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DPB100: First Bachelor Project

Future Histories

FINAL REPORT

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Introduction

Our prediction for the future consists of two parts: more people will be living in smaller spaces, and people will want to live their life in luxury. We think a lot of space in our current homes is lost because there are so many rooms. We want to condense the functions of all rooms (kitchen, bedroom, bathroom etc.) into one, that morphs to fit your exact needs at different times during the day.

The challenges we face in our design include breaking conventions surrounding some everyday appliances and optimizing surface usage while safeguarding comfort and ease of use.

Project Goal

The general goal we all want to achieve is to fully go through three different iterations. This is our First Bachelor Project and the name says it all, “first”. With this project we wish to find the way a design process works during such a period of time with those different iterations. The knowledge gained during the courses ‘From Idea to Design’ in Quartile 1 and ‘User-Centred Design’ in Quartile 2 are put to good use here.

Pre-iteration 1

Pressure cooker

In the first week of the project we used a quick project technique called “Pressure Cooker” in which we had to go through an entire iteration within one week. At first we made a mindmap on all of the different future scenarios we could possibly think of (see figure 1). Then we categorized some of the most interesting ones by when we thought they could take place on a timeline from now to thousands of years in the future (see figure 2).

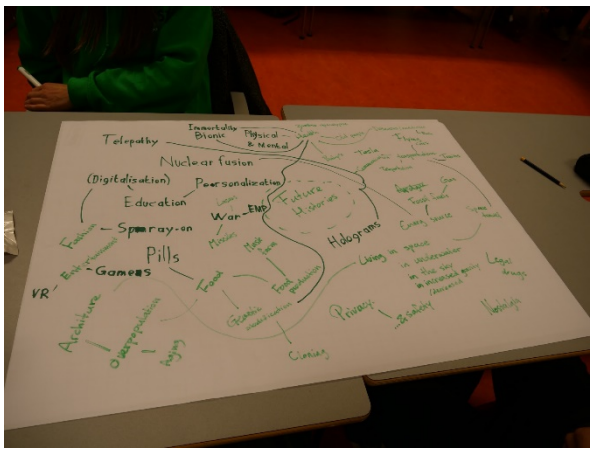


Figure 1: Mindmap on scenarios

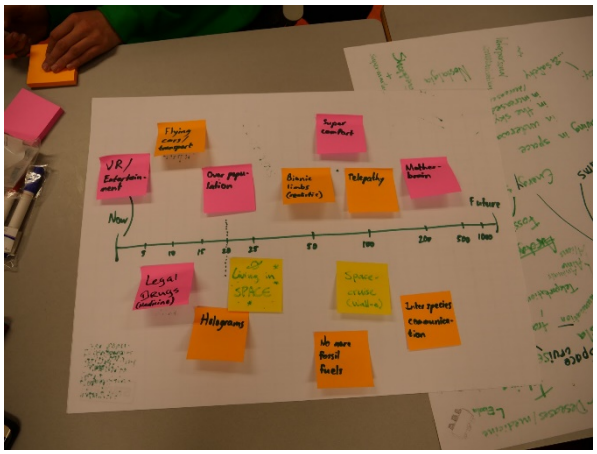


Figure 2: Interesting scenarios on timeline

Some of our scenarios included: no more fossil fuel, living in space, holograms, and bionics (full list in appendix 1).

The scenario Super Comfort eventually seemed the most interesting and very believable to us since design and innovation are inherently focussed on making life easier and more comfortable for people.

Iteration 1

Ideation

After we had done the pressure cooker in the first week, we decided that the future scenario of Super comfort was something we could build further on. To ease upon this idea for ourselves but also others, we created our own design case.

Design case: Super comfort

Everybody knows technology is rising rapidly. One could state, in mathematical terms, it is rising exponentially. People have become quite dependent on their electronic appliances. We have replaced the newspaper by the TV or mobile phone. Pen and paper turned into laptops and there are many more examples. But what about the value of these changes? What do these pieces of technology bring to the world? The answer is simple, technology makes life easier. In other words, life is more comfortable with technology. In present time, cars are becoming autonomous. Voice controlled systems are able to provide the user with all kinds of information such as Siri and Alexa. All sorts of sensors are applied into everyday objects like doors with motion sensors, heartbeat sensors in watches and touch screens at McDonalds for 'Easy Order'. And so there are many more technological advances that make life easier. The question that arises is what will happen next? What will technology bring? What happens when comfortability takes over? Can comfortability get out of control? For this First Bachelor Project, the idea of 'super comfort' is investigated. What sort of future products could we expect? Will these products change society as we know it? What will people think about such a product and/or the idea of super comfort itself? What will happen if super comfort is achieved?

We ideated again on the different problems Super comfort brought with it, and what we could do to prevent or fix those. These are some of the problems but also advantages our scenario would have.

Problems in Super comfort future

- Laziness / Everyone in bad shape
- No more physical jobs
- Extreme consumer society
- Extreme boredom
- Overpopulation
- Dependency on technology

Advantages in Super comfort future

- Different priorities
- Faster technological progression
- More room for sports and hobbies
- More knowledge readily available

We did a brainstorm of all kinds of possible solutions to these problems and wrote them all down in a list (see *appendix 2*). Then we placed them on a Valuable/Realizable map to see which ones were important and still do-able (see *figure 3*).

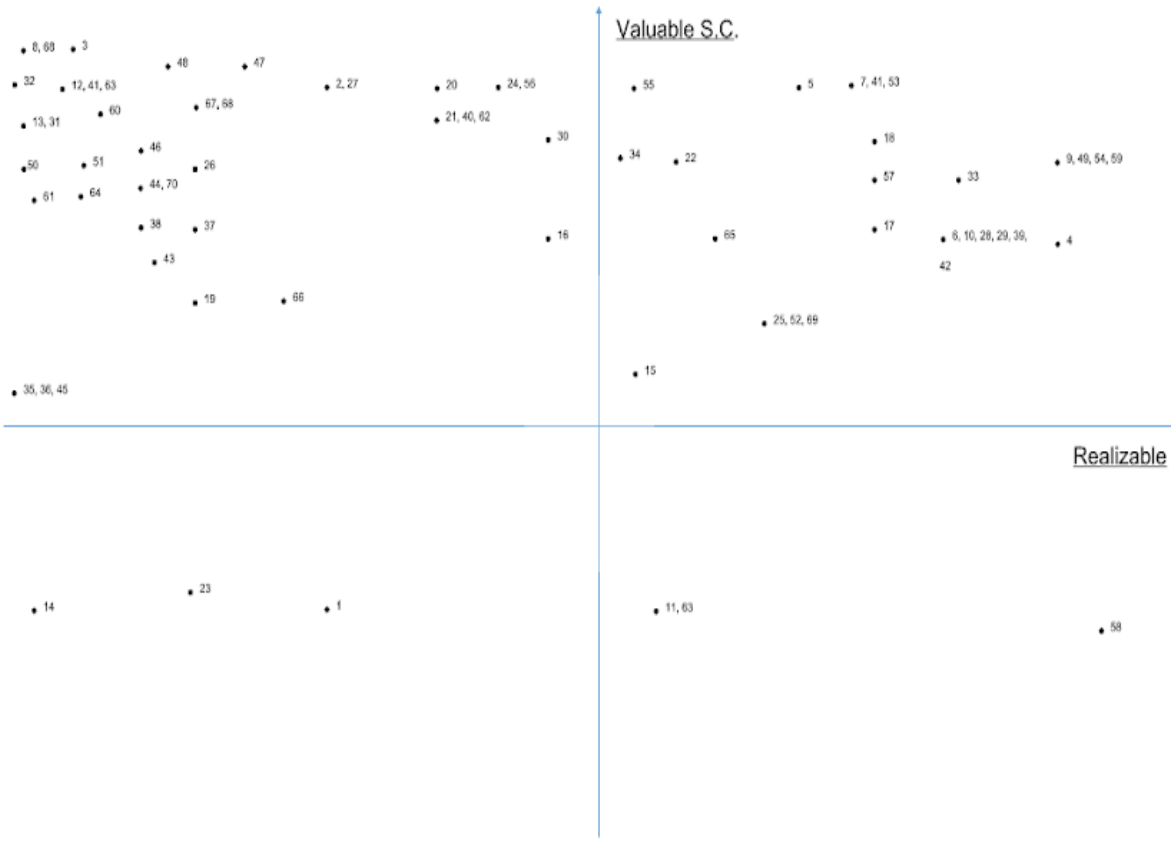


Figure 3: Valuable/Realizable map of around 70 solutions to Super comfort problems

As a result of this, we had a few good ideas in the upper right corner, which were both valuable in a Super comfort context and realizable for us.

Best ideas:
9, 49, 54, 59: Automated all in one wall
7, 41, 53: Personal assistant (robot)
18: Windowless cars
33: Underground flats
6, 10, 28, 29, 39: Holograms
57: Mobile workspace

With these ideas we did a QOC analysis to see which one would fit our values and our project the best.

Criteria:

1. Realizable (to research within our team)
2. Realizable (to implement in the context of future technologies)
3. Value for society
4. Value for Super comfort
5. Safety
6. Health / Physical condition
7. Availability

Weight of values: 1-3 (higher is more important)
Scale: 1-5 (higher is better suited)

QOC 1 - 5	Realizable (our team) 3	Realizable (future technologies) 2	Value for society 3	Value for Super comfort 1	Safety 2	Health /physical condition 2	Availability/ affordable 1	**Total**
All in one wall	5	4	4	5	5	4	3	55
Personal assistant	3	4	4	5	3	5	2	52
Windowless cars	4	4	3	2	5	4	2	51
Underground flats	4	3	4	4	1	3	3	45
Holograms	2	3	4	2	4	4	2	44
Mobile work	4	4	4	1	4	4	4	53

The automated all in one wall turned out to be the highest ranked to our values. We then all wrote a scenario for this case (see *appendix 3*).

Realization

Right after the concept was created, we started to make 3D sketches with the use of Google SketchUp. We figured that a room of about 24 m2 would be a suitable size as a lot of student rooms are in the size range of 15 to 30 m2. 24 m2 was picked because this allowed the room to be divided into two equal parts easily as they would be 4x3m each. The transformative room then needed to have space for all collapsible furniture so three extra rooms of 1.2x3 were added in. The height of the rooms was set to 3 meters so that there would be extra space for cabinets as well.

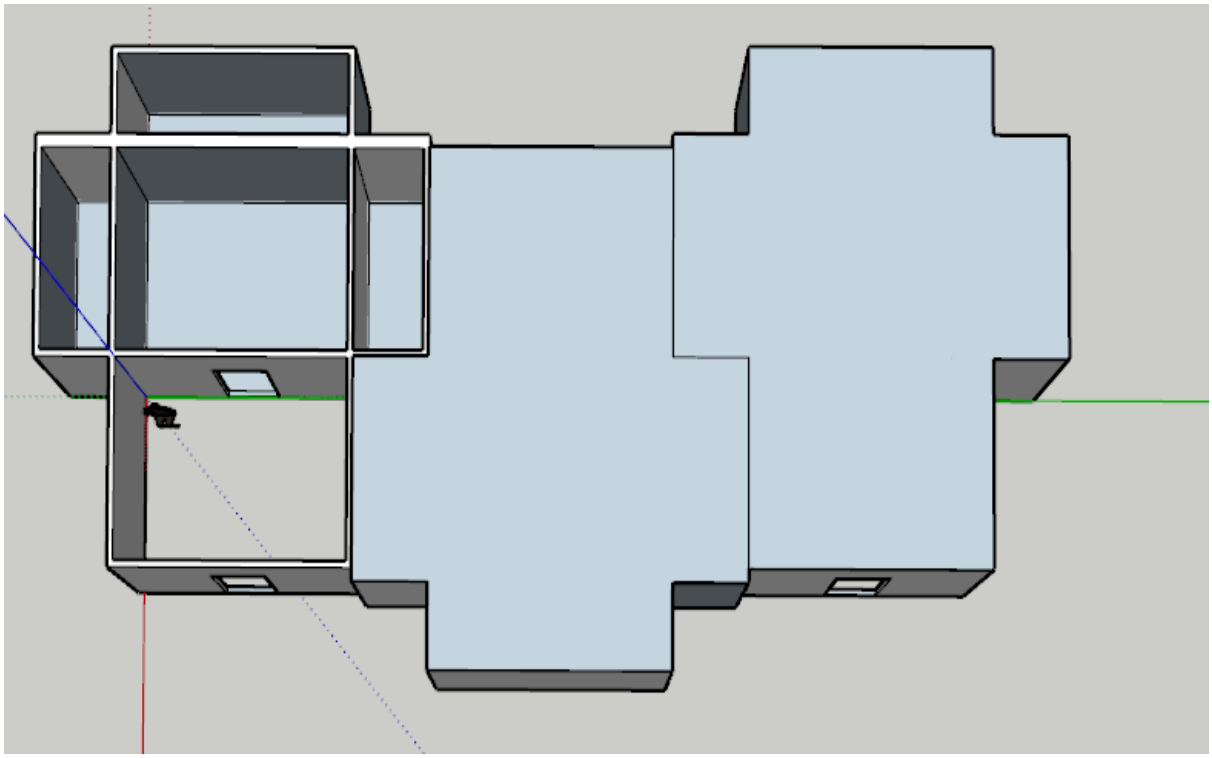


Figure 4: Top view of the first, preliminary 3D sketch

As can be seen in figure 4, three rooms were placed next to one another. Obviously, this pattern of housing looks fairly odd. In order to change this, Dayne made another sketch wherein the three extra spaces were left out (see figure 5).

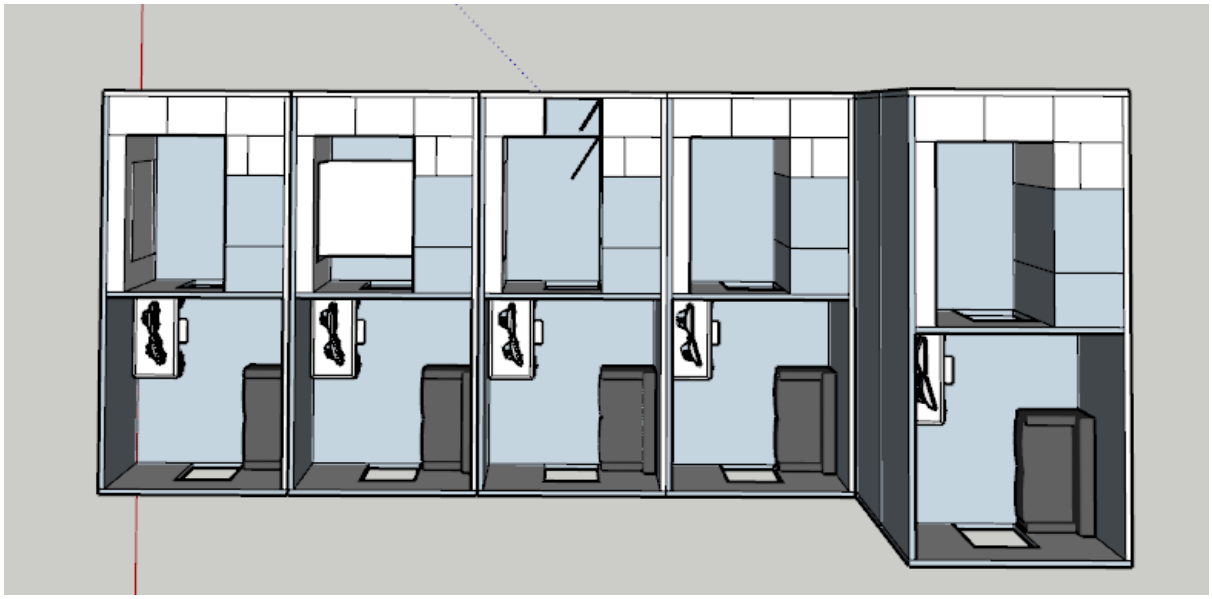


Figure 5: Top view of the second 3D sketch

From the picture it can be derived that we changed the layout of the rooms quite a bit. First of all, one notices that the rooms are smaller. In fact they are cut to the size of 3 metres in width instead of 4. The length however increased to 7 metres. Besides altering the sizes of the rooms. they also contain more detail. From this top view, the concept is visualised better as one can see where all the furniture is placed. As an extra, there are also a desk and couch added in to give a better impression of the size. Figure 6, the front view shows the rooms even better.

Figure 6: another view of the second 3D sketch

The most left room, shows the transformative space when everything is folded in. The second room shows the bed being collapsed. The third room shows the shower and toilet in the two corners. In the middle, one should imagine a bathroom sink. In the last and fourth room, the kitchen can be seen with the stove in the middle and the fridge in the corner.

From these last sketches, we started our realization. Firstly we made the three rooms as a sort of lay out of what it could look like. This can be seen below.

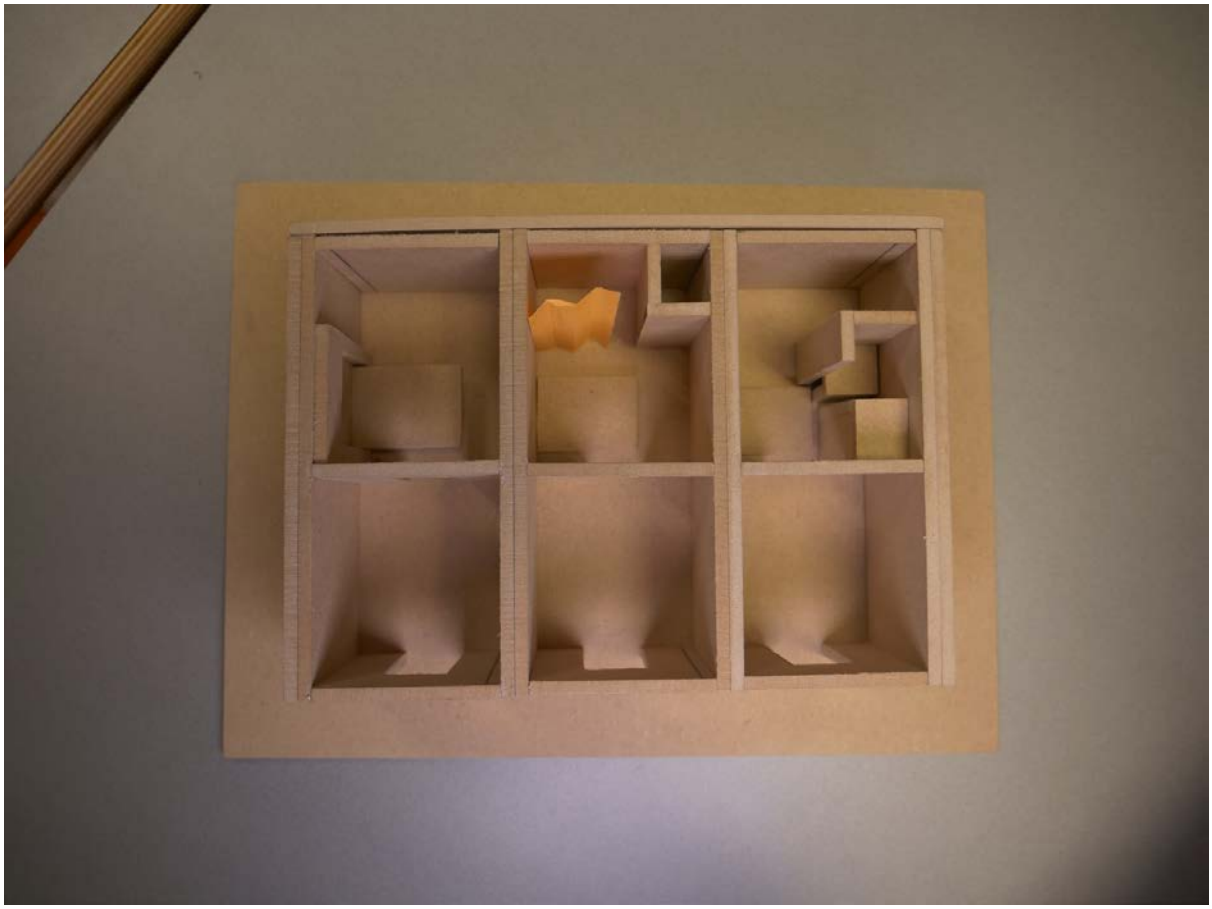


Figure 7: small prototype, top view

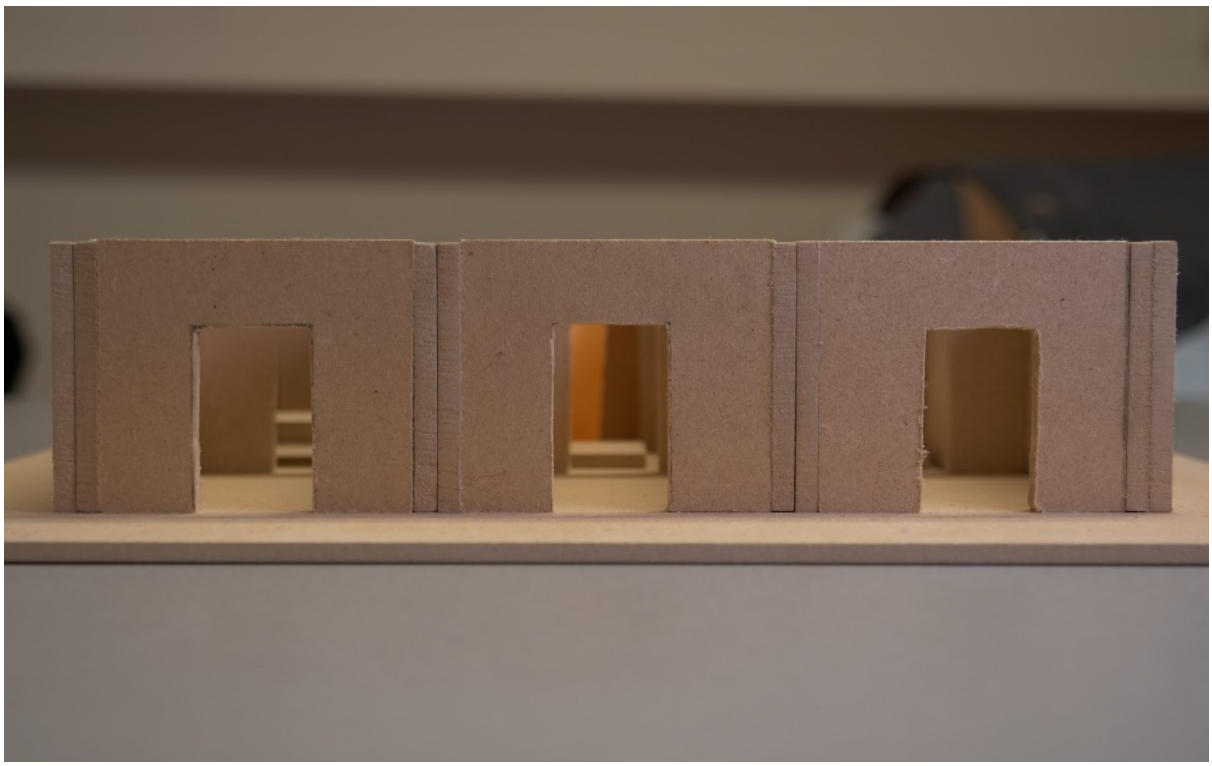


Figure 8: small prototype, front view

Figure 9: small prototype, ¾ view

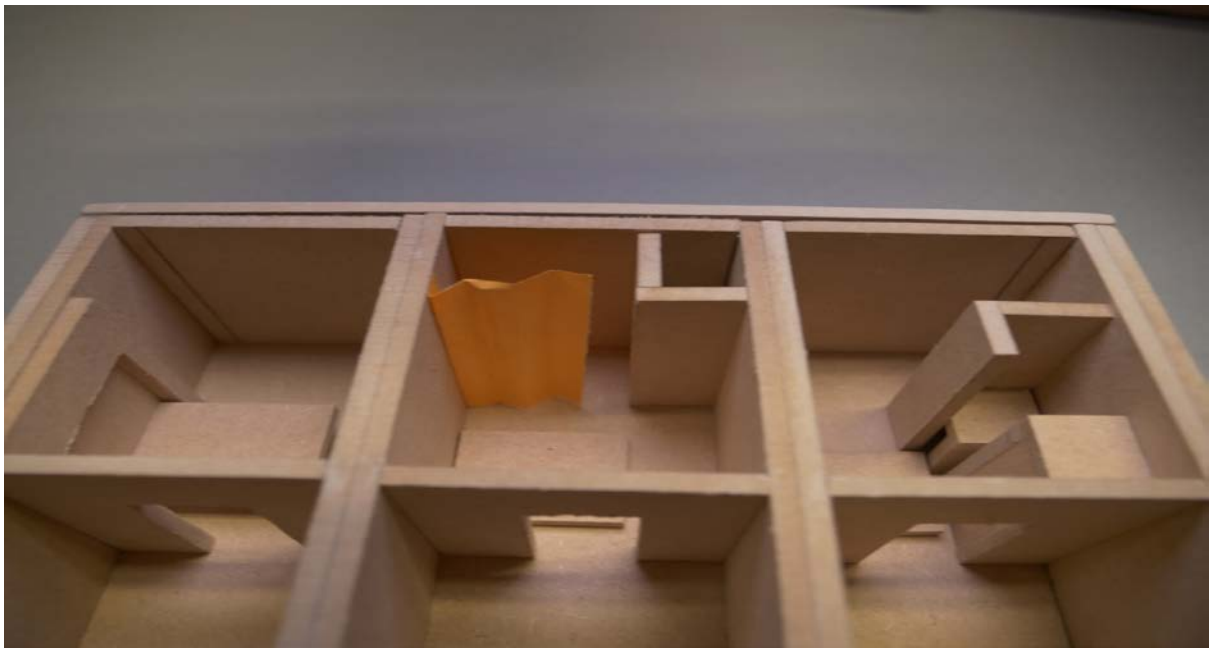


Figure 10: small prototype, transformative rooms with simplified bed, bathroom and kitchen

From this basic lay out, we made a prototype of the transformative room. We scaled this one up to a size of 0.27x0.315x0.27 meters (scale ≈ 1:11). To visualize this, we made a person on scale as well. The prototype can be seen in the pictures below (See appendix 5 for more):

Figure 11: complete prototype

Figure 12: bed, bathroom and kitchen

Figure 13: bed and bath (collapsed)

Figure 14: human figure for scale

Figure 15: bathroom

Figure 16: kitchen

Validation

To validate our concept, we held a few interviews with our target group: commuters and students. We formulated the questions (see *appendix 4*) and then performed the interviews. From the interview with a student we learned that light, space and the color white are closely associated with feeling comfortable. Things like a bathtub, dishwasher, and washing machine are considered luxury. For a room of 20m^2 students would pay about 450 euro a month.

From the paper Designing High-Density Cities: For Social and Environmental Sustainability[1] we concluded that other than light, factors like air, noise and waste are also very important in building a high density environment.

During the mid-term demo day we got a lot of useful feedback. For instance that we should be aware and cautious of the pipeline, the humidity and the electricity if we were building one room that fits all purposes. Things like cooking and showering in the same room could cause trouble if handled poorly.

We, again, got feedback on the amount of light that could come into the apartment and from where. The insulation of the house was also something that needs to be addressed.

But one of the most important things that we should focus on is the architectural structure of the entire building (the way the houses are stacked together). This is what we decided to do in our second iteration.

Iteration 2

Ideation

In this iteration we focus on the entire building made up of multiple small houses, since this should also be as compact as possible, but still structurally sound.

Shortly after the mid-term demo day we brainstormed on the feedback we had gotten. One of the things that caught our attention was the Autostadt Car Towers[2] (see figures 16 and 17). Cars are parked against the outer walls of the garage, and in the middle there is room for them to be transported up and down. We tried to do the same thing with our small houses. We figured that if you could place them in and out of the building very easily, moving would become as simple as parking your car somewhere else.

Figure 17 and 18: Autostadt Car Towers

We looked into the dimensions of shipping containers[3], to see if those could be used as the outsides of our houses. Container houses have a bright future as smart-homes since they are mobile, affordable and energy efficient[4]. For the circular flat we looked into more compact containers (with an area of only 13.9m2), but they turned out to be quite small to separate into two rooms.

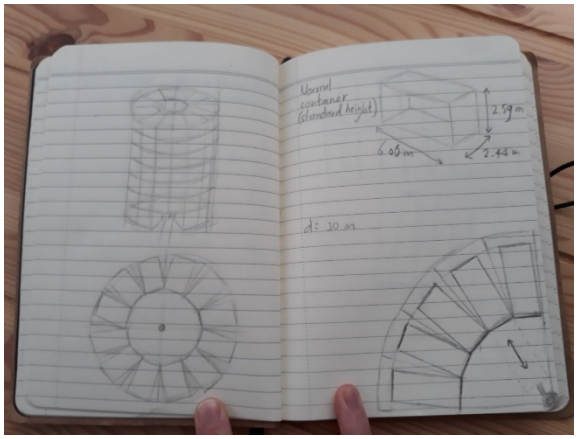


Figure 19: sketches of circular flat

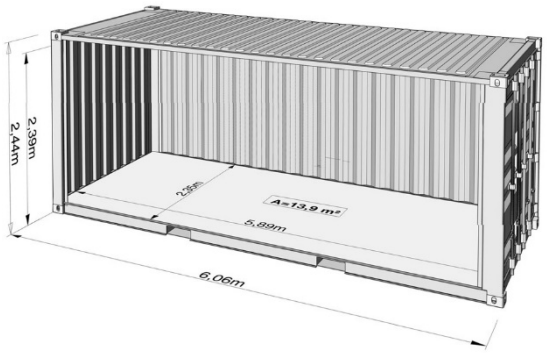


Figure 20: dimensions of a small container

We made a few paper prototypes to see how it would look and to get a better idea of the shape.

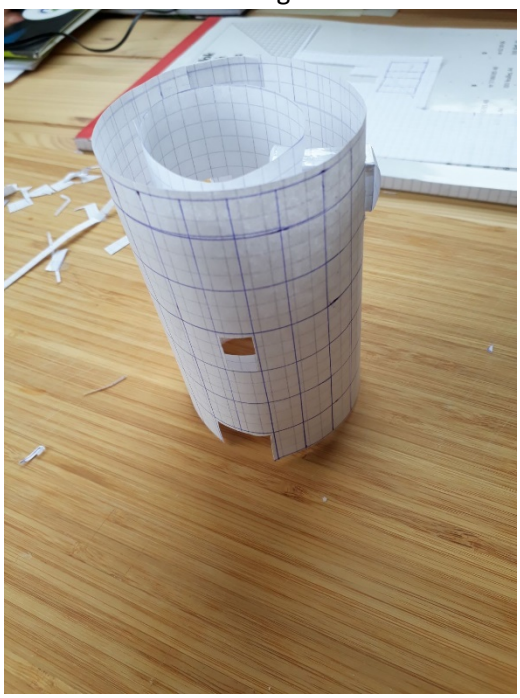


Figure 21 and 22: paper prototype of what the circular flat would look like

However, though a nice look, a round flat with containers only on the outside ring would not be very space-efficient. Eventually we contemplated ways to make the flat in its normal rectangular shape, while still keeping the idea of being able to move the individual houses.

Realization

In the second realization phase we expanded on what was done in the ideation. We decided to look into the different ways container homes are stacked currently. Some were very artistic, but not space efficient such as Container city (see Figure 23).

Others were more efficiently stacked, but not interesting to look at. These were mainly built for fitting as many houses into very little space. Keetwonen (see Figure 24) is a good example of that.

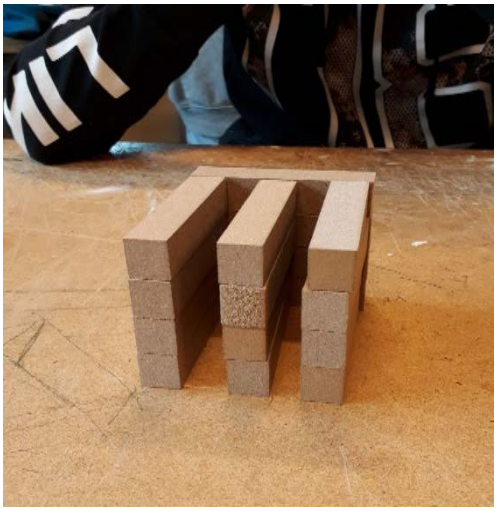
Figure 23: Container city

Figure 24: Keetwonen

Next we each drew a few sketches of possible ways to stack the containers (*see Appendix 6*).

We also cut out small wooden blocks in the proportions of containers (scale 1:150) and brainstormed on how to stack them the best by trying out different positions. All ways of stacking the containers we came up with can be seen in *Appendix 7*.

From this point on we decided to combine the validation and realization phases since we would have to first evaluate our different ways of stacking the containers before we built the final flat scale model. Accordingly, more about the validation process of this model will be in the next chapter.



For now we will simply show the flat that would turn out to be the final preferred shape and the process of building the scale model.

Starting with the raw shape of the model (see Figure 25 below) we figured the best way to enter the building would be through a central staircase leading into hallways, which would be the backrow of the flat. The front three rows would be the individual apartments. Two elevators were also added on each end of the hallway.

To give the model a more natural look, we put it in an environment with a street, driveway and some people. Then we painted the model different colors per container, to accentuate the idea that they are individual, separate apartments that are combined in one building.

Then we added balconies made from the doors of the containers and a floorplate.

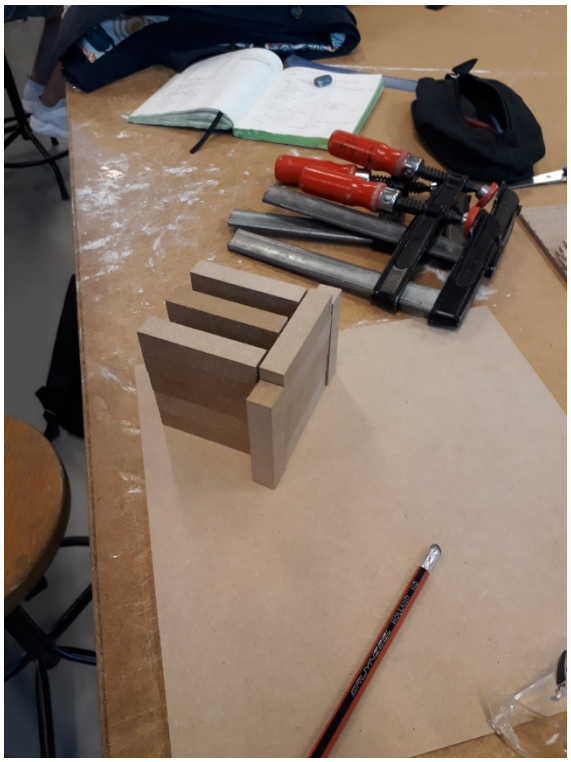


Figure 26: model with elevators

Figure 27: Ground plate

Figure 28: Stacks of containers painted

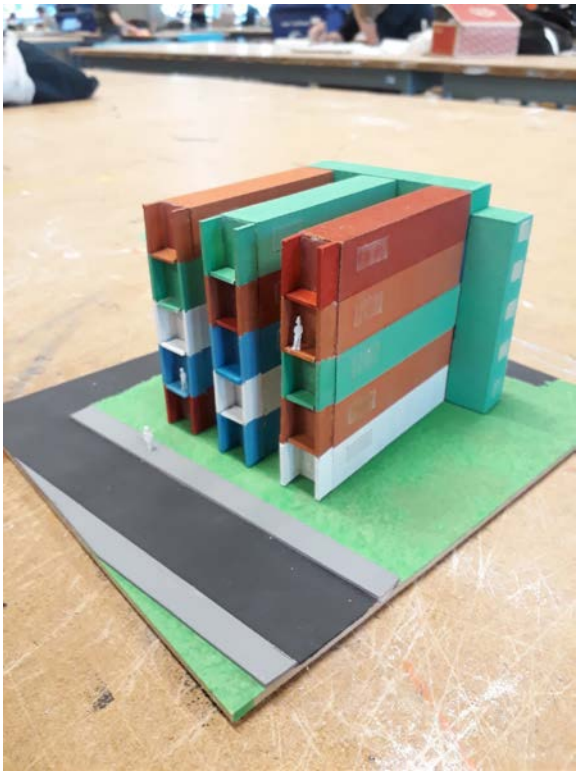


Figure 29: Finished scale model

Validation

As mentioned before, the validation was done in combination with the realization of iteration 2. In order to determine which shape of stacked containers would function best as our flat, we first sorted out our 8 favorite designs, and then did a QOC on those. The full QOC analysis can be seen in Appendix 8.

The values we judged the models by were: spatial efficiency, structural integrity, openness to natural light, accessibility of individual apartments, equality of conditions between apartments and extra space for a balcony or small terrace. Flat 5 turned out to have the highest score in this analysis, having a mixture of good scores across almost all values.

After we had done our own QOC of our favorite designs we contacted several different Architecture students from the Technical University of Eindhoven. We requested feedback on all designs, and we asked to give their preference and their top 5. These students had to judge our models and give feedback on the space efficiency and the amount of sunlight getting through. As these criteria were our priority.

We have established contact with an Architecture student and she gave this feedback on our different models:
“To be honest I’m not sure I have the knowledge to say which one is the most space efficient. It all depends on the routing inside the building and on whether it is necessary to be able to walk from one building to another. Flat 9 looks like a nice idea but you would get an awkward dark area in between the buildings. Flat 4 would have unevenly distributed light cause of its curved shape. Flat 10 would be efficient for interior routing - you could move easily from one building to another. Flat 5 is quite a typical design - so for the interior routing and internal space efficiency it should be easy to find inspiration on the internet. Flat 11 I think it the least space efficient in its environment. Takes up a large piece of land are for small built surface.”

With this piece of information, we have found that the 5th and 10th model was the best one out of the top 5. We finally have decided for the 5th one which has an E shape. We didn’t choose for the 9th design because of the dark area between the buildings. We have set light as one of our priorities which made clear that this design was not an option. As the Architecture student described about the second design, the curvature in the round building would not distribute the light evenly. This would cause for areas with hardly to no light into the buildings. The 5th design with the E shape made it convenient for transportation as the central piece (the long piece) would act as a hub where the apartments/containers could be slid into its place. This would make it also very space efficient as they would not use a lot of space but easily stackable. The 10th design is like almost every design out there where the apartments lay in a rectangular shape/formation. This is like described a typical design but this would not be very functional for transportation. The 11th is as described least space efficient because of the area it uses compared to the actual living area. This is why we have decided to take the 5th flat as our main focus.

Iteration 3

Ideation

On the advice of a fellow student, Thijs took a day to visit the famous Rietveld-Schröder house in Utrecht. This is a house that was designed by famous 'De Stijl' furniture maker and architect Gerrit Rietveld. There was a guided tour of the house, and it pointed to some key details and design principles Rietveld used in dreaming up this house.

The bottom floor was pretty ordinary. It was the top floor, where most walls were not load bearing, where things got really interesting. During the day, most of the walls folded away to optimize the feeling of openness and spaciousness (a short clip of this can be viewed here: youtu.be/bnhVvIS8p8I). The bathroom sink and tub disappeared behind a big wall/door, because it simply was not needed during the day. The whole upper floor was like a big lounge area. During the night they rolled and folded into place to divide the floor in bedrooms.

As you might have gathered, a lot of this rhymes with the core ideas and values of our project: things disappearing when they are not needed, creating more spaciousness and a feeling of comfort. Rietvelds view on space (more specifically negative/empty space) was really interesting, and Thijs had a chat with the guide about it. This day gave a lot of inspiration and information to report back to the group.

Figures 30, 31 and 32: Listening to the supporting audio guide of the Rietveld-Schröder house

Throughout the second iteration, our concept had become centered around containers. With this new idea of building our homes in containers, came an added bonus of a mobility aspect.

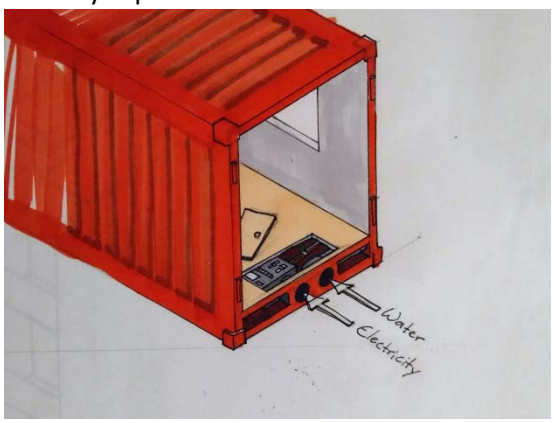


Figure 33: Sketch of container

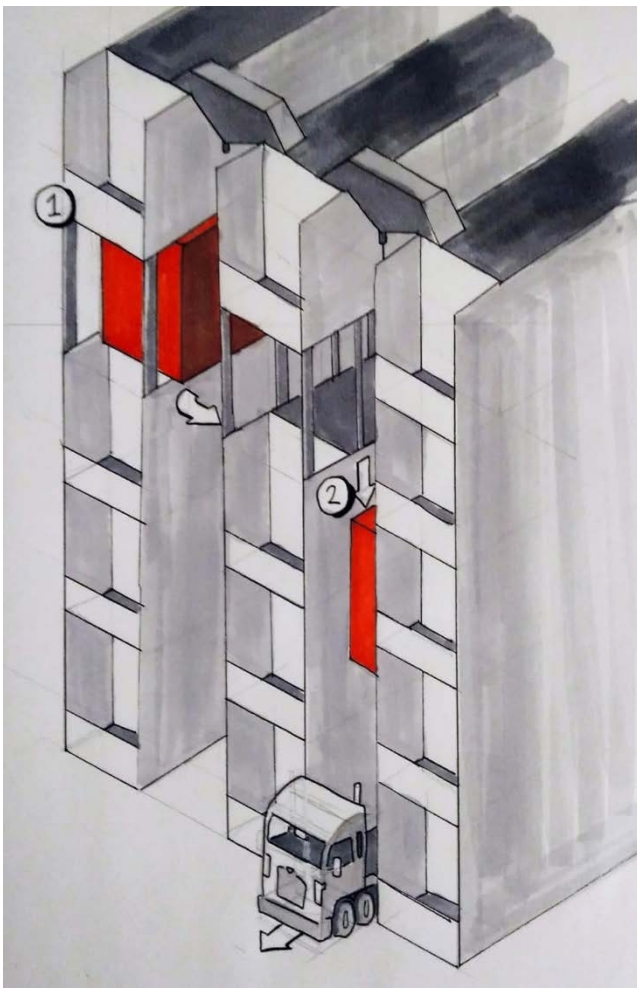


Figure 34: Sketch of moving container

Our container homes have the plumbing and electrical all installed in the bottom 30cm of the container, under the floor. Water and electricity are provided by the central hub, through connectors in the floor. In the future, cooking and heating is done using sustainable electricity, so no dangerous gas connections are needed. If the house is to be moved, everything is first strapped to the floor to prevent sliding and breaking during the shipping process. Next, the electrical and water connectors are disconnected and the container is slid to the side (step 1). The support beams of the flat make sure the stories overhead don't shift or fall. Then the container is lowered onto a truck waiting below by two roof-mounted cranes (step 2), one on each side of the container. These cranes can be mounted to the roof for the occasion of someone moving.

Next, the container is shipped, this can be done by train, boat, or even aircraft. All the infrastructure for moving shipping containers is already in place.

Realization

For the third realization, it was necessary to make our concept visual with a piece of technology integrated. Dayne already made a beginning to a 3D sketch again just as a guide for yet another scale model. At a certain point though, the 3D sketch was in a pretty advanced stage that it was very representative for our concept. The sketch was perfectly scaled and one would really get an idea of what the container would look like. The thing about it however was that the experience was lacking. One could not really tell from the sketch how small or large such a container house would feel like.

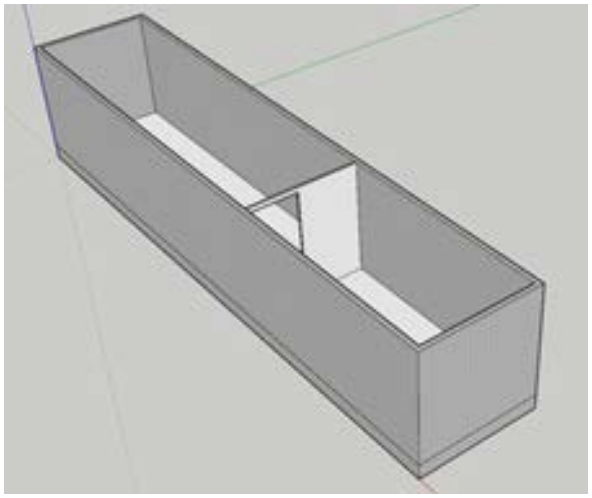


Figure 35: progress 3D sketch

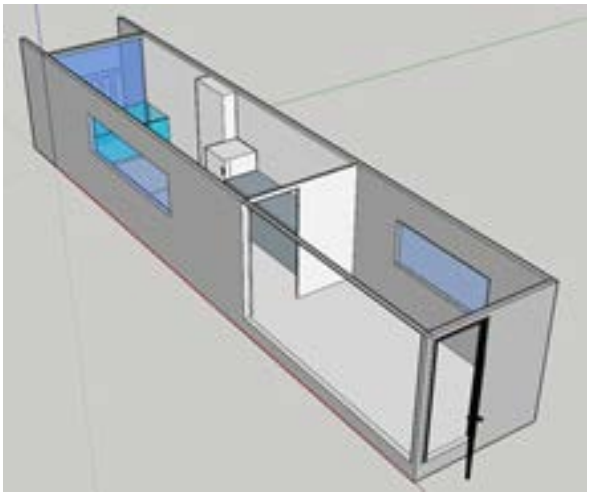


Figure 36: advanced progress sketch

During a meeting in the Gemini building in a OGO space, the hallway adjacent to that space looked to have approximately the height and width of the container's dimensions that are 2.59x2.44 meters. It turned out this was off by just a few centimeters on both ends. By looking for endpoints in the hallway to represent the length of 12.19 meters in the hallway, a sense of great joy arose when these were found using a pillar on one end and a doorframe on the other. That hall gave us the perfect idea of the container's size. It was a simple but good and very useful experience. Upon entering the OGO space again, we discussed ways to create that experience of the container's size into the scale model. Of course it would not be physically possible to create such a container, let alone the future applications and gadgets inside of it. But by creating a virtual reality, everything becomes possible. And that thought came to mind, because at some point Erwin was the one to come up with the idea of virtual reality. He figured that it may be possible to use the 3D sketch to turn that into a 3D experience.

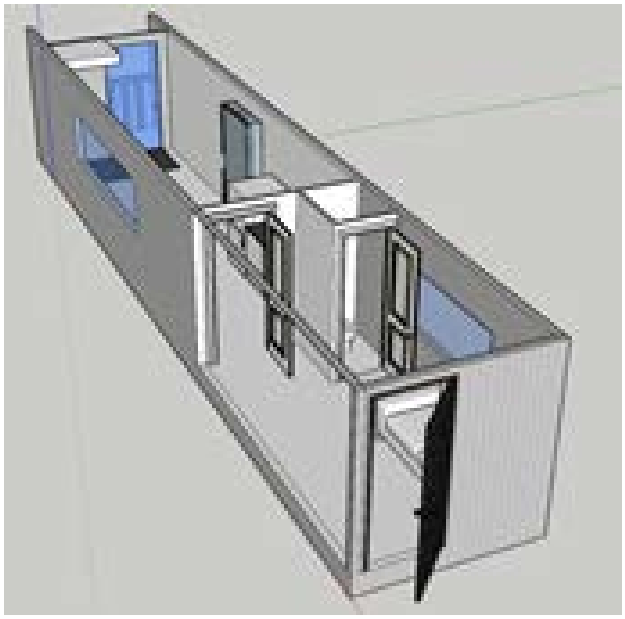


Figure 37: apartment folded up

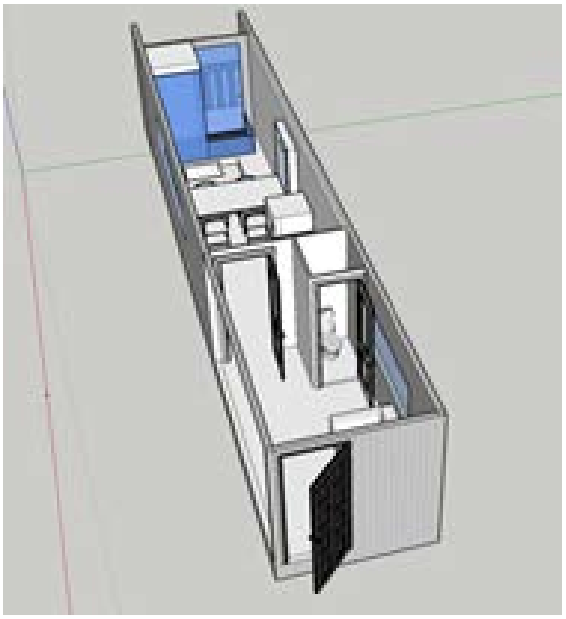
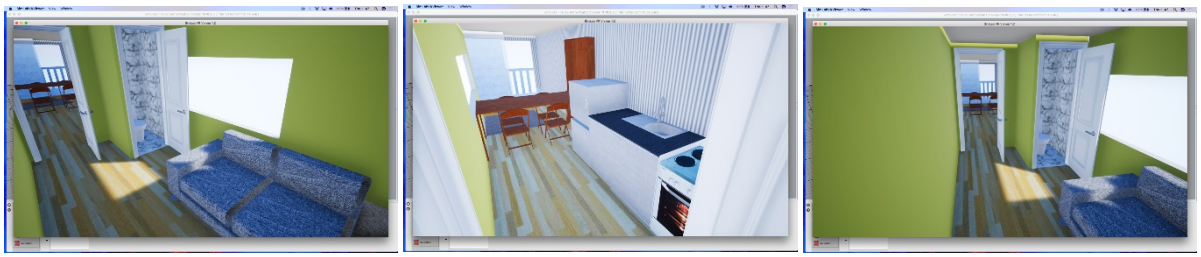


Figure 38: apartment unfolded

After the meeting in the OGO space at the building Gemini, the decision was made to dive deeper into the possibilities of Virtual Reality. After a couple of days of research, finding out that it was possible to transform the 3D sketchup into a VR experience. Cine 4D, Simlab Composer 8 and Adobe After Effects were the several different applications used to make the VR experience[6]. Without any knowledge on how to make a VR model. By looking on the internet and following courses on Skillshare a better understanding was created on how it works[7,8]. After a week of experimenting the possibilities and capabilities of VR were shown to the group. At a meeting with the tutor, Mark told us he would like to see a life sized model of somesort. This was of course very challenging, to make a real sized furniture which moves. At this point, the VR experience was the best way to showcase a real size model. A few weeks went by when the first prototype of the VR was shown to the group. By showing different VR experiences a decision was made which one was the best for the demo day. After the decision was made, the VR experience got developed more towards a final product. The final VR experience was made in Simlab composer 8 by importing the 3D sketchup model and adding the different textures to the objects, adding different viewing angles, adjusting the lighting within the apartment and more.
At the final demo day we had 3 VR headsets with each the VR experience. Almost everyone who used this VR headset had a pretty accurate feeling of how big the apartment was and what you could actually do with such a small space.

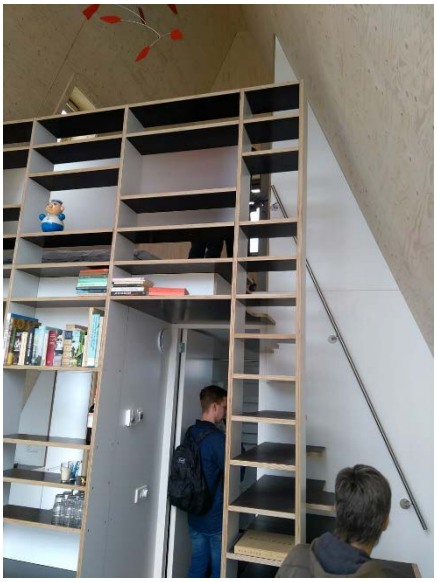


Figures 39, 40, 41: Screenshots of VR experience

Validation

On May 15th we travelled to Almere to visit the Tiny Housing Experience[9]. This event included a talk about the personal experiences of someone living in a tiny house, and guided tours of several very different tiny houses. An interesting mix of very different stakeholders in the field of housing were present there that day (ranging from prospective house builders and owners to tiny house owners to interested municipal officials).

While we were there we exchanged information with some of the attendees. Hennie Tibben, who has lived in a tiny house for nine months now told us about her experiences and was able to answer some questions we had concerning the practicalities and feeling of living in a small space. We also discussed our project while waiting for and during the tour of the tiny houses.

Figures 42 and 43: Tiny Housing Experience

We took the train back from Almere a bit wiser. Key takeaway points were that to live small, you need to get rid of a lot of the 'stuff' most people have aquired. You simply do not have enough room to store a lot of furniture, books, souvenirs, board games, tableware sets and what have you. Living small means living a minimalist and sober lifestyle and Hennie argued it was definitely not for everyone. Our goal is to make the One Wall available and attractive to everyone, and this was something that we until then had not really taken into account.

It was also interesting to learn that everything under fifty square meters is considered a Tiny House in the eyes of the project group. With our shipping container houses measuring in at approx. 30 square meters we are apparently still being fairly modest in size.

Another thing we wanted to know was whether it was viable to build our container houses for couples, or even small families. Hennie (and some of the other attendees we spoke to) said she would not be able to live in her house with a partner. She works at home and thinks a couple would just be in eachothers way all the time. That being said, she came across as a very independent person and had lived on her own for most of her life. She had never tried sharing her tiny house, and was basing her answer off of her experiences of living in her tiny house alone.

Finally, apart from being a moment of reflection and evaluation, we were also inspired by all the new, bright ideas when we were there. Some highlights were:

The villa volta tiny house (by studio RTM, more info at: studio-rtm.nl/villa-volta/), which was planned, but not built yet. It revolved to make use of every possible inch of space.

The tiny-A, (bij DaF architects, more info: tiny-a.nl), which was cheap to build due to it having no walls, and which was able to fix a problem it encountered with stairs by incorporating millers stairs that alternate to make for a more compact ascend.

The slim fit, (bij Ana Rocha, more info: anarocha.nl/work/slim-fit-presentatie/), that challenges urban densification by fitting a floor space of 50 square meters on a footprint no bigger than two parking spaces.

Conclusion

When you are designing a small and compact house, one of the most important things is that the people living there should not feel claustrophobic in any way. This means that we had to create a design which makes the person feel like he or she is living in a rather big apartment. This can be achieved by giving the interior a different look, creating more light into the apartment and shaping the entire building in such a way that it looks spacious. We managed to put all the unnecessary things away when you do not need it. The furniture will be stored away in the floor and walls and will only be displayed when needed. The bathtub folds into the floor, the dining table folds into the wall and the bed lowers into the floor which makes it very space efficient. We have designed a lot of different prototypes and designs and have boiled it down to the apartment and flat shape of an E. For the final demo day there has been made a scale model with the E shape tho showcase the building. There has also been made a VR experience to showcase the actual sized apartment from the inside which gives a good representation. After finishing the three iterations by ideating, realizing and validating a good understanding has been created around this concept of a compact, container-sized and luxurious apartment.

Discussion

In the final stage we have made a lot of designs, sketches, prototypes and 3D models. These all have helped to get one specific design which has been validated by experts and users. This is what we hoped for in the previous iterations. By visiting the Tiny Housing Experience exhibition on may the 18th, the opportunity was created to ask a lot of questions and received a lot of extra knowledge.

In finalizing the concept there have been minor but important things that had to be taken into consideration. Humidity, electricity, and flat structure were the main priority and have been taken care of through separating water and electricity in the 30 cm floor layer, and the evaluation of different flat structures.

After improving our prototypes based on feedback from the mid-term demoday, user surveys and experts, new improved prototypes, sketches and 3D models were made. By realizing this with Sketchup and Simlab composer the possibility was created to make a VR experience and 3D model. Besides that the physical model was improved by making the picture more complete with a model of the entire building.

References

1. Ng, E. (2010). *Designing High-Density Cities: For Social and Environmental Sustainability*. Retrieved from https://books.google.nl/books?id=mWW2zkn0QCwC&printsec=frontcover&hl=nl&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false Retrieved on April 11, 2018
2. *Car Towers*. Retrieved from https://www.autostadt.de/en/explore-the-autostadt/car-towers, Retrieved on April 15, 2018
3. *A Guide to Shipping Container Sizes*. (March 12, 2018) Retrieved from https://www.bigboxcontainers.co.za/blog/a-guide-to-shipping-container-sizes, Retrieved on April 16, 2018
4. Martinez-Garcia, M., (2014). *Alternative Housing: the Shipping Container Home.* Retrieved from https://crt.blogs.realtor.org/files/2014/12/shipping-container-homes-white-paper-2014-12-10.pdf Retrieved on April 16, 2018
5. Figure 23 & 24, *45 Amazing homes and offices built from shipping containers*. (March 15, 2017) https://www.popularmechanics.com/home/how-to/g172/shipping-container-homes-460309/ Retrieved on April 25, 2018
6. Simlab Software http://www.simlab-soft.com/SimlabArt/gallery/vr-gallery/
7. Virtual-reality applications give science a new dimension, (APRIL 30 2018), nature.com, David Matthews, https://www.nature.com/articles/d41586-018-04997-2
8. The Accuracy and Precision of Position and Orientation Tracking in the HTC Vive Virtual Reality System for Scientific Research, 2017 May-Jun, Diederick C. Niehorster, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5439658/
9. *Tiny Housing Experience*. Retrieved from https://kaf.nl/expo/seizoen-2017-2018/tiny-housing-experience/, Retrieved on April 16, 2018

Individual Reflections

Dayne

The project theme Future Histories was my second choice. At the moment of making that choice, I was drawn by the project description. I found the idea of imagining the future very appealing. The description gave me the expectation that this project was more related to design for concept than for design for realization. It said that it was all about making scenarios, raising questions and opening debate with the chosen user group. These were the things I expected to be doing during this project.

I was both positively and negatively surprised to see that the project was filled in a little different. The project in fact needed to be more realizable with pieces of technology implemented according to the project requirements. This countered my expectations obviously. At that point, I felt like it changed into design for realization. I found this to be positive for me personally because I really enjoy the process of realization. The negative side about it to me was the fact that it contradicted the project description too much. I feel like the project now is too focussed on building prototypes rather than raising societal questions and opening debate.

Although I had these double feelings regarding the project's direction, it has had a positive effect on some of my personal goals stated in my Personal Development Plan (PDP). The first one I am referring to is a goal for creating an aesthetically pleasing prototype. As of the fact that the project's direction has gone more to the direction of realization, I was able to enhance my 3D sketching skills in Google SketchUp. This also covers the competency area of Technology and Realization. I can definitely state that the end prototype of our VR experience was very pleasing both aesthetically as well as experience-wise.

Secondly and lastly, another goal I have was to investigate the influence of stakeholders with regard to User and Society. The main aim of that of that goal was to identify stakeholders that influence our design and to specify how they do so. Unfortunately, we have not specifically identified stakeholders as part of our design process. What we did do however was meet some stakeholders and look for their interests, demands and opinions. Those interests were namely quite influential for our choices. For example, during the Tiny Housing Experience we had the opportunity to learn about people's opinions regarding their view on tiny houses. Those opinions, or desires more or less, let us to finding the most suitable options with regard to for instance size, household utilities and space efficient elements. From that perspective I personally believe I can state that this project really helped in finding user desires and demands in order to translate them for use in the design process.

Bianca

Future Histories was my first choice because the premise of finding solutions for problems that could arise in the future seemed very interesting to me. I expected Future Histories to be mainly about different kinds of scenarios that could take place in the future, and the best way to invent solutions to the problems that came with them. I also expected to learn about more specific techniques for the iterations of a design cycle, like QOC's and value mapping.

Those expectations turned out to be partially true. I've mostly learned about the project process itself. How to iterate properly, and how to plan and meet more efficiently. Especially the idea of iterating was new to me at first, because I was used to simply working linearly towards a solution and then presenting that as the final product. But after the start of the second iteration I found it much easier to adjust any flaws in the first prototype instead of sticking to it and trying to work around what we already had. It was refreshing to start over with an improved view on the matter.

In the beginning the biggest obstacle for me was figuring out the right direction for the project. This also tied into my goal to be more decisive when it comes to meetings and deadlines. We were a little bit behind on the initial planning after the midterm demo day, but through more efficient planning weekly journals, and setting more deadlines for small tasks, we eventually got back on schedule.

In the second half the team dynamic also came to a stable balance between work and friendly banter. We were a team that immediately got along very well, but this also meant that the productivity of meetings sometimes suffered under our banter. All members acknowledged this after the third quartile and we decided to keep things more structured and professional in the fourth quartile. This turned out to be a success since our meetings took way less time and tasks were divided more efficiently.

I am very pleased with our end results. I've been able to implement many of my goals into this project, such as lofi-prototyping for Creativity & Aesthetics, using different methods of validation for User & Society and keeping better track of the working process for Technology & Realization.

I also had a very enthusiastic and hardworking team and I learned a lot from them about documentation, presentation and pitching.

With the knowledge I gained in this project I can go into my next projects with more structure, efficiency, and a clear direction of what I want to learn from the experience. I will be more accustomed to iterating, and I will have more skills in the realization of a concept or idea.

Erwin

For my project 1 I got the subject 'Future Histories'. We chose to design a foldable house which is applied around the era of 2200-2300. This should prevent the problem of overpopulation and keeping luxury.

We all contributed together in this project with varying tasks. As we all sat together when we were prototyping in the beginning fase. I took the task to take pictures and document everything and eventually create the VR experience. We also all did the brainstorming and a lot of ideation and reviewing together. Beforehand we had to do this solo and discuss it afterwards together which gave us new insights.

When we made the prototype we looked at the desires of our ideas. By doing this we created an image which would be feasible. When we met a couple of times we always worked and added a bit more to the idea. By meeting in vertigo where we made the sketches, it was easy to adjust everything together and make it together. We also made a low fidelity prototype for the pressure cooker, but this was something that didn't turn out to be our final project idea but it did bring us towards the right direction. This lead us to the foldable house. It did help in shaping the final prototype, since we could see the idea's and desires which actually interested us. We then made a new prototype that was a little bigger but still not the actual size. We used the wood and styrofoam to showcase the scale with working functions.

After the midterm demo day we decided to dive deeper into the information we had and gathered more. We started with ideating about the actual size and shape of the apartment. Which was then validated by an architecture student. By doing this we immediately knew if we were doing the right thing. This has learned me that an expert always knows more and that you can learn greatly from asking experts. To realise this we have made a scaled prototype and an actual sized prototype. This actual sized prototype is made in virtual reality where only your imagination can stop you. Experimenting with VR has shown me the great possibilities of technology and designing. By learning via skill share how to develop a model in VR, I was able to please the desires of our tutors who would have liked to see an actual sized model. By knowing how to make a VR model in Simlabcomposer, I now know that this will be an extra tool for me to show my designs in the future.

Having learned so much in this half year, I am pleased to say that I not only have learned a lot about sketching and modelling but also about team work and thinking outside of the box. I have learned how teamwork is essential to a good functioning team and the end result. I have also thought myself how to make VR models.

At the half of this project I have said to be more active, which I did by contributing a big part for the demoday by developing this VR experience. Our group work was in the beginning also very laid back which has changed in a positive way by making the meetings more effective and dividing the tasks clearly.

The future is full of surprises and I'm looking forward to learn more.

Thijs

Because I had gone through design processes in Idea to Design and User-centered Design, where I had focussed on ideation and validation respectively, I wanted to develop prototyping and realisation skills during project 1, as well as apply and practice the techniques I learned during aforementioned courses.

I feel like I succeeded in this. Throughout the iterations I have been very busy in the workshop. I got comfortable using the machines and working with a variety of materials. I notice that the act of making something stimulates my creative process. I prototype to materialize and communicate ideas, but also to gain new ideas and insights.

Especially when writing the report and assembling a portfolio, it became very clear that I should have been taking pictures and videos of everything I do, to be able to be assessed better and to be able to show my work to others and have a conversation or exchange of ideas. I tried to document my work and ideas more during the second quartile by applying some of the skills I gained from exploratory sketching. This worked effectively: group members said they were impressed with my drawings and it got the idea across without need for lengthy explanations, making for more effective and productive group work.

I also gained a lot from the excursions I made. For ideation purposes, it really helps me to look at and analyze other people's work and to reflect on what they did and what I would do differently. At the schröderhouse as well as at the tiny housing experience I was invigorated with renewed energy to work on the project. I think I could say my creativity starts flowing best when I have something to work with, be it a prototype I am working on, or somebody else's work I am admiring. A blank canvas can be hard for me to overcome.

Group dynamics were very good. I think we have similar personality types that make us get along very well. I had a lot of fun working together, while I also feel like we got substantial amounts of work done each week. At the end of the second quartile I reflected on the group dynamics stating that maybe it would become our pitfall. I contemplated getting more strict. I think everyone felt this way and was open to tackling this potential problem. To make sure we all stayed on track, during the second quartile we worked less with the whole group, and more individually or in smaller collaborations. This way everybody had a specific responsibility and was kept more alert and productive. I felt like this was a very good tactic, that I will keep in mind for future projects. Everybody was feeling friendly and jovial towards each other, nobody was bossing anyone else around, but still we were all working very hard and nobody was wasting time or taking advantage of the rest of the group.

Task Division

Iteration 1	
Ideation:	
Brainstorm & idea sketches	All
Design case & possible problems	All
Ideas for super comfort	All
Scenarios & QOC	All
Realization	
Sketchup exterior model	Dayne
Small 3 house model	Dayne
Big transforming room model	Thijs, Erwin, Bianca
Poster	Thijs
Validation	
Interview	Bianca
Iteration 2	
Ideation	
Sketches & paper prototype	Bianca
Sketches flat sorts	All
Realization	
Block brainstorm	All
Flat scale model	Thijs, Bianca
Validation	
QOC of flat types	Thijs, Bianca
Interview Architecture student	Erwin
Iteration 3	
Ideation	
Rietveld-Schröder house	Thijs
Realization	
Moving the container scenario	Thijs
Sketchup interior model	Dayne
VR experience	Erwin
Report	All
Validation	
Tiny Housing Experience	Dayne, Bianca, Thijs

Appendices

Appendix 1: Most interesting scenarios from the mind map

Topic/issue	Pros/arguments in favour	Cons/arguments against
Mother brain	- All information in one set - Links and relations are immediately present	- Is it already there in big data sets like Google?
Legal drugs	- Reducing the black market	- People are always high - Driving under influence will happen more
Space cruise	- Wall-e - Science is already moving to this	- Very extensive - Artificial gravity
Telepathy	- Ultimate teamwork - All problems are solved - Honesty lasts longest	- Problems are caused - Is there even a possibility this can be done?
No more fossil fuels	- Better for the environment - Stops the enhanced greenhouse effect - Inevitable	- Will we move to other sources in time? -
Nuclear fusion	- Very efficient - Good for the environment	- Extremely large - Expensive - Extremely complicated -
Living in space	- Elon Musk's SpaceX - Prove from Mars - ISS station	- Is there a planet suitable? - Transportation
Flying cars	- Fast	- Pollution - Not efficient - No value for society
Digital education	- Move into digitalised world -	- Writing is proved to be better in many ways
Bionic humans	- Film predictions - Terminator - Technology is advancing exponentially - Breakthrough in the medical world	- What are the dangers? - Will this cause a rise in AI?
Holograms	- Science is already looking into this	- What is the societal value?
Super comfort	- Past predictions all lead to comfort - Future predictions will also lead to comfort - People will always search for more knowledge and info	- Lazy society* - Weaker human bodies - dependency - ethnic decision

Appendix 2: Brainstorm of all 70 ideas on Super comfort problems

Ideas on the Design Case

Dayne

1. Hovering chairs
2. Automated cars
3. Hyperloop
4. Public cars
5. Dynamic temperature adjusting clothes
6. Holograms
7. Voice control panel (Jarvis, Alex)
8. Brain/memory back ups
9. "The complete kitchen" ❼ fridge, furnace, oven and microwave in one
10. Hologram movies
11. Eye controlling mouse
12. All in one ❼ phone, wallet (digital cash only), ID, driver's license(s), basic medical records for first aid,
13. Robots for physical work ❼ no more human infrastructure builders ❼ the evolution of intelligent people
14. Talking animals via chip
15. Hat that massage the head
16. Dynamic paintings
17. Screen only walls (like the windowless plane)
18. Windowless cars (360° view)
19. Human charge rooms ❼ the ultimate energy boost
20. Bionic limbs
21. Bionic ears
22. The self-adjusting chair (specific for less mobile elderly)
23. Taste adjusting drink ❼ be able to eat anything
24. Communicating cars
25. No more physical shopping
26. Lighting skin (like fireflies)

Bianca

27. Transport (self driving trains / busses / underground transportation)
28. Hobbies (entertainment / art)
29. Communication (holograms / screens)
30. Sports (traditions / old-school)
31. Physical jobs (maintaining robots? / everyone is smarter?)
32. Health (chip / frequent scanning / sports)
33. Overpopulation (space exploration / underground flats)
34. Languages (instant translation / just 1 human language)
35. Cultures & minorities (mixing / preserving?)
36. History (preservation / musea / education)
37. Climate change (prevention / adapting)
38. Natural disasters (better predictions / prevention)
39. Home comforts (tv / vr / robot-cooking etc.)
40. Sound experience (direct to head / nerves)
41. Computers/Phones (obsolete / adapted into control panel)
42. Education (vr / ar / experience sharing through computer)
43. Energy supplies (nuclear / environmentally friendly)
44. Preservation (nature / wildlife)
45. Isolated communities (Amish etc.)
46. Privacy (internet police / robots)
47. Poverty (third world?)
48. Genetic modification (optimization of genes)

49. Food (restaurants / Wall-E-junkfood)
50. War (ended? peace treaties / VN)
51. Economy (money obsolete? / value of different things / prices constantly keep up)
52. Shopping experience (at home or better experience?)

Thijs

53. Personal assisting robots
54. More efficient living space where things are stored in the walls and come out on command (bed, table, kitchen, tv, closet, etc.)
55. Flying camera with arms for simple tasks so that you don't need to leave the house.
56. System for interacting with appliances on a distance.
57. Mobile workplace, taking all your files with you and having access to colleagues anywhere.
58. Cereal maker
59. Automated kitchen
60. Superfast transportation (underground trains/flying cars)
61. Interaction with machines through thought
62. Bionic appendages and limbs
63. Interacting with user interfaces through something else than touch (voice/eye movement/gesture/nodding/etc.)
64. Everything is readily available (entertainment/social contacts/education/work)
65. New forms of entertainment (more immersive vr gaming/movie experiences)
66. Transactions even more automated.
67. Accessing all your files over the web from any computer anywhere using fingerprint.
68. Docking a small handheld (usb-stick-like) device anywhere.
69. Automated shopping delivery (registering when you ran out of a product, making sure you always have certain things in the house)
70. More nature, windows, fresh air

Appendix 3: Scenarios for all in one wall

Scenario Bianca

Jane lives in 2168. She has a home in one of the biggest cities in the world: New York. New York has a lot of work opportunities and the population has become so dense that special cluster-apartments have been built to sustain the amount of people within the city center. These cluster-apartments are very small in comparison to regular houses, but are designed in such a way that they provide all the luxuries of a larger house.
Jane comes home to her cluster: 7B. She goes up the fast elevator and walks into her apartments living room. This is the static room where she has a nice view on the city, a comfortable couch and a tv. When she want to go into the dining room, she simple says so to the AI of her apartment called Alter, and the second room transforms into the dining room. A table pops up from the floor, chairs fold out of the cupboards and the light drops down from the ceiling. When she's finished eating she goes back into the living room and asks to go to the bedroom. The table, chairs and light go back into the walls and a bed folds out of the other wall and drops down. Along with it, a small night table pops up next to the bed.
With this transforming room, the furniture takes up minimal space, which allows for more people to live in the city. The prices of these cluster-apartments are also much lower than those of regular houses, since they function as very small but luxurious flats.

Scenario Erwin

In the future there are already self driving cars, hyperloops, highly advanced technology
A busy businessman living in New York or Osaka where little space is available. Very crowded areas and definitely overpopulated. He has a wife/ girlfriend. They live together in a tiny space which is has a very expensive rent for maybe 60 m2 floor space. The business man has enough money to provide for himself, his girlfriend and has enough to spend it well. He still needs more space for an office to work and a bedroom and a kitchen and living room and a bathroom to be happy and not be worrying. The one wall is the best solution for this man. He will be able to use his little space and transform it into any space he likes it to be. It needs just a touch of a button and his tiny room will transform in any space or room he likes it to be. it is fully automized which makes it time efficient, luxurious and not physical demanding which makes it available for anyone varying from any age.

Scenario Dayne

Jean-Paul will be a master student at the Eindhoven University of Technology at the department of Chemical Engineering. Jean-Paul finished his bachelor in Paris last in 2068 last year, when he was 20 years of age. Jean-Paul decided to go to Einhoven for his master due to the fact that European Union grew into the United Nations of Europe (UNOE). His master is funded by this authority. Besides the payment of his study, he also receives some extra in order to pay for his residence. Since the population has grown for some bit as well as the infrastructure that has taken up more and more space during the course of time, the availability has become less and less. Not to mention the extra foreign students from which Jean-Paul is only a single example. Organizations such as Camelot on the TU/e campus, the Student Hotel and Vestide, have failed to keep track of the rising demand for residence. In addition, some of these rooms are hardly affordable due to inflation of the housing market. Jean-Paul found an alternative however. An organization called <our concept> has started up a project to build affordable, small but comfortable rooms that fit his criteria. The rooms are 20-25 m^2 for a price of under €600/month. One such a room consists out of two separate spaces. There is a general living space wherein a couch and desk can be placed. The other room is where the magic happens. Via a control panel, the user can select what kind of room this will be. In this case, Jean-Paul can select if he wants to go to bed, to his bathroom or if he wants to cook in his kitchen. These three types of spaces have been designed in such a way that they are fitted inside the walls. By selection, one such a space will fold out. This will save a lot of space and defines comfortability.

Scenario Thijs

9.500 years ago, something significant in human history happened. The first cities were founded in Mesopotamia and the rest of the world would soon also see cities forming. These cities reduced the need for transport, by bringing goods, people and ideas together in one spot. Cities were safer, and more comfortable to live in.
More recent history has seen an enormous population growth. Over the last two centuries, human population has increased sevenfold. With the population now still growing, some people worry about overpopulation; will the growth stop? How big can cities get? Will we run out of space?

In the future, there will be a lot more people and city populations will be larger than they are today. Houses will have to be smaller, more efficient and sustainable.
People however, will still find comfort important. People want space, a view and ease of living.
Technology will have advanced a lot and will have become even more integrated into our life. With these technological advancements, poverty has decreased. The way we think about work has shifted: all physical work can be done by machines, so work has become more theoretical and creative. Overall people will have more free time. Nature will still play an important part in our lives. Nature will be preserved and protected more strictly, further pushing the need for urban areas to house more people on a smaller area.

Appendix 4: Interview questions

Personal information

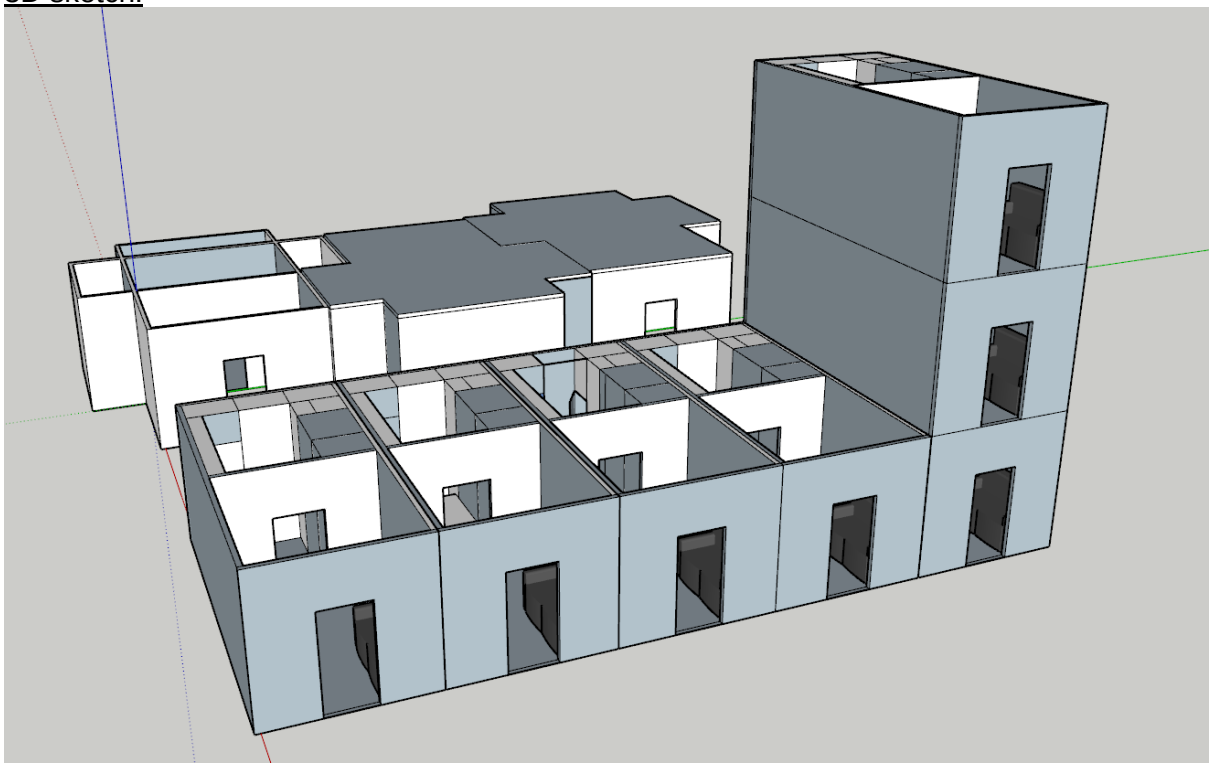
1. Gender
    a. Male
    b. Female
    c. Other
2. Age
    a. 19
3. Level of education
    a. VMBO
    b. HAVO
    c. (VWO)
    d. MBO
    e. HBO
    f. University
    g. None
    h. Other, namely: ...
4. Where do you live (generally)?
5. What is your housing situation?
    a. At your parents
    b. Renting a room
    c. Your own place
    d. Else, namely: …

General questions

6. What are your first thoughts or associations with the word ‘comfortable’?
7. What do you personally find a necessity at your home?
8. What do you consider a luxury at your home? (unnecessary yet desirable)
9. How much space would a home have to take up to still be a reasonable size to live in (for one person)?
10. What are things/appliances you use in your house all day round?
11. What are things/appliances you only use once or twice per day?
12. If you are a student, what would you pay (per month) for a room that is 20 m^2?

Appendix 5: Extra photos of realization

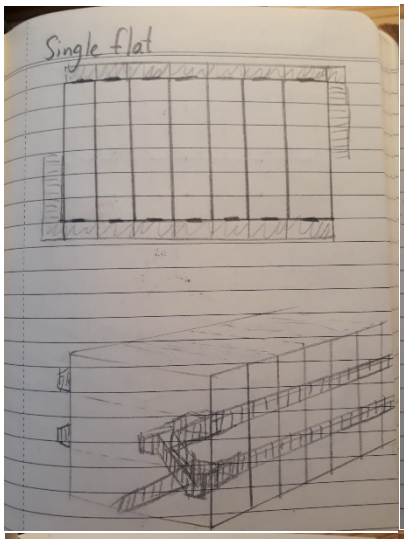
3D sketch:

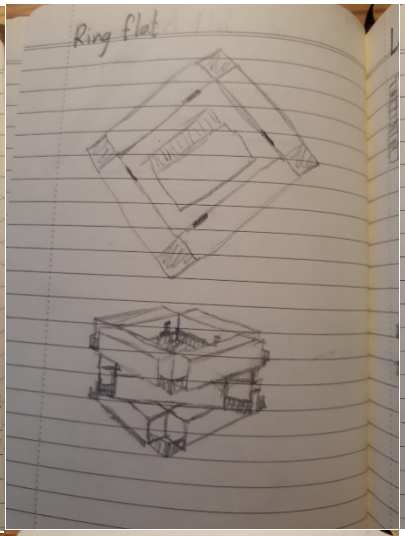


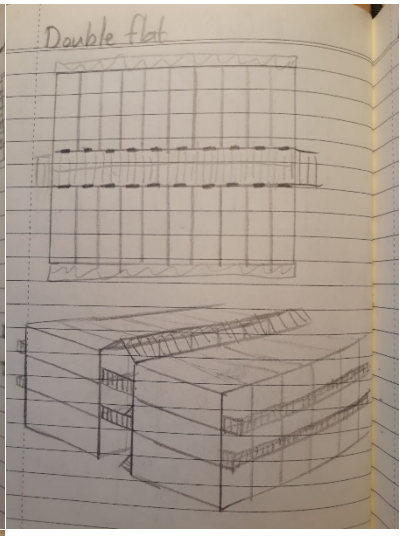
Prototype:

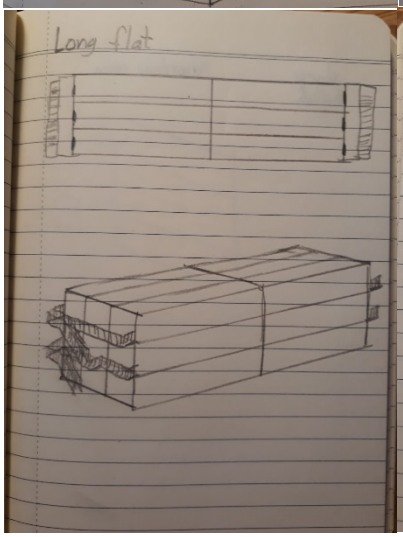


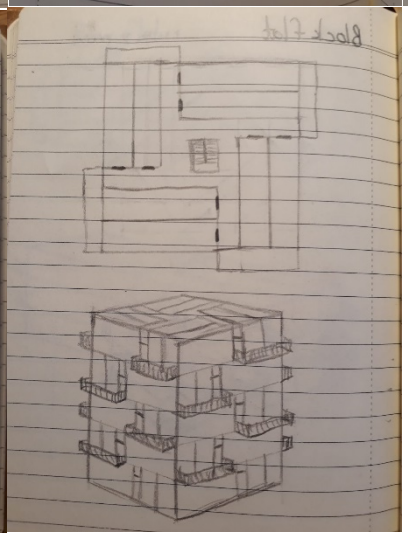

Appendix 6: sketches of ways to stack the containers





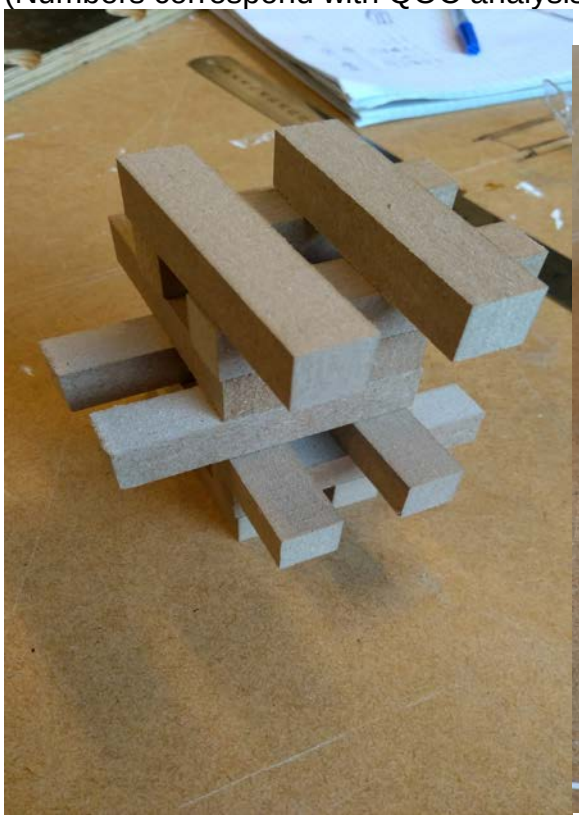




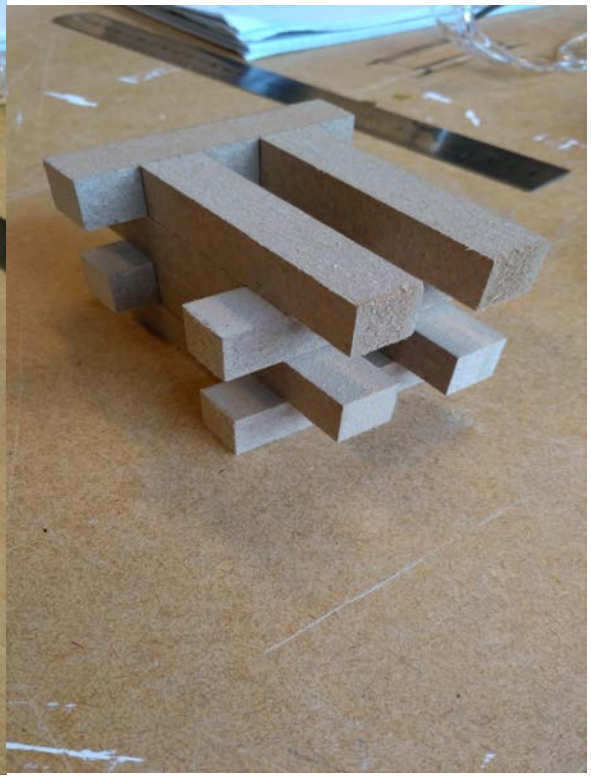


Appendix 7: brainstorm on how to stack the containers

(Numbers correspond with QOC analysis in Appendix 8)

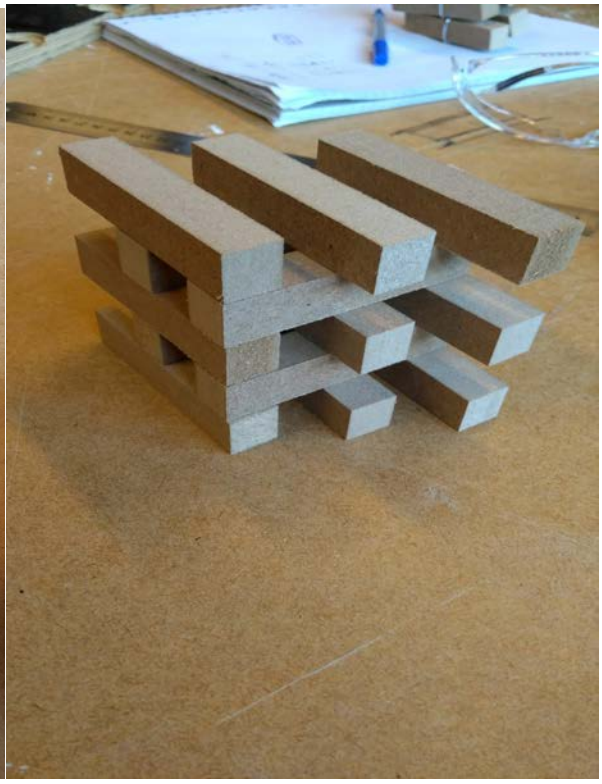


Flat 1

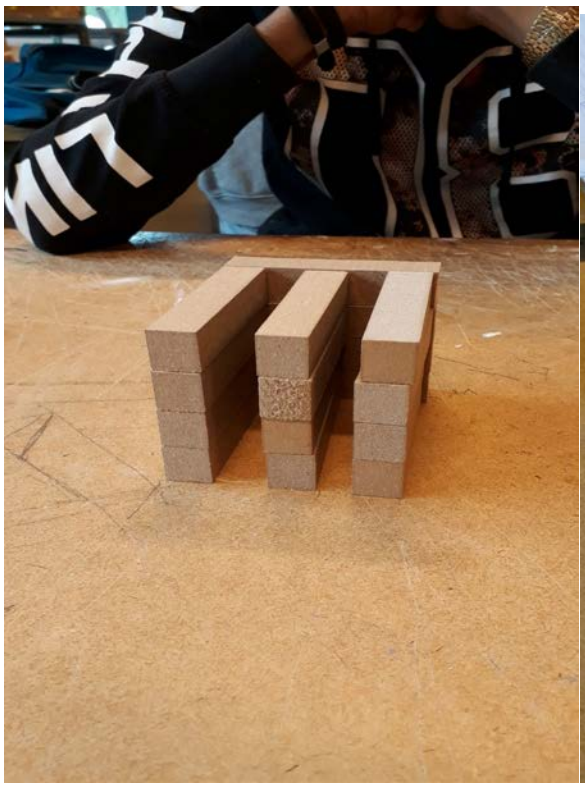


Flat 2

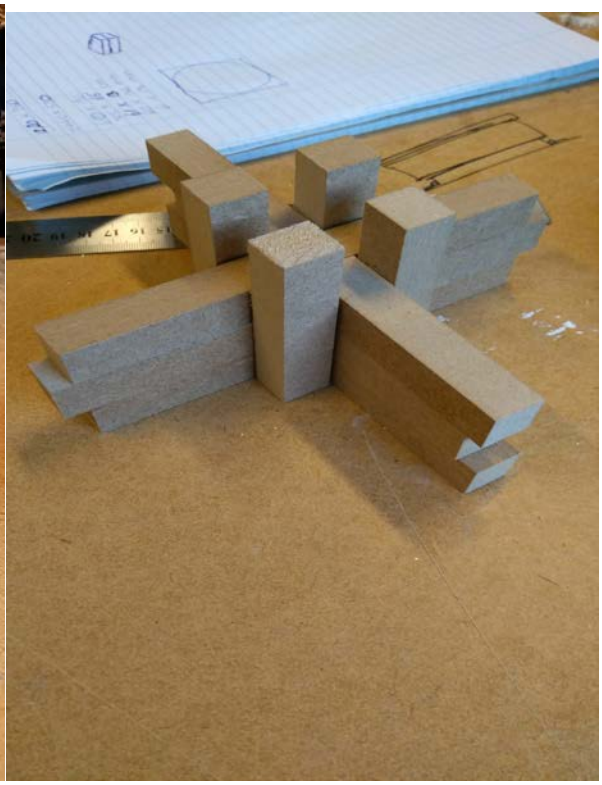
Flat 3



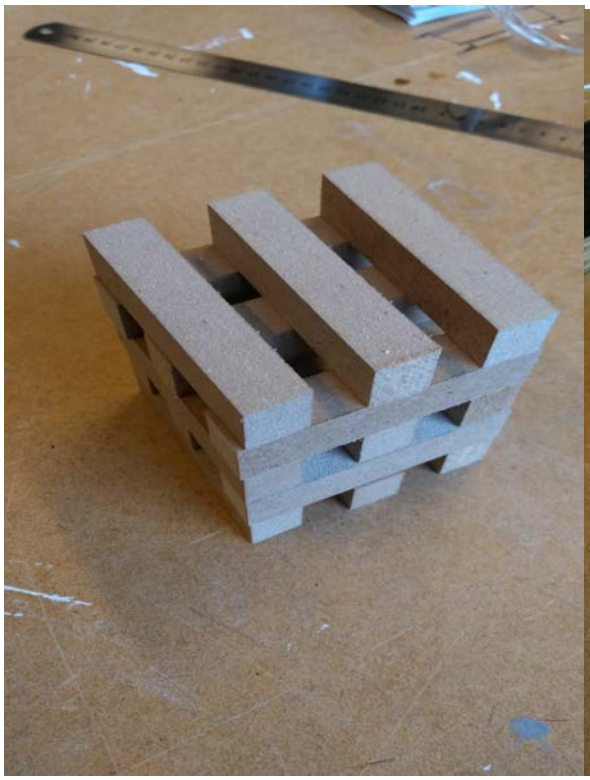
Flat 4



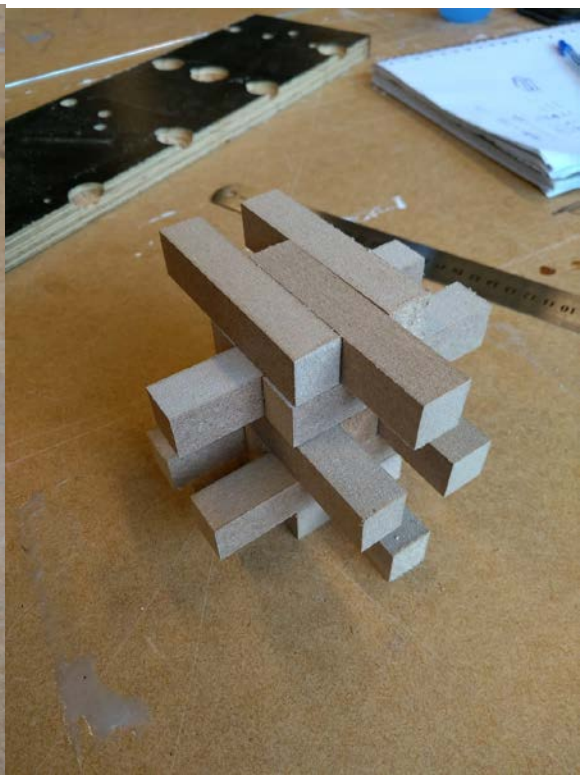
Flat 5



Flat 6



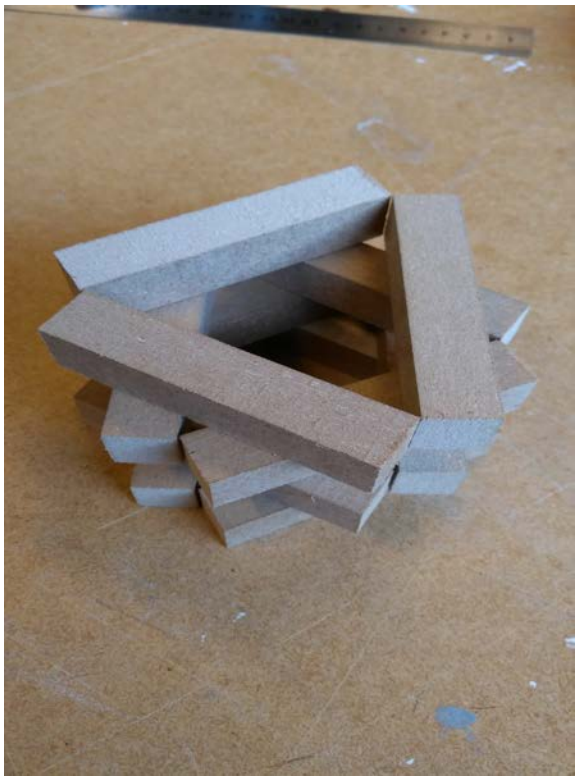
Flat 7



Flat 8

Flat 9

Flat 10



Flat 11

Appendix 8: QOC analysis of 8 favorite flat designs

(Numbers correspond with pictures of Appendix 7)

Value-> Flat	**Light 2**	**Accessi-bility 2**	**Spatial efficiency 3**	**Structural integrity 3**	**Extra space 1**	**Equality of conditions 2**	**Total**
Flat 1	4	3	2	3	4	4	41
Flat 2	4	4	3	4	2	3	45
Flat 3	3	4	4	4	2	2	44
Flat 4	2	4	3	3	3	2	37
Flat 5	3	5	4	5	1	4	**52**
Flat 6	4	5	2	4	1	4	45
Flat 7	2	3	3	4	2	2	37
Flat 8	4	1	3	2	4	3	35