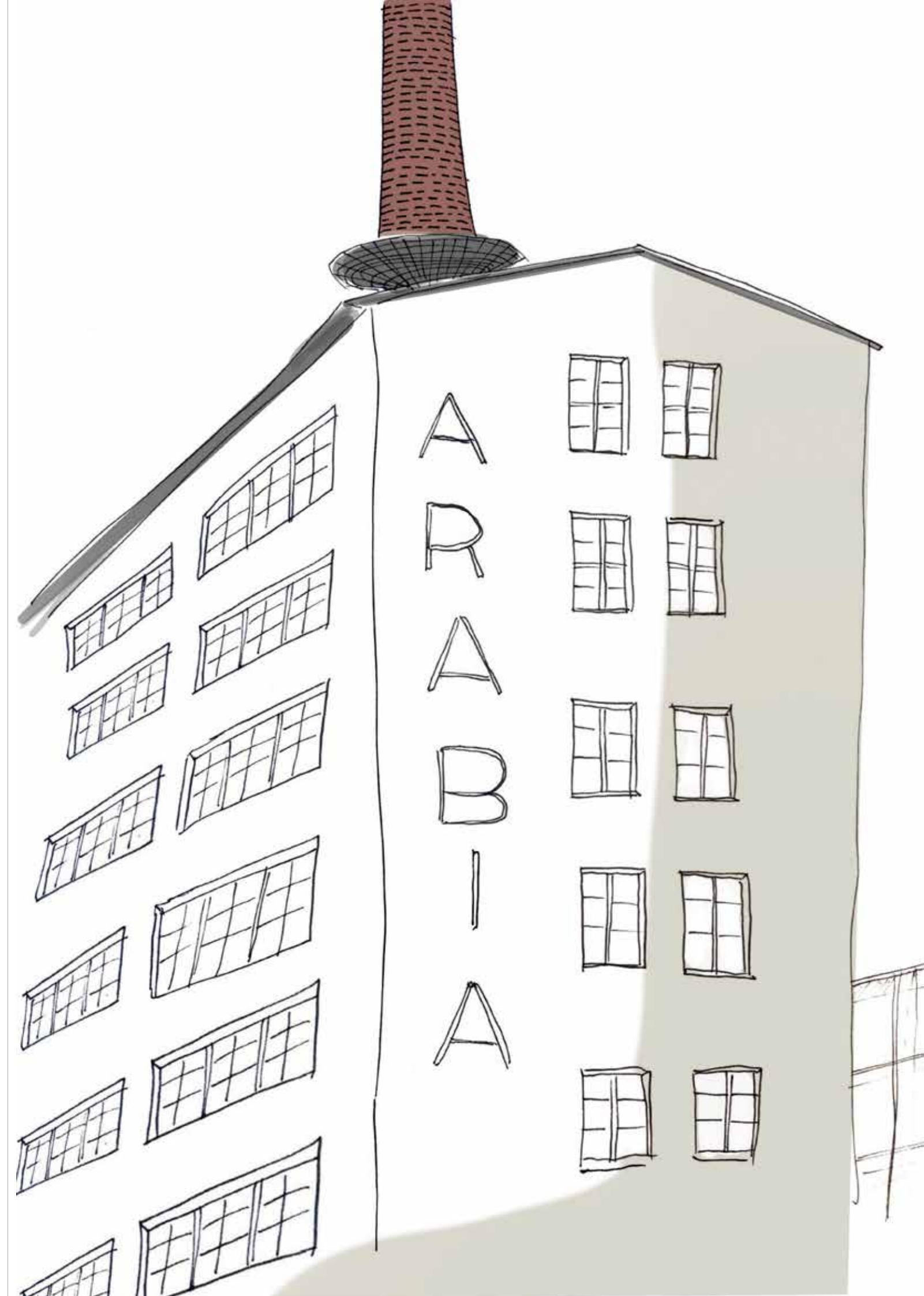
Arabia campus and the location /

Arabia campus is located to address Hämeentie 135, Helsinki. Before Metropolia there was located the University of Arts and Design that later changed to be part of Aalto University. The school was working in the spaces since 1984 and is moving completely to Otaniemi during the summer 2018. (Varma 2017)

The spaces have been renovated and transformed completely to fit for the purposes of the Design department of Metropolia University of Applied Sciences. The location has a new main entrance, 20 meters to the left from old Aalto University entrance. The spaces are nicely renovated without covering the architecture and the old materials of the space. Architects Tommila Oy has been in charge of the redesigning of the campus. (Metropolia 2017)

The history of the location is long. In the year 1873 Swedish ceramic manufacturer Rörstrand built the Arabia factory so that they would have easier access to Russian markets. In the beginning of 1910's when the first world war just around the corner Rörstrand sold Arabia for Finns which meant strong growing and development period for the company. This was the beginning of beloved Arabia ceramic brand. The manufacturing was stopped in the factory 2016. (Arabia 2018)

It is a great advantage to have the creative university in such an historic location.



the campus furniture course /

The background for the whole project is a campus furniture course, held by Pasi Pänkäläinen. The course took place in the fall 2017. I set up a team with Teemu Haranko and Milka Tanskanen, and we made together three different furniture concepts to the main lobby of Arabia Campus. One of the concepts was a chair concept, and that will work as a starting point for designing the chair family. The other two concepts were a sofa concept and a sofa table concept. Teemu Haranko will continue the sofa concept as his thesis.

The idea of the course was to make different kind of concepts to the common spaces of Arabia campus. The potential ideas could be possibly being developed further and made there for real. During the course we got to visit in the construction site couple of times to get the feeling and idea of the new spaces. We got familiar of the layout of the campus and we got to know the architecture and materials of the spaces.

In our team we chose to work on with the main lobby and the third-floor lobby area (picture 2.1). From the main lobby there is direct vision to the third-floor lobby and vice versa. We felt that the main lobby has an important role in creating the first impression of the creative campus. It is the first thing visitors see; even if they are then students, teachers, visiting guests, tourists or residents of the area.



Picture 02/1. Layouts of Arabia campus
(architects Tommila Oy)

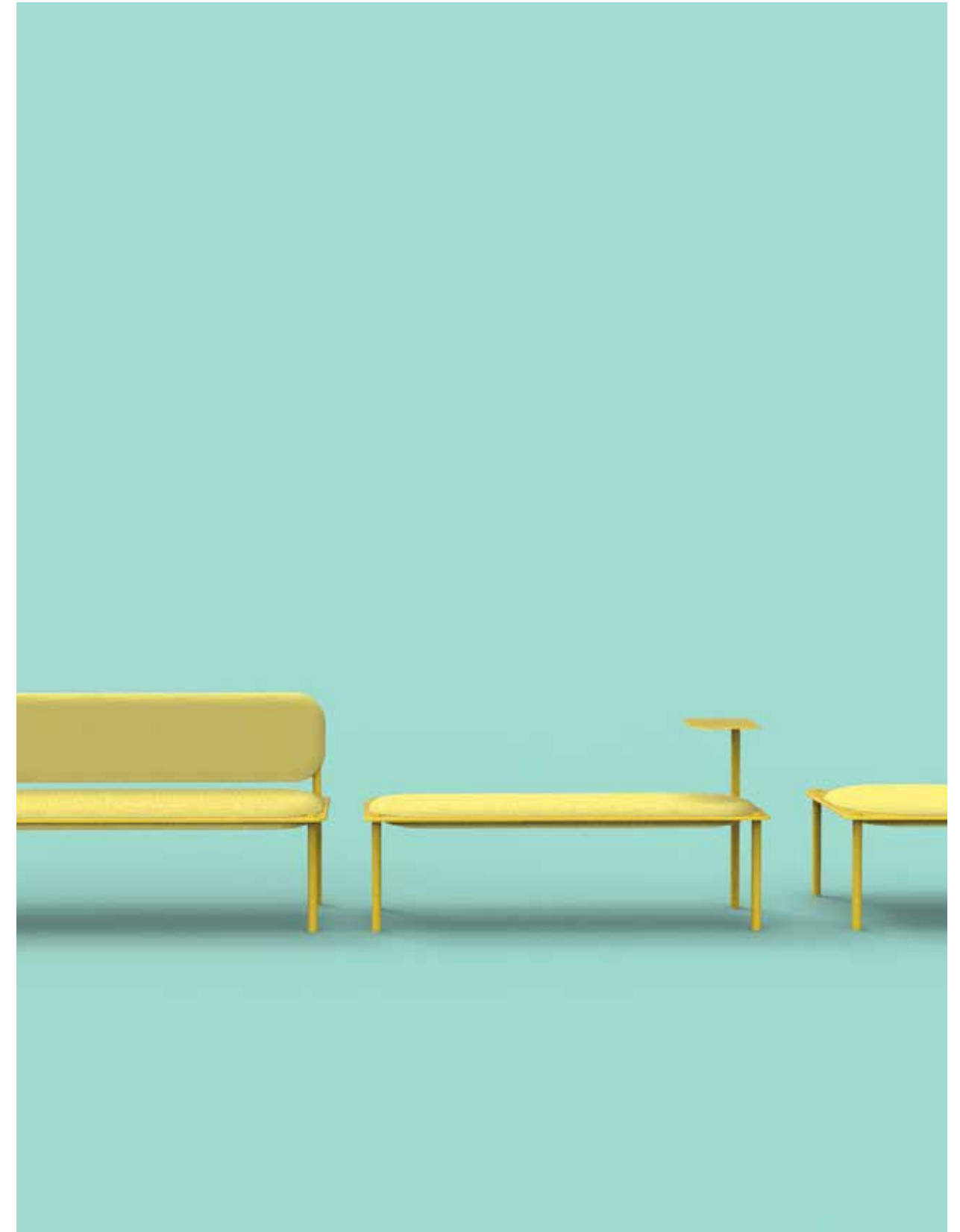
the furniture concepts /

These are the three furniture concepts we made during the campus furniture course. The first ones were sofa or bench concepts (picture 02/2 and 02/3). The idea was that the upholstery would be also in the bottom creating this feeling of it being completely through and working as a sound muting panels. In this concept we had a metallic version and a wooden version.

Then we had the chair concept (picture 02/4) that I will go deeper into in the following chapter. And as a last thing a sofa table concept (picture 02/5). We wanted to make something solid looking and wooden, so we created this rounded cube with very thin metal legs. In the sofas and in the tables the main idea were some very nice details you can only feel or see close by.



Picture 02/2. Sofa bench concept - wood



Picture 02/3. Sofa bench concept - metal



Picture 02/4. Chair concept



Picture 02/5. Sofa table concept

the original chair concept /

Coming up with the chair concept felt quite difficult compared to the other furniture concepts. Me, Teemu Haranko and Milka Tanskanen were working on with different ideas for quite a long time. At the end Milka and me got an idea of a chair where the legs/frame would be possibly laser cut from metal sheet and just bended to a shape like a paper.

Looking at the very first model (picture 02/6), I can see multiple problematic spots. Especially the balance of the chair. The leg frame is too narrow in the front becoming to be basically three-legged chair. Most likely it would fell if not seated right in the middle. No one wants to sit in a chair that will even slightly give a feeling of felling. But we felt that there was something fun in the general idea of the chair and worth of putting more attention.



Picture 02/6. Sofa table concept



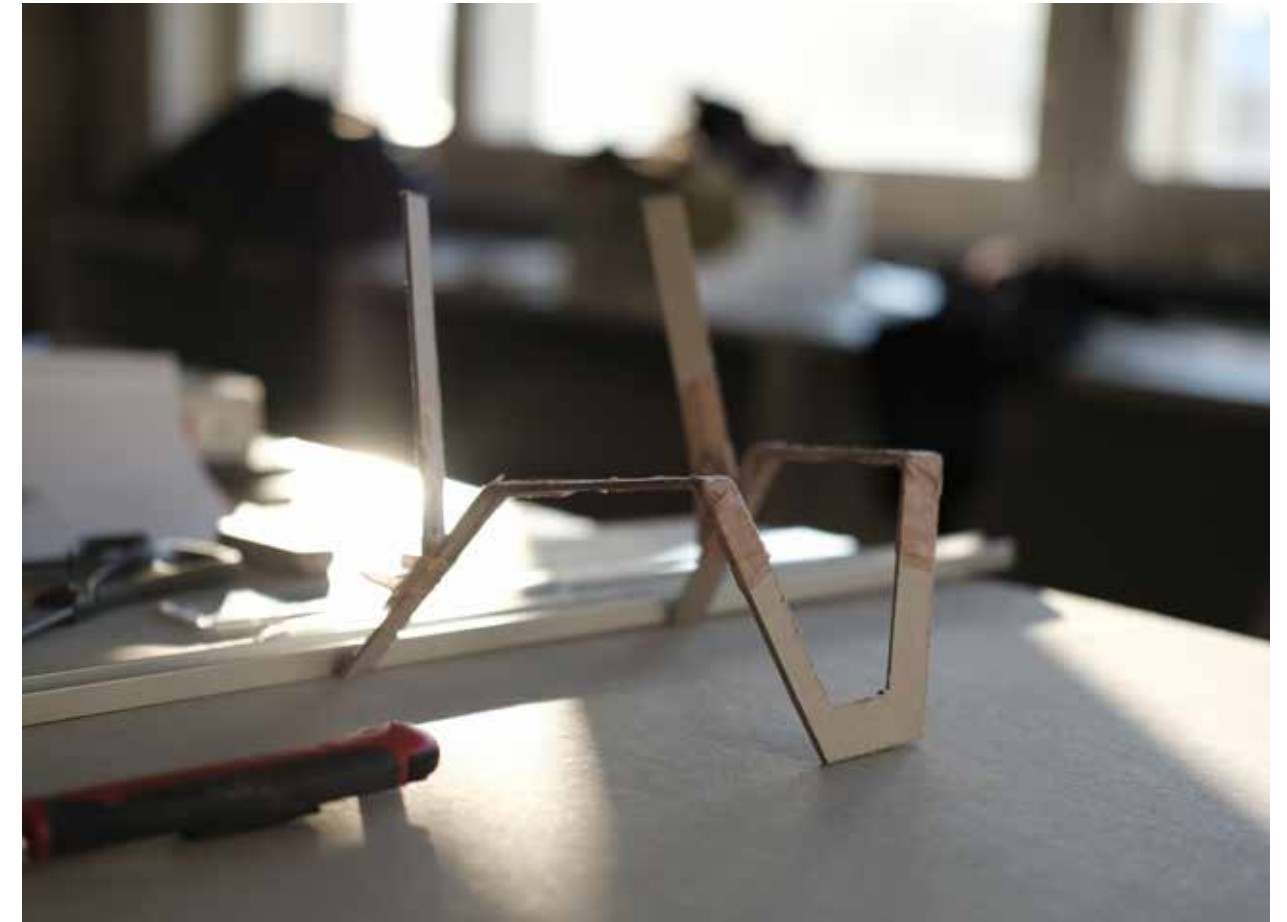
Picture 02/7 3D model of the lounge chair, second version

For the second version we made the front leg part wider to make the balance better. Even though the balance might have still been an issue, maybe the chair would have kept it balance just because of the weight of the whole steel structure.

In general, the appearance of the chair, especially the seat and backrest reminds too much of this Eames style – it is missing its own character. The leg structure is the most interesting part and I think that the idea of one flat bar circulating around making the structure and legs should be emphasized more. That could make the chair look interesting and the visual would be very light. Also, it would be more economical and efficient to use a standard size steel flat bar instead of laser cut metal sheet. The material itself is rather cheap even though working the flat bar (bending, dwelling, power coat painting etc.) brings more price to it.



Picture 02/8 Making of a 1:5 scale mockup from the original chair concept



Picture 02/9 1:5 scale mockup from the original chair concept

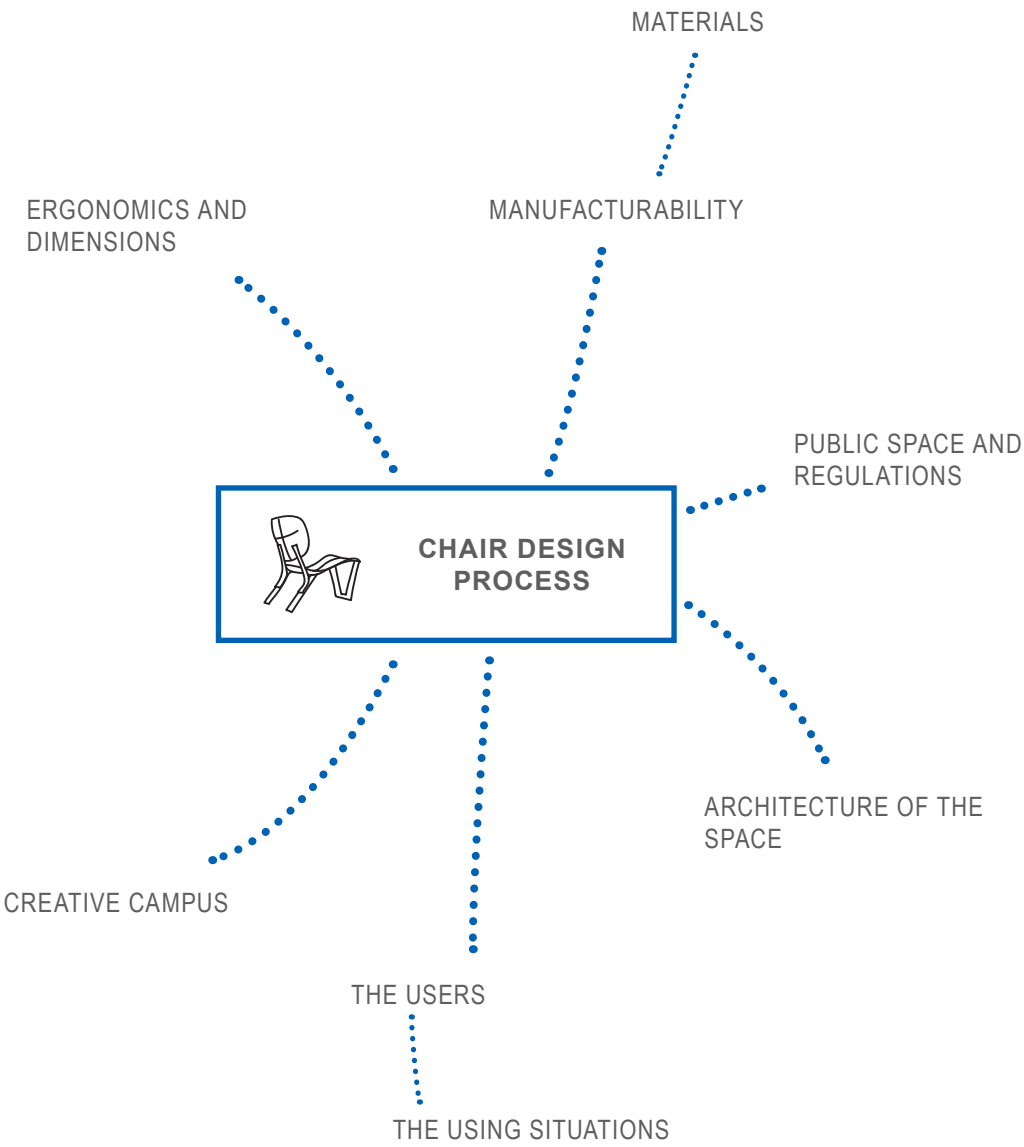
03

THEORETICAL FRAMEWORK



theoretical
framework/

Theoretical framework will put together all the areas that are relevant in my design process. Those are: Arabia campus, Creative campus, the users of the space and the situations of use, the architecture of the space, public space furniture requirements, ergonomics and dimensions, materials and manufacturability.



creative campus /

Arabia campus won't be just any regular campus, it will be a creative campus. It is very important what is the first impression when a visitor steps in. The entrance, main lobby and other public areas will work as a business card for what to expect from Metropolia University, what to expect from the creative degrees of Metropolia. Sofia Frantsi is listing in her thesis Metropolia-window (2016, 18) the key concepts for designing the campus spaces. These are among the other things versatility and adaptability, transparency, communication and functionality.

The adaptability of the space is specifically about the furniture and layout. The transparency means the connection between the space and action, in the location. Communication is the social impact of the furniture and layout solutions. And the functionality describes how well the space works in everyday use – the functionality of the space as well as the activity of the groups in the space. (Frantsi 2016, 18)

Especially the lounge chair together with the sofa of Teemu Haranko are in key role for creating the communication of the space – what is the social impact of the furniture in the space? what we want students and other visitors to do there? how we want them to be there and feel there? The furniture should make an atmosphere one feels welcome and relax. There should be meeting points with other people and the furniture have role in that. The furniture should tell that this place is something else than just an ordinary office building and an ordinary lobby. It should tell that this is a creative campus.





the users and the situations of use /

All in all, the goal is to create these meeting spots and places of everyday life for students and visitors. The space should be a platform for encounters, conversations and development. A space that encourages to come closer, that inspires and develops good atmosphere. (Frantsi 2016, 24) It is now very current topic for Arabia campus to create this inspiring atmosphere with the furniture solutions.

The main lobby of Arabia campus is public space where just anyone is welcome to step in. Mainly the users will be students, teachers and other members of staff though. In addition to this it is also possible that there comes in other visitors, tourists, future students or local residents of the area. The using situations in the main lobby can be for example waiting or short meetings. Maybe someone is waiting there the start of an appointment or students are relaxing there while having a coffee break. It should be possible to have a quick meeting there with someone, sit down and go the matter through.

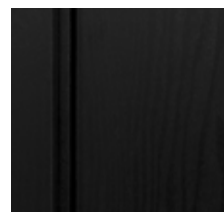
The focus is in the fact that the space and furniture should tempt people to sit and relax. It should create open and collective feeling (Metropolia Vision). This means that the furniture should work for relaxing and for relaxed working (the actual working spaces and group works spaces are elsewhere). The furniture shouldn't make the space feel packed and it should not look too formal and look like a waiting room. The furniture should enable conversations not create waiting areas for one person.

the architecture of the space /

As mentioned before, architects Tommila Oy has been responsible of the redesigning of the campus. The nature of the space is very rough and industrial. There are old concrete pillars, concrete floor, old brick walls, black steel frames and glass walls.

The roughness shows very openly there, and there has been no trying to cover all that. There is a lot of open space and walls are in most places glass. In some areas the sealing between floors consume been opened and some areas are rather low. Also, the workshops are behind the glass walls which makes it possible for anyone to look what is happening there, creating transparency and creative atmosphere.

Main materials in Arabia campus lobbies:



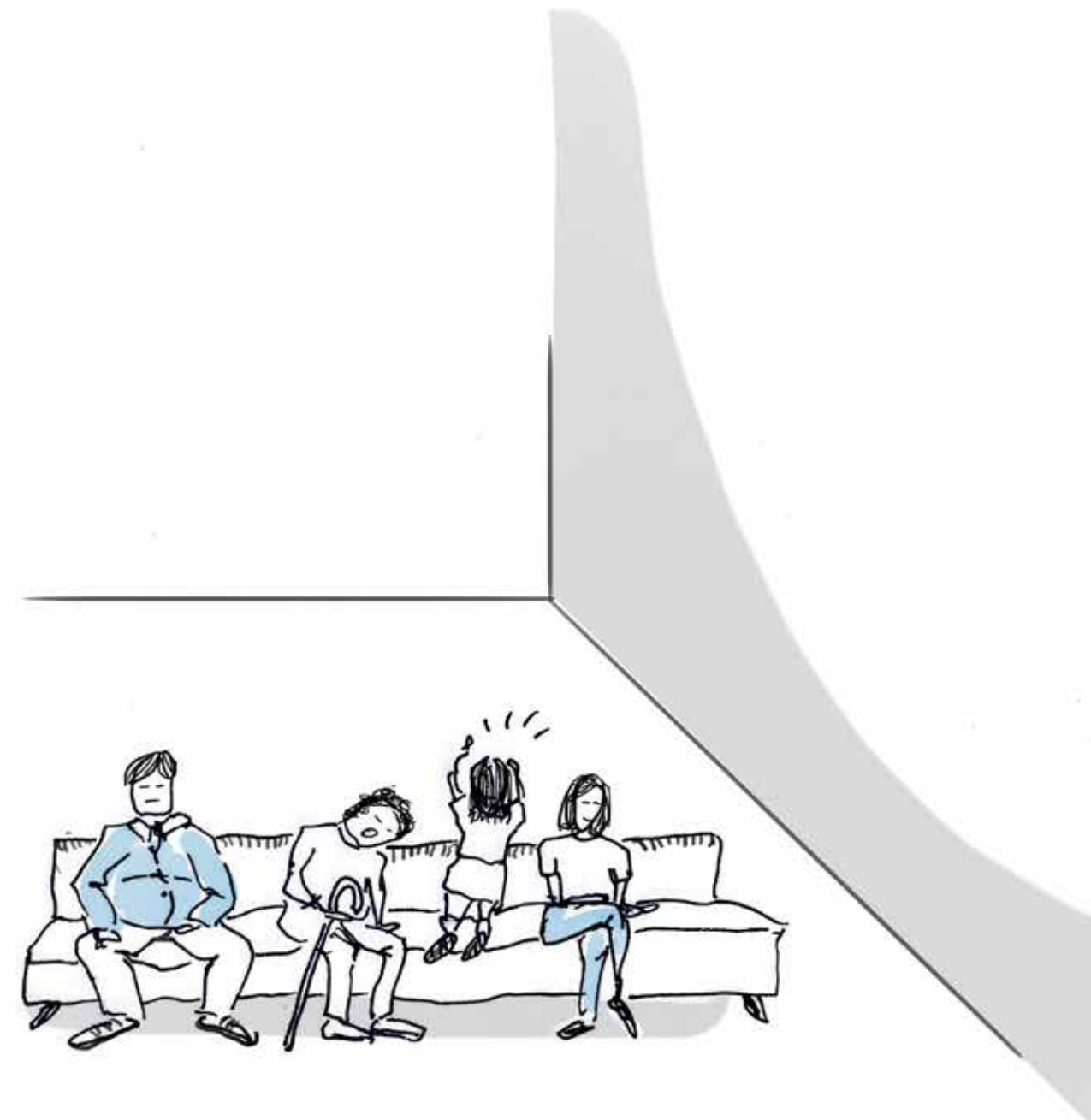
Staircase and old concrete pillars in Arabia campus lobby.

public space requirements for the furniture /

Furniture that are placed to public spaces have high requirements for the durability and safety of the structures and materials. Furniture meant for public space should be designed the way it can handle the years of heavy use. There should be considered that different size of people may use them and they most likely are in a heavier use than in home environment.

In principle, the furniture should be safe to use. This affects to the durability of the structure, the right measurements, the balance and the fire safety of the material (Kuluttajavirasto 2015). In the structure should be considered the parts that are in a high stress, so that they are strong enough not to bend or break with time.

Materials should be easily maintained, easily cleaned and durable. In the public spaces people use their shoes and outdoor clothes which means the furniture get in contact with dirt rather easily. For example, upholstery that goes till floor surface or very close to it, is in high risk to start looking dirty quickly. Stains, hairs, dead skin, dirt are easily visible in a fabric that is just one even color even if the color was darker. Also, the filling and upholstery must meet fire safety regulations. Tukes, an organization that supervises the safety and reliability of the products brought to market, writes in their webpage that there is fire safety regulation for upholstered furniture with an ordinance 743/1990. The furniture must pass fire safety standard or the fire safety should be proved in some other means. (Tukes 2015)



ergonomic and measurements /

The ergonomics of the chairs will mostly come true through dimensioning. There are certain measurements that should be followed. The seat and backrest angles will affect the seat comfort highly. If seat and backrest are soft that will give more room for maneuver with the ergonomics. Arena chair (picture 03/1) manufactured by Piironen and designed by Pasi Pänkäläinen will work as a reference for the chair measurements. I also have the real version of it available.

There are more options with the measurements of the lounge chair. Some lounge chairs are very low and deep angle, some are higher with a smaller angle. I don't want the lounge chair to be too low, the seat height should be around 400 mm. I also need to consider that if the seat is soft it will give up a little bit when used. The lower the lounge chair is, the harder it will be getting up from it. Also, will affect the seat angle and if it has arm rests. I want the lounge chair clearly to look like for one person, so that can be avoided multiple people trying to sit in it putting the structure for high stress and because I don't want them to take too much space in the location.

Arena chair: seat height 450mm, seat height from back 420 mm, seat depth 415 mm, seat width 390 mm, backrest height 340 mm

Chair (Varjoranta, Holmberg*) angle 3-5 degrees, backrest angle 15-19 degrees

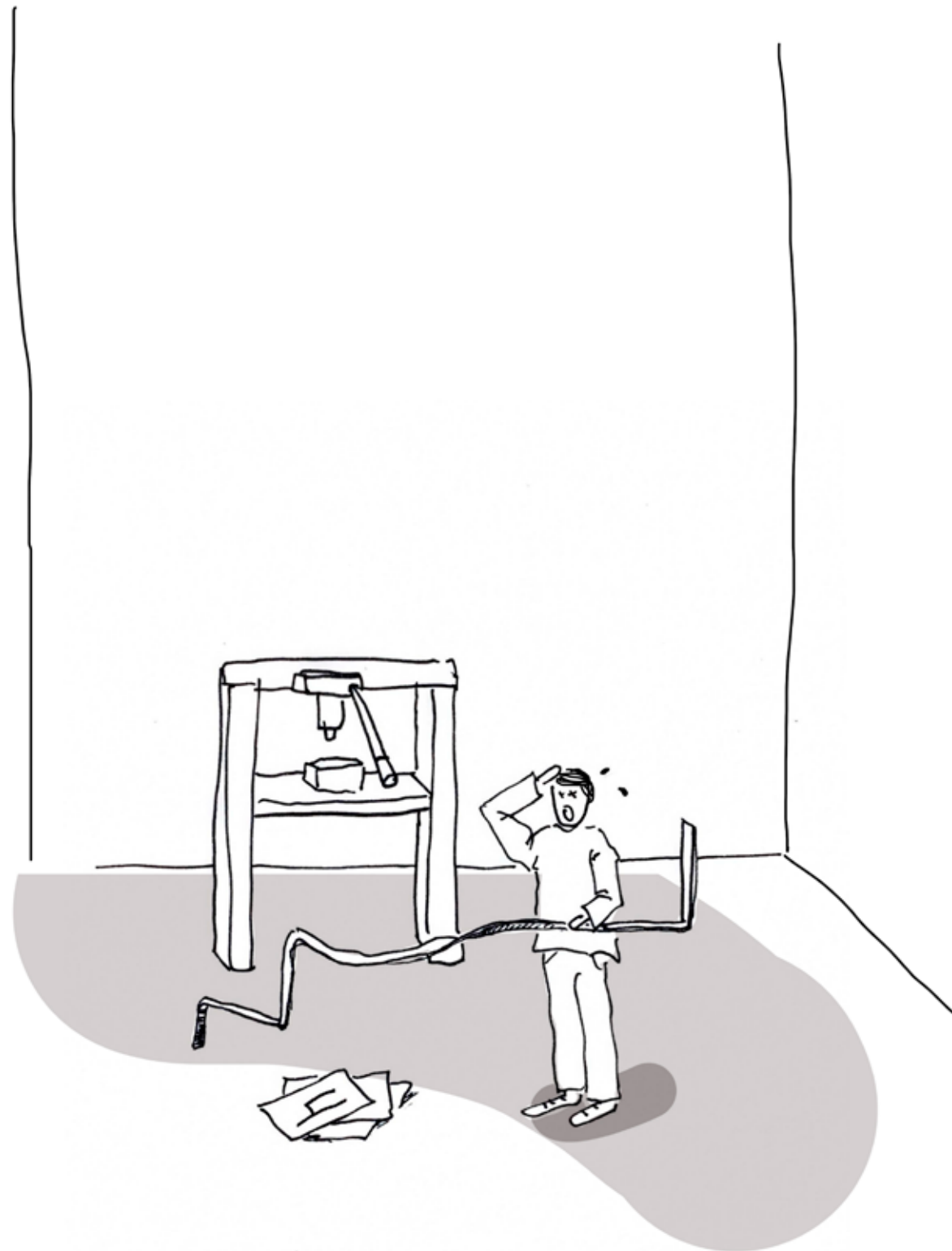
Lounge chair (Varjoranta, Holmberg*): seat height 390-400 mm, seat depth 450-500 mm, width 480-530mm

Especially the lounge chair measurements vary a lot from these ones.

*Measurements, Kimmo Varjoranta, Kaarle Holmberg / Pasi Pänkäläinen course material



Picutre 03/1 Arena 022 chair, Piironen



manufacturability and materials /

The frame and legs will be steel flat bar. Flat bar can be hot-rolled or cold-rolled steel. The cold-rolled steel probably suits this chair better, as the manufacturing method makes the steel stronger and more durable. This way is possible to try to use thinner flat bar. In general steel is very good material for making furniture that are strong or complex. As a material it is easy to form and there are plenty of developed manufacturing methods. It suits very well for industrial manufacturing and working steel is rather fast and cost-effective. Solid steel is widely used in chair structures to strengthen joint or bending points or as a structure which enables very light and thin looking frame. (SIT 72-610075 2010, 8-10)

For working and molding the flat bar can be used different kind of crutches, presses and bending machines. Nowadays the bending machines can do multiple bends with different radius and angles at one go. The steel flat bar can be joint together by welding. The welding method will affect to the look of the product and to the costs. They can be roughly shared for two categories: additive and additive-free methods (SIT 72-610075 2010, 4-5) Using so called tig-welding is possible to make almost nonvisible joint. Usually in this method there is no need for additive unless is made by hand. For this, the parts must be prepared accurately to fit for each other. (SIT 72-610075 2010, 6)



04

BENCHMARK ANALYSIS

structure and manufacturing perspective /

For this I have been trying to look for chairs that have steel flat bar structure or something close to it. I have been putting attention of the thicknesses and in how big angle the legs are, to consider what kind of structure would be strong enough.

I noticed that quite many seem to have spots in the structure that could feel like they are under a lot of stress when someone is sitting in the chair, for example Barcelona chair and PK 22. In Jean Nouvel's chair Milana the flat bar is clearly changing the direction, and is mostly in upright position to keep it strong. Milana chair is Nouvel's version of a Barcelona chair (Jean Nouvel Design 2018). In the Brno chair by Mies van der Rohe, is impossible to see any seam from welding.

David Rowland's 40/4 stacking chair is a good example how to make chair stacking in chair that has the "ski" leg structure.



**David
Rowland
40/4 /**

**Poul
Kjaerholm
PK 22 /**



**Jean
Nouvel
Milana /**



**Mies van
der Rohe
Barcelona /**



**Mies van
der Rohe
Brno /**



seat and upholstery perspective /

This is the hardest benchmark as I haven't had any clear vision of the style of the seats. I want the seat to be relax or fun/youthful and still seek for timeless look. I like the Vega lounge chair of Jasper Morrison, it looks playful with round seat and backrest. In the sofa of Nendo and Nichetto has over fat pillows, which makes it look interesting. I really like the comfortable and relax feeling that the chairs Bollo and 394 have, looking very inviting to sit.

**Jasper
Morrison
Vega /**



**Nendo &
Nichetto
sofa /**



**Rolf Benz
394 /**



**Fogia
Bollo /**



design drivers /

These are the design drivers I set for myself based on the theoretical framework and benchmark analysis

**playful /
comfortable and relax /
interesting /
timeless /**



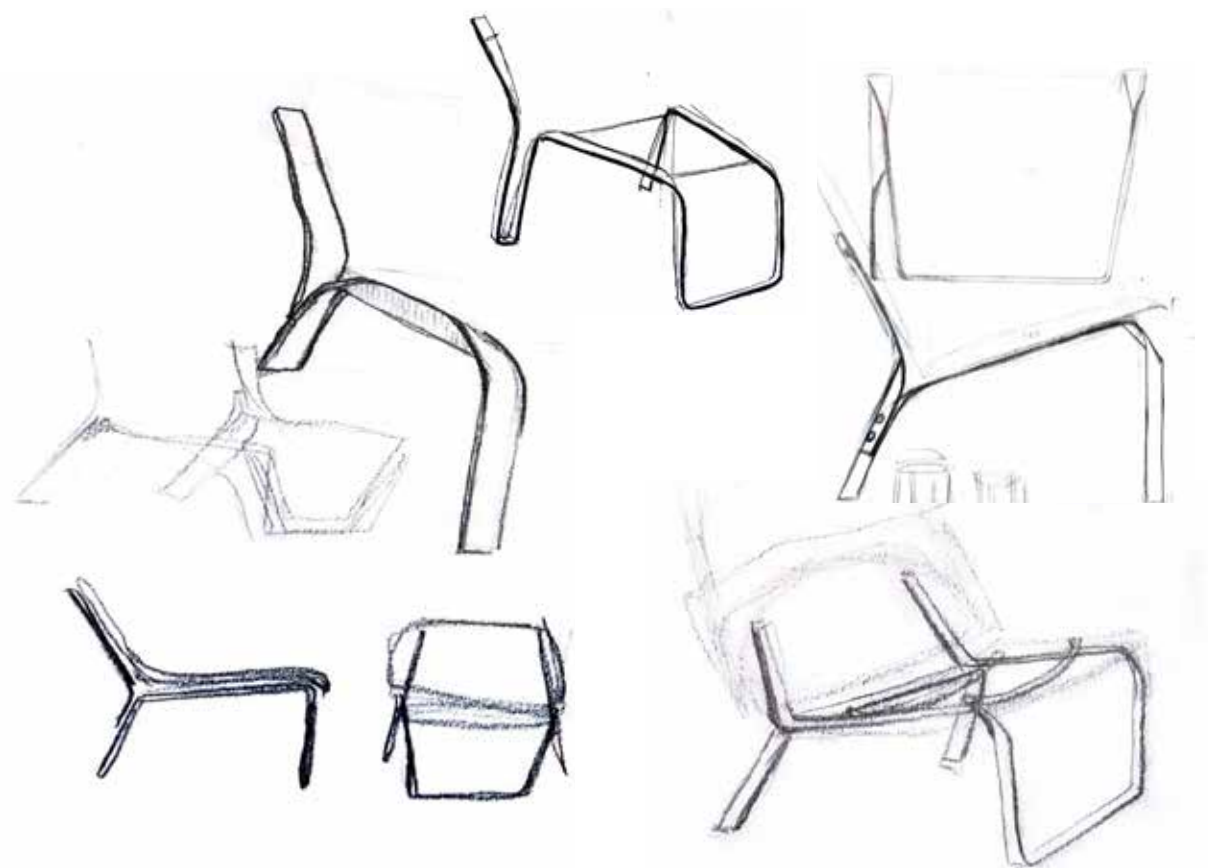
05

DESIGN PROCESS

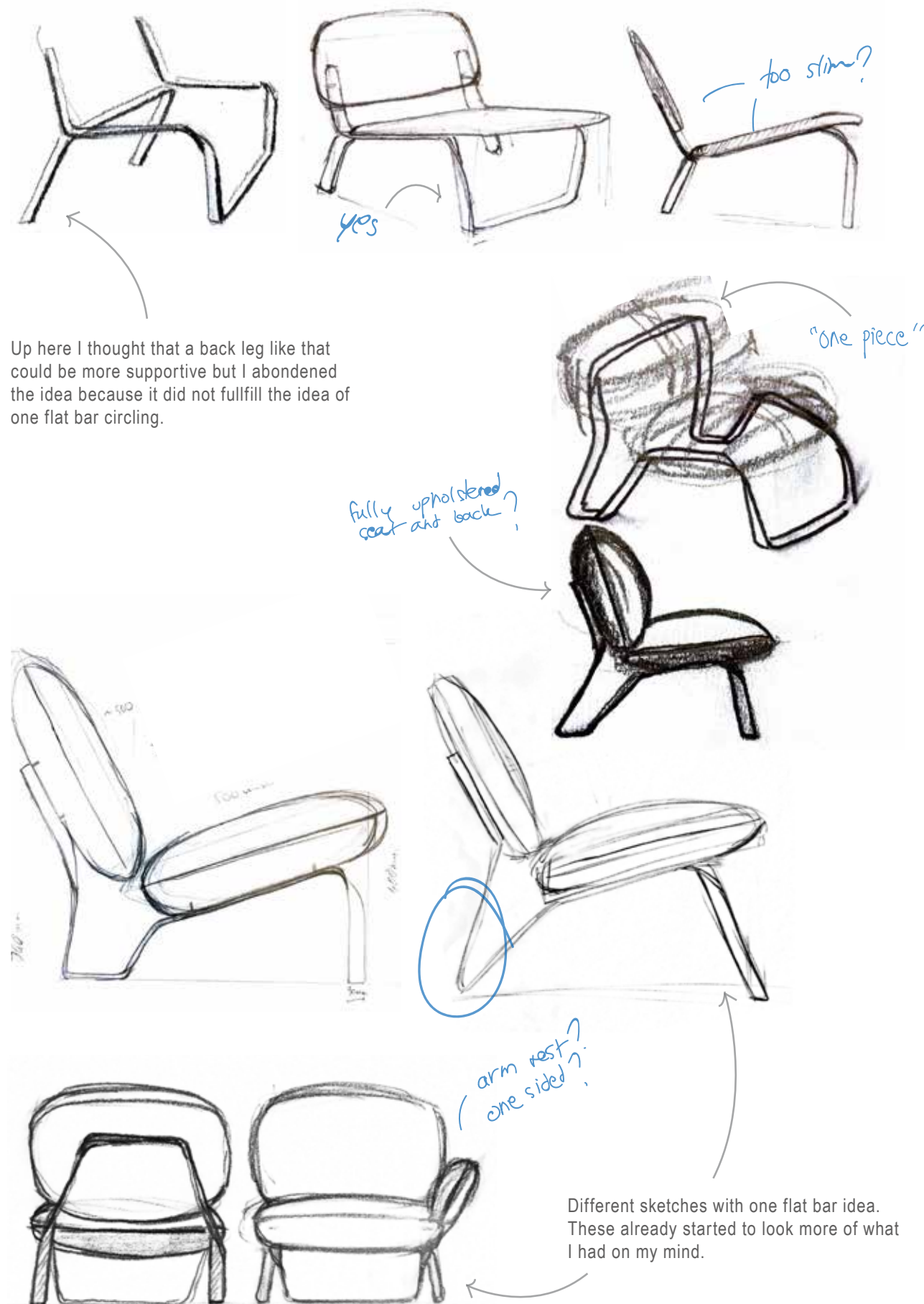
sketching /

As the leg structure was the thing in the first chair concept made in the campus course, I felt like I needed to start sketching how it would go. Things to consider were where the turns would happen and when the flat bar is in horizontal and when in upright position. Also, the stability of the frame was a concern. I had in mind that the back leg could be separate part (Box 1) but I abandoned that idea quickly as it broke too much the whole idea of the legs.

At this stage I did not have any clear idea of the lounge chair together with the seat and the backrest. I had no clue if it should be flat or fat. And the normal chair I hadn't even thought about. I felt like I had to first get something right with the lounge chair before I could move on to that.



Sketches of the legs and the twists.



Up here I thought that a back leg like that could be more supportive but I abandoned the idea because it did not fulfill the idea of one flat bar circling.

Different sketches with one flat bar idea. These already started to look more of what I had on my mind.

lounge chair leg structure /

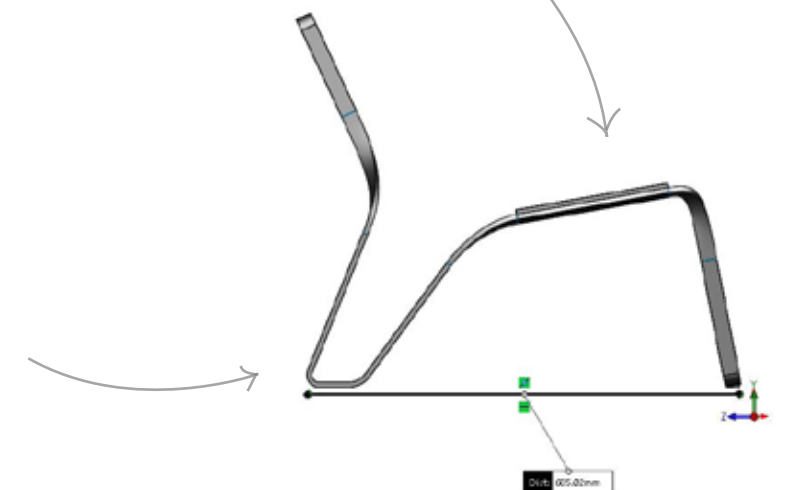
After going to the 3D modelling world with the leg structure of the lounge chair, it became more concrete thing compared to the pile of sketches. I ended up making the flat bar thinner. Also, first I started making rather wide lounge chair but as I wrote earlier I wanted it to be clearly just for one person so I made it to be 500 mm wide. Making it less wide, the proportions turned also much better. The angle in the first models was bit too exaggerated too which I corrected later. Otherwise it could be difficult to get up from it easily, especially for elderly people.



Here is the first 3D model of the lounge chair and how the leg structure could go. It is still too wide, and there are some weird angles. This worked as a base for the next versions though.



Here I have tried different versions of the leg – different angles and different ways to do the bag leg part. Some of the things I tried were not good at all. But by trying different ways, I could find the right angle for the front leg and bag leg part. This model stayed with me throughout the whole design process until I started adjusting it again.



chair sketching and 3D model /

The normal size chair started to come to some form after I had the structure for the lounge chair close to something it could be. I was trying to think different ways to keep the same idea of one flat bar without doing it in the same way as in the lounge chair. Also, I figured that having the flat bar in the front right under the shoes might be annoying, so it was obvious to make it go like skis.

The first version (version 1) where the bar bends under the seat looked silly so I straightened it to have more continuous look. I also played around with the back, thinking that it could work also as a handle. But in the end the version (version 3) where it's lowest looked most right. At this point I was quite happy with the proportions.



Version 1



Version 2



Version 3



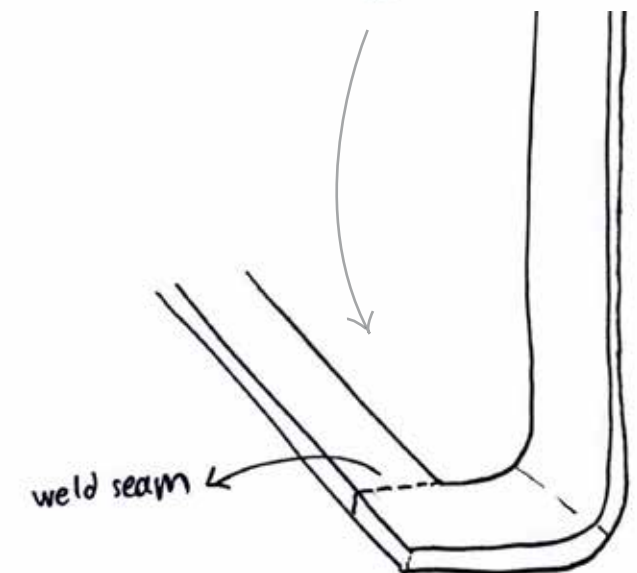
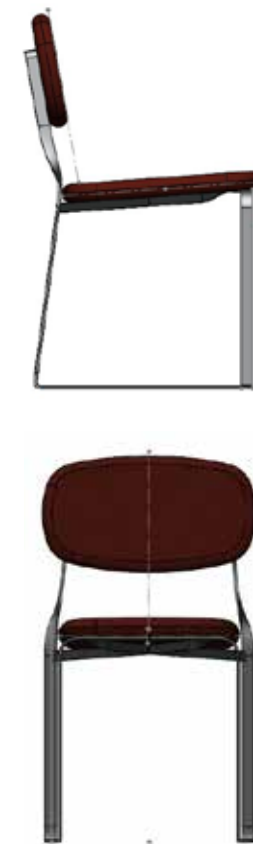
stacking chair /

Now I had to turn it to stackable version. It could be crucial feature to be able to stack the chair in the school environment or in general in public space environment. This means that because of the skis the back leg and ski part must be wider than the front leg part.

I tried a version where the ski part open ups more towards back and the back leg would make the twist lower in the leg. This version looked weird and I gave up of the idea that it should be made by bending or twisting. The transition can be made to be an illusion and in fact it is welded.



First version for stacking chair leg structure.



Second version for stacking chair leg structure.

mockups /

I made a 1:1 mockup from the normal chair over the Arena chair. That gave pretty good idea of the proportions and how the legs would go. I decided that it is not necessary to have two chairs, other one stacking and other one not. So, I chose to only continue the stackable chair further. With the mockup it was easy to try and adjust the seat and backrest. Based on the mockup, I made the backrest kind of overbig. I also made a scale model from the lounge chair. That made me realize that I needed to widen up the backrest too, to make the difference actually visible



1:5 scale models of the lounge chair.



1:1 mockup over a Arena chair. Different versions of the backrest and the normal chair leg and stacking chair leg.

seat and backrest /

For what I felt most challenging was the seat and backrest. I had really hard time to vision how it would look in reality. Hard materials are easier to imagine, but with something soft and organic I felt that I could not fully trust for what I was seeing on my mind. I sketched a lot of different shapes and tried to 3D model some of them. The thickness of the seats would affect to height of the leg structures, so I really had to make some decisions. As I got those forms right with the stacking chair mockup, that gave me a direction for the seat and backrest of the lounge chair. In the end the form became close to something I sketched very beginning.



Different 3D model versions of the seat and backrest cushions. Below the version closest to the final version.



upholstery details /

The seats still needed some personal touch, something for the upholstery. The first version is just a plain big area of fabric (picture 05/1). From behind the flat part sinks half way in to the cushion. The middle part will be a separate panel so the attachment can be hidden. For the front I tried making an illusion that the flat bar would do there something too, so it had two upright “retractions” sewed doing the same effect if there were buttons in the cushion (picture 05/2).

In the second version the cushions were cut horizontally (picture 05/3). That would allow to play with the fabrics and color combinations. I chose to continue with the cut version. That somehow gives a fresh or stronger look for it.



Picture 05/1 The backrest cushion plain version



Picture 05/2
The backrest cushion details, first version



Picture 05/3 The backrest cushion details, second version



The cushion details in the lounge chair. From the front the cushions are separate, and from the behind there is in the same line a seam. The flat bar sinks half of the width into the cushion and the middle part is a separate panel. The attachments are hidden under it.

final adjusting /

Trough out the whole process I've been adjusting the frames until very end. For the stacking chair I made the legs lean 2 degrees to possibly avoid wobbling of it. That also fit better with the backrest part and the twists of the flat bar there - it made the line more continuous. It still seemed to be concern that the legs looked like they would have been melted on the ground but in my opinion, that got fixed with the buttons under the flat.

I've been changing back and forth the leg structure of the lounge chair. I had to move the back legs more in so that the whole chair wouldn't be leaning on to them so much. After thinking that it's okay, I ended up changing it again, from flat to rounder or to more sharp bend. At last I made it go straighter and making some small adjusting. Even if the back legs and the front legs aren't exactly from the same world, it is fulfilling the idea of one flat bar circling around. It is interesting to realize that it went back for something I had been sketching in the very beginning.



Final version



First version



Sketch that I had done very beginning that in the end ended up be closest the final version.

materials /

Already very beginning I had decided that the frame and leg structure will be flat bar. During this process it got a lot narrower from the original chair concept. I would also want to go as thin as possible with the flat bar without risking the durability. In the normal chair the biggest concern is the weight. It quickly becomes rather heavy. The question is how thin it can be and still be strong enough?

When I started to think about more of the weight of the chair, I took away 5 mm from the width it being now 25 mm (earlier 30 mm) to make it lighter. I cannot take it too much away from the thickness, so that was obvious thing to do. I measured that the chair will need approximately 4 meters of flat bar. So, if the size is 25 mm x 5 mm, it would weight 3,92 kg (just the frame structure). If the thickness would be 4 mm it would weight 3,16 kg. (Terästarvike 2016)

25 mm x 4 mm weight 0,79 kg/m
25 mm x 5 mm weight 0,98 kg/m

With the lounge chair it is not so crucial how much it weights as is not meant to be moved around much. And if the weight is disturbing in the normal chair, especially if it's stackable, it can be considered from the angle that the weight makes it feel good quality – it won't feel too light and wobbly. The frame will be powder coat painted to black.

Aside from the steel, the upholstery fabric has been among one of the hardest choices that I spent way too much wondering about. Something relax, something that doesn't show dirt, something that fits to the location, something that matches to the sofa of Teemu Haranko, and first of all, something that I feel that belongs to that chair. Also, the type of the fabric should be suitable to the shapes of the cushions.

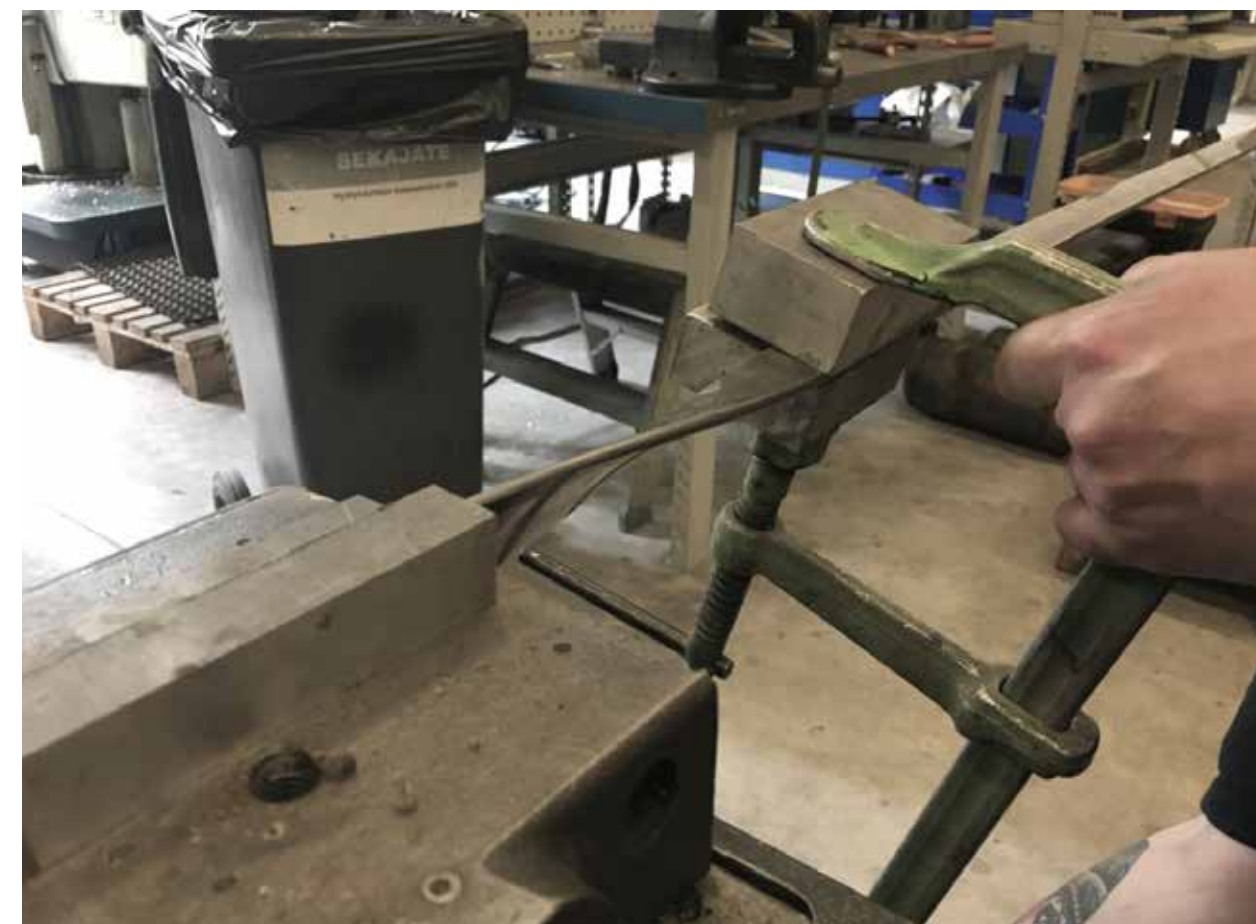


prototyping & testing /

The prototypes of the leg structure will be made in Koskelo, where is Metropolia's proto-workshop, with the help of Toni Grönmark. We started testing of the twists and bends. At least the 5 mm thick flat bar twisted quite nicely without any problems. But there were some concerns: the backrest part where it bends back before the twist might be too weak. It is definitely the weakest point and the flat bar is kind of the wrong way round in that spot. That can be tested better when the prototype is ready.



Picture 05/4 The front leg part for the stacking chair



Picture 05/5 Making the twists for a flat bar with measurements 25 x 5 mm

06

FINAL PRODUCT FAMILY

final models /



stacking chair /



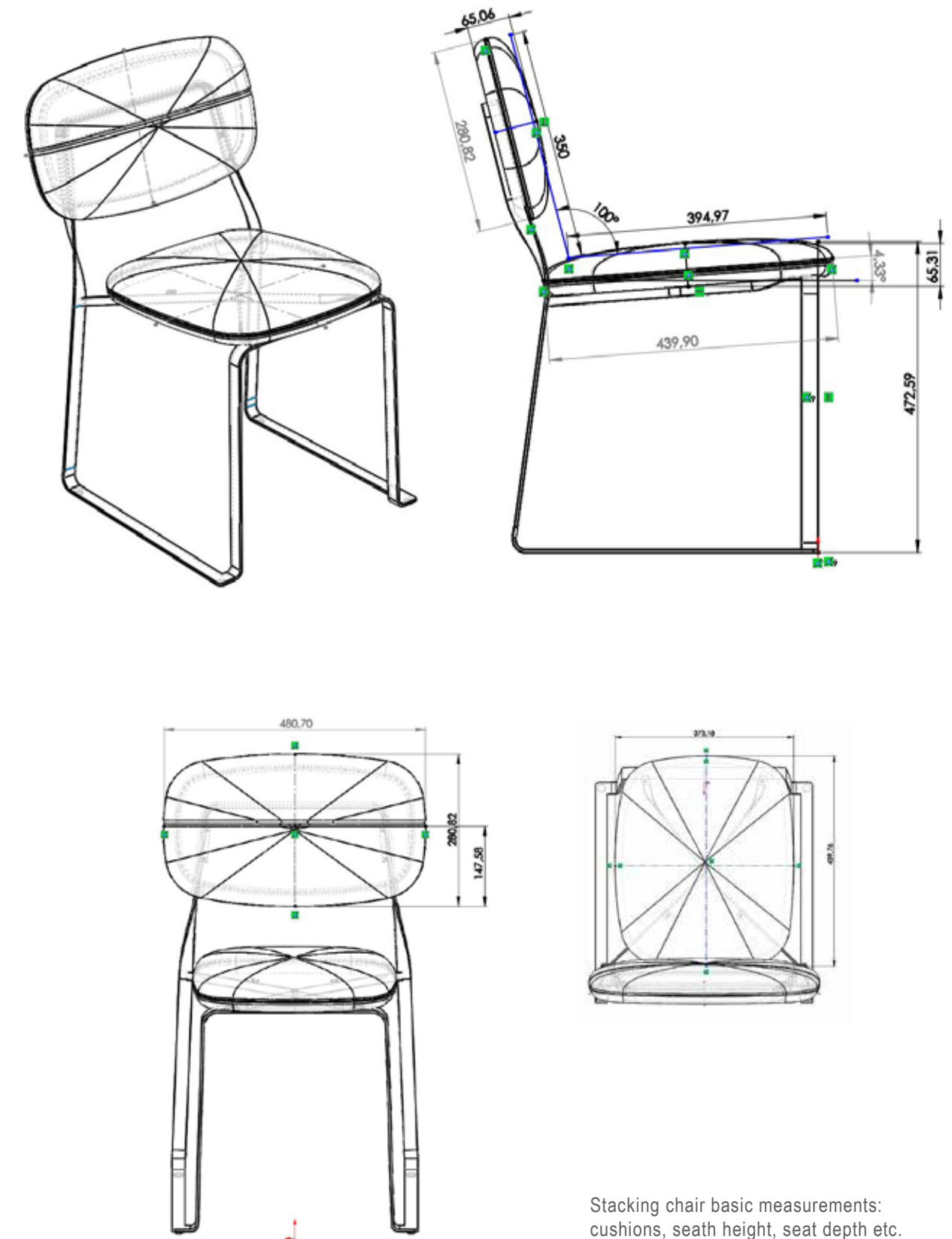
stacking chair 2D drawings and parts /

The backrest of the chair has a hidden attachment. The middle part is a separate panel which will be attached very last hiding all the screws (picture 06/1). The cushions are quite full, overall thickness is around 65 mm.

The cushions are made of two panels that have the filling on them and they are attached to each others. It will make a clear joint between the two halves. In this way the fabric can be mostly stapled which will make the manufacturing cheaper.



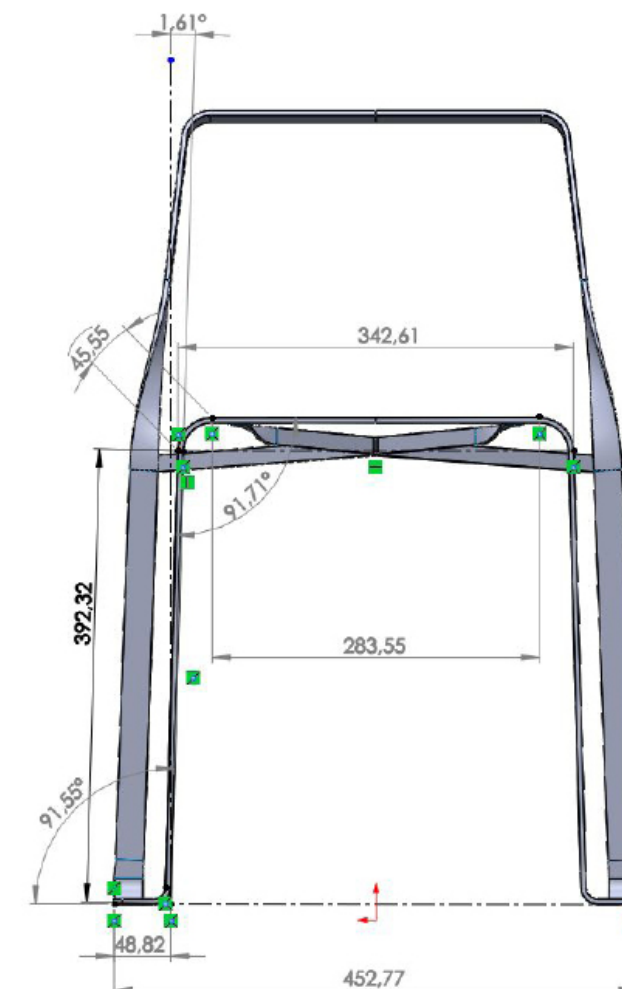
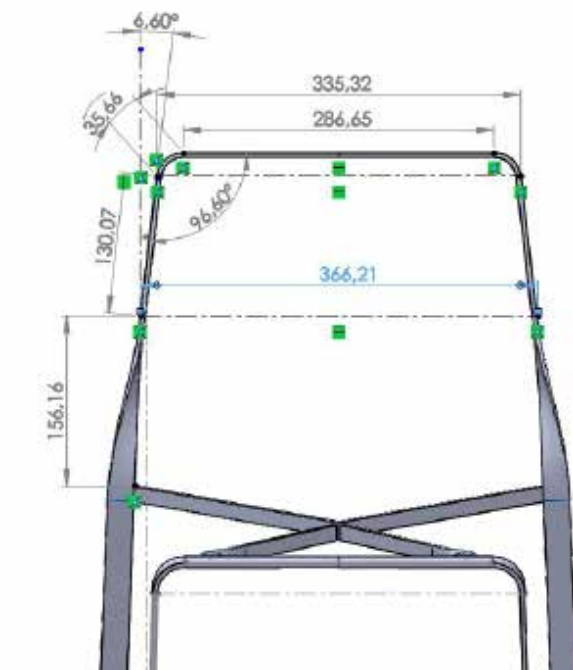
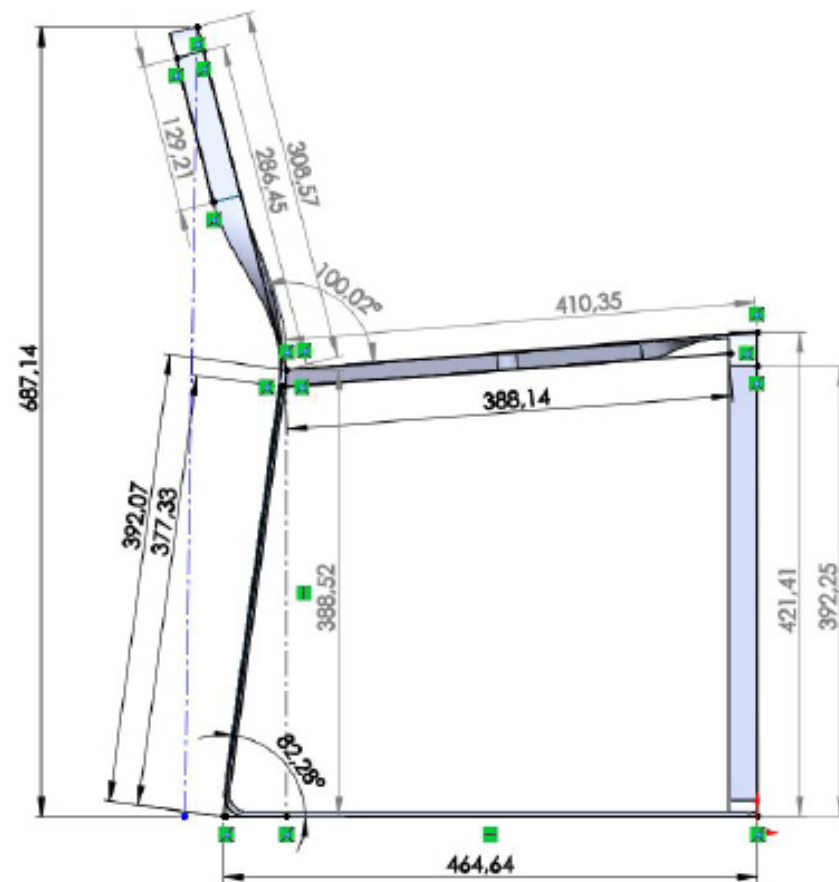
Picture 06/1 Backrest attachment is hidden behind a separate panel



Stacking chair basic measurements:
cushions, seath height, seat depth etc.

dimensions for prototyping stacking chair /

These are the detailed measurements of the leg structure for helping to make the prototype. The leg structure is made out of 25 x 5 mm steel flat bar, and it will need about 4 meters of it for one chair.



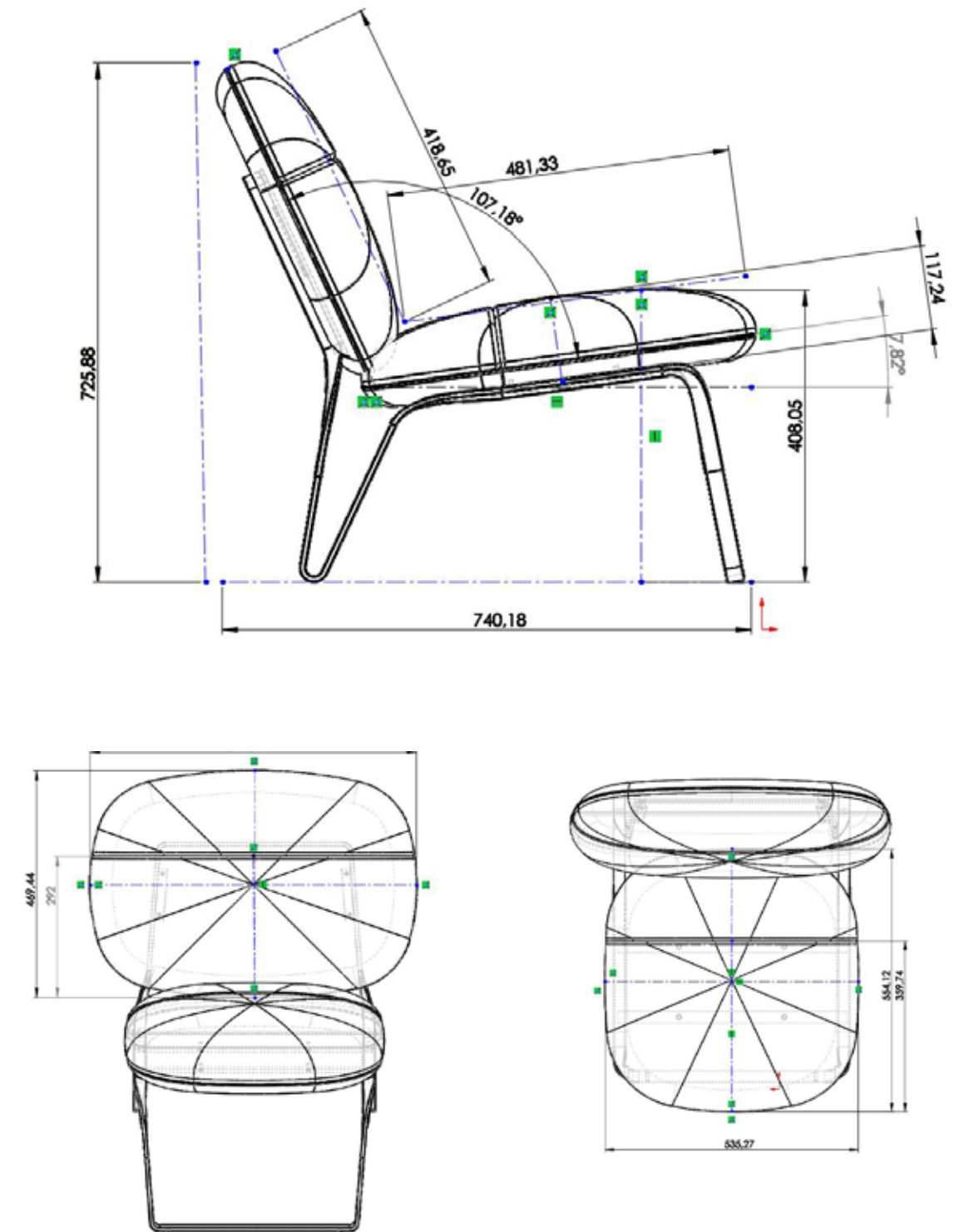
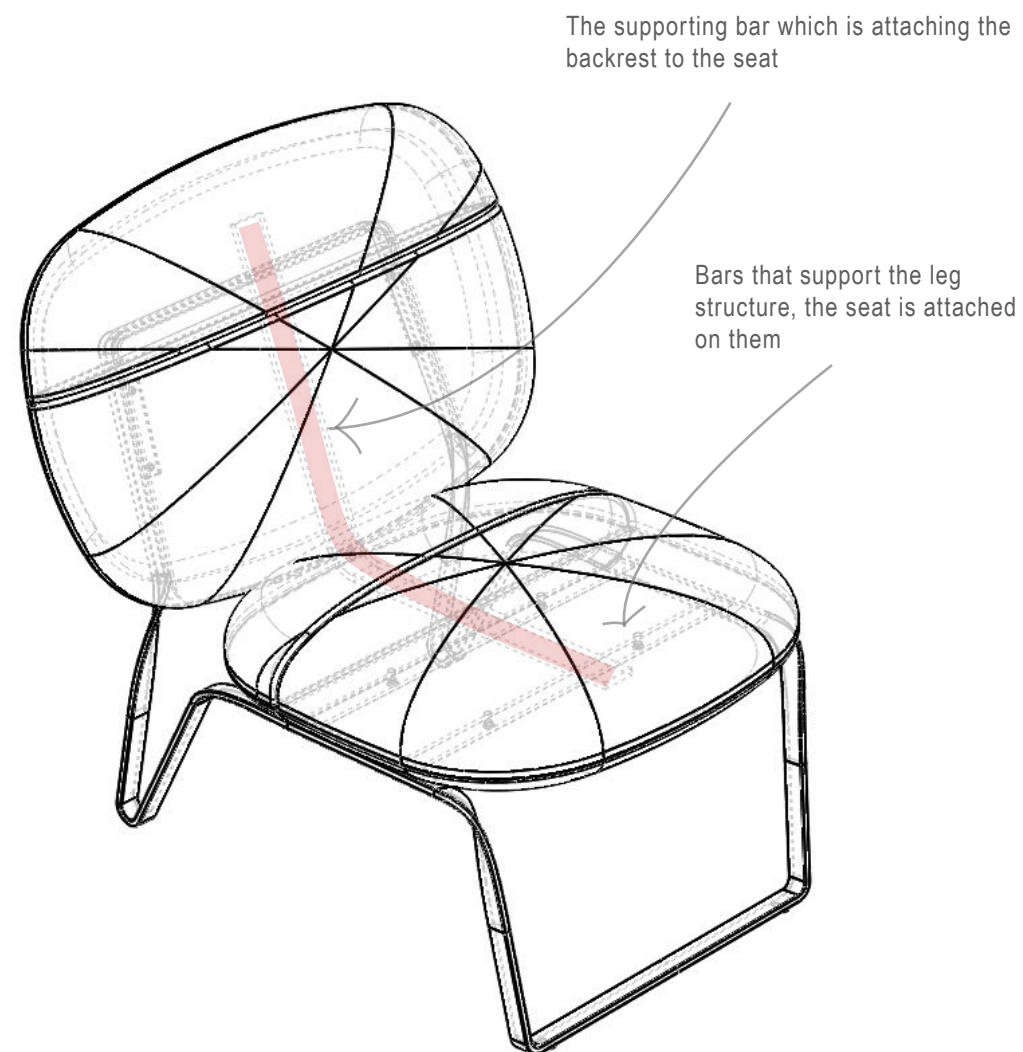
lounge chair /



lounge chair 2D drawings and parts /

The structure of the lounge chair is equal to the stacking chair. Only the seat cushion and the backrest cushion are attached to each other with a steel bar going inside. That will strengthen the back leg part where the stress is highest.

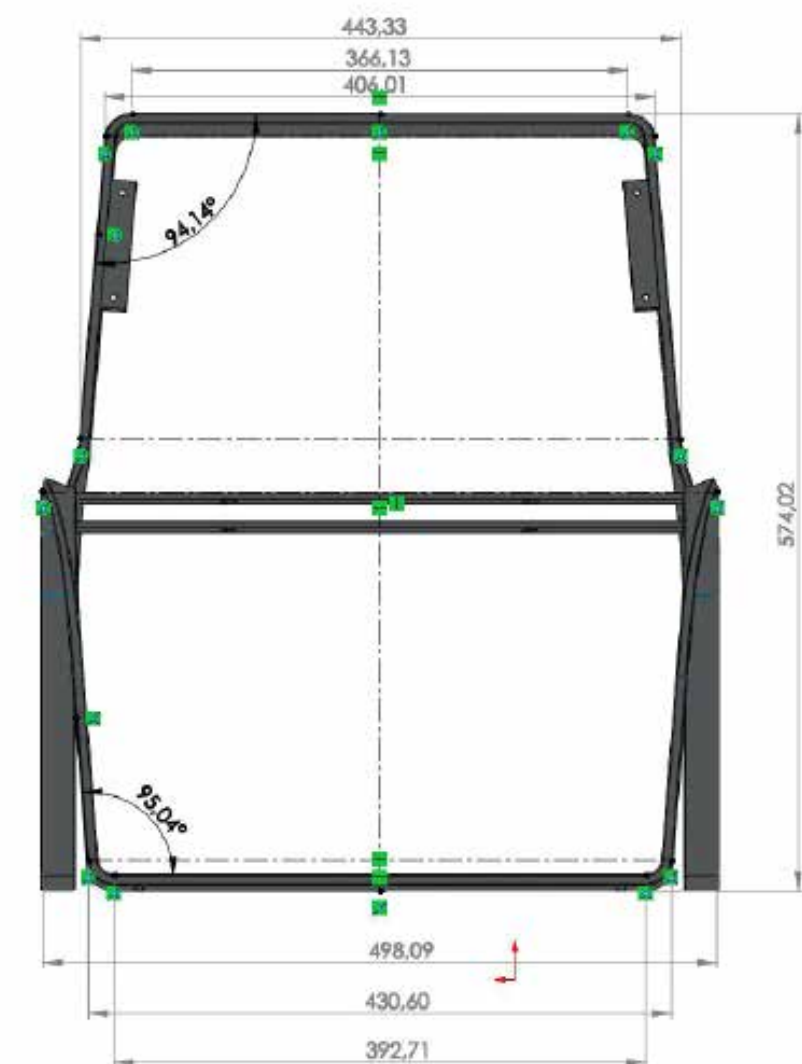
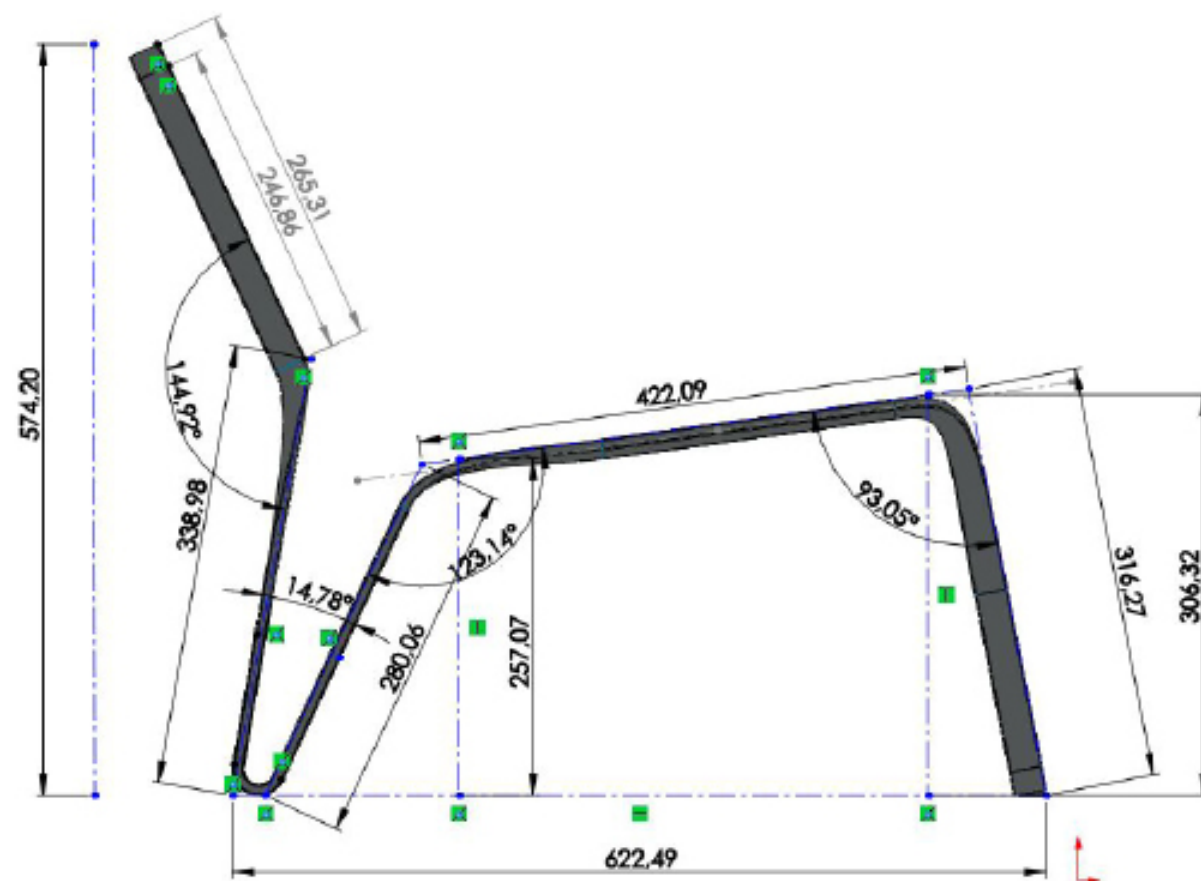
The cushions are made of two veneer panels that have the filling on them and they are attached to each others. It will make a clear joint between the two halves. In this way the fabric can be mostly stapled which will make the manufacturing cheaper.



Lounge chair basic measurements:
cushions, seath height, seat depth etc.

dimensios for prototyping lounge chair /

These are the detailed measurements of the leg structure for helping to make the prototype. The leg structure is made out of flat bar dimensions 25 x 8 mm. And one chair will use about 4 meters of the steel falt bar.



in the location /



The lounge chair in the main lobby of Arabia campus.

conclusions /

Overall, I think the whole project went good. I am happy that I could design two chairs inside the topic of Chair family for Metropolis Arabia campus. Even though the topic was a chair family, I failed to make a concept of a full family. Now the family includes a lounge chair and a stacking chair. But I think even these two chairs do accomplish the idea of a family. They are clearly from the same world, even though the leg part is not exactly same in both. The seat and the backrest are speaking the same language even though they are different size. Materials and the details are the things that will tie these two chairs together.

The scheduling of the project was a biggest failure. Not just my own scheduling skills, but also realizing that buying subcontracting doesn't happen in the next day. It took time to get materials for the prototypes and making the upholstery got scheduled way after the deadline of the thesis. There is also a lot to blame myself, as I was too long stuck in certain points. It would have been most useful if I would have been able to start the prototype earlier. Now I had time to start it, which only raised more questions about the durability. I also had some setbacks, for example 1:5 scale 3D prints that got ruined in the printer. There was also plenty of moments when I questioned my own skills and my decision to be in this industry.

In general, I learned a lot of furniture design process. The hardest thing was to try to imagine the soft parts. It is easier to vision how hard materials form when working on them. The fillings and upholsteries are more outside of my own comfort zone. I am anyway very happy how the soft parts came and I am really looking forward seeing the real versions in the prototypes.

I think the chairs are playful and not too formal. I think they fit to the design drivers I set for myself earlier. And it's easy to change the colors and materials to fit any location. Now I am just waiting to be able to test the actual chairs so that I can really say what succeeded well and what failed.

further
development /

For further development I am sure the chairs would change a bit from what they are now. There should be made version with armrest for both chair and maybe continue the family also with a bar stool. The leg structure is most likely easier to manufacture in industrial way rather than as a handwork. That will allow the manufacturing to be faster and also more exact.

references /

Arabia
www.arabia.fi/arabiasta/arabian-historia 2018

Frantsi Sofia
Metropolia-ikkuna, opinnäytetyö, 2016

Jean Nouvel Design
Milana chair https://jeannouveldesign.fr/en/produit/milana/ 2018

Kuluttajavirasto
Turvalliset huonekalut www.tukes.fi/Tiedostot/Tuoteturva/Kulutta-
javirasto/Turvalliset%20huonekalut.pdf 2015

Metropolia
www.metropolia.fi/tietoa-metropoliasta/kampukset/arabia 2017

Piironen
www.piironen.com 2018

SIT 72-610075
Kalusteiden teräsrakenteet 2010

Terästarvike
Teräsluettelo 2016: www.terastarvike.fi/tuotteet/

Tuke
www.tukes.fi/fi/Toimialat/Kuluttajaturvallisuus/Kulutustavarat/Ta-
varoiden-turvallisuusvaatimuksia/Huonekalut/ 2015

Varma
www.arabia135.fi/historia 2017

Photos 1-9
www.howe.com
www.knoll.com
www.piironen.com
www.fritzhansen.com
www.jeannouveldesign.fr
www.hivemodern.com
www.domusweb.it
www.rolf-benz.com
www.dn.no

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