FOGPOD

by Clara Storsten
2020

LUND
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by Clara Storsten

Degree Project for Bachelor of Fine Arts in Design
Main Field of Study Industrial Design
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Department of Design Sciences

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Print year: 2022

ISRN: LUT-DVIDE/EX--22/50610-SE

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FIRSTLY,

I'd like to thank my family for your support and encouragement over the years and in this project, I really needed it.

Secondly, I want to thank my supervisor Anna for pushing me forward in this project when I got stuck. I also want to say thanks to all the other teachers at IKDC for teaching everything there is to know about design, I didn't have a clue about it before.

Lastly, I want to thank my classmates. You were the best part of school and I wouldn't have gotten the kx-pencil without you. A special thanks to Nils Tarukoski for giving me a Keyshot crash course in the eleventh hour.

ABSTRACT

Our food is produced further and further away from us. Consequently, we have lost our connection and respect for it, resulting in unnecessary food waste. Investigating alternative methods of growing vegetables created the ambition to encourage the end consumer to self-sufficient crop production at home.

Initial trend research led to the rising interest in urban farming. The world becomes more populated, cities grow larger and it is necessary to explore new methods of utilizing cities as cultivation areas. Therefore, investigating how to facilitate cultivation in apartments became the chosen task. An analysis of the difficulties of growing greens showed that it is dirty, requires plenty of space, and understanding the plant's needs is tricky.

Market research of indoor garden systems, and the DIY-equivalents, resulted in concentrating on fogponic gardening, a method using fog to provide the plant with nutrients and water, eliminating the need for soil. The roots are more exposed to oxygen and the tiny droplets are easier to absorb, generating a greater yield.

The result is Fogpod, a modular fogponic system for home-usage. Inspired by sculptural art, the white base acts as a podium, turning the modules and vegetables into art pieces. To contrast existing products, porcelain was chosen as the main material, making it an interior piece to fit the modern home. The playful expression invites the user to create a close connection to the food by growing it themselves and encourages the user to cultivate their growing interest.

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1. introduction

BACKGROUND

Early 2020 I watched *Rapport från 2050*, a TV show about how the Swedish society might look and function if Sweden becomes climate neutral in 30 years. The show investigated every aspect of our everyday life and how it could be if we meet the goal of being climate neutral by 2050. How we'll live, what we'll wear, how we'll move and what we'll eat.

What I found most interesting was the ideas of how food could be produced in the future. I have always been very interested in food, but I only been focused on making something new of what I already have in my fridge instead of questioning where it comes from. More often than I want to admit, I've forgotten a cucumber or a bag of salad, resulting in waste of money, food and resources.

I have always relied on the producers to bring the goods to the store where I can collect what I want, with little thought on what's in season.


RAPPORT FRÅN 2050

INITIAL RESEARCH

In 2017 the Swedish parliament decided on a new climate policy framework, obligating the current and future governments to work for the same environmental goal: making Sweden climate neutral in 2045. This means that in 25 years Sweden will have net zero emissions of greenhouse gases into the atmosphere.[1]

For this to become a reality requires a lot of changes in how we live and act today. It is necessary that the governing politicians changes legislation to make it an environmentally friendly alternative to the best and smartest one. It is necessary that producers think more long term, choose better materials with a cyclic thinking, and not just with profit in mind. For us as consumers, it means that we are not allowed to emit more than one ton of CO2e per year annually. Today that number is almost ten times more.[2]

Although this sounds scary and gruesome, I still found it quite abstract. What does this fact actually mean for me as an individual? To better understand what this represent, I decided to dig deeper into what the numbers consists of.

1. Miljödepartementet. Det klimatpolitiska ramverket. *Miljödepartementet.* 2017-06-12. https://www.regeringen.se/artiklar/2017/06/det-klimatpolitiska-ramverket/ (2022-08-10)
2. Naturvårdsverket. Konsumtionsbaserade växthusgasutsläpp per person och år. *Naturvårdsverket*. https://www.naturvardsverket.se/data-och-statistik/konsumtion/vaxthusgaser-konsumtionsbaserade-utslapp-per-person (2022-08-10)

THE CARBON FOOTPRINT

According to Naturvårdsverket, the average carbon footprint per person and year are 9,01 CO2e tonnes in Sweden. Although the emissions from all sectors decreased over the past 14 years, the average Swede still has a significantly higher climate impact than the global average.[3]

About 40% of the Swedish carbon footprint is linked to public consumption and investments, whereas the remaining 60% relates to household consumption. Though it might (often) feel overwhelming when thinking of how one can stop an approaching climate crisis, this shows that the choices you make in your everyday life do have an impact. The household consumption of food stands for 1,4 tonnes alone, making it the second largest source of emissions for domestic consumption. This made me curious to investigate what could make the food sector a bit more sustainable.[4]

3. Naturvårdsverket. How can I reduce my carbon footprint? *Naturvårdsverket.* https://www.naturvardsverket.se/en/topics/climate-transition/omraden/klimatet-och-konsumtionen/how-can-i-reduce-my-carbon-footprint?_t_hit.id=Boilerplate_Episerver_Features_EpiserverFind_Models_EpiserverFindDocument/6210_en&_t_q=consumption (2022-08-10)

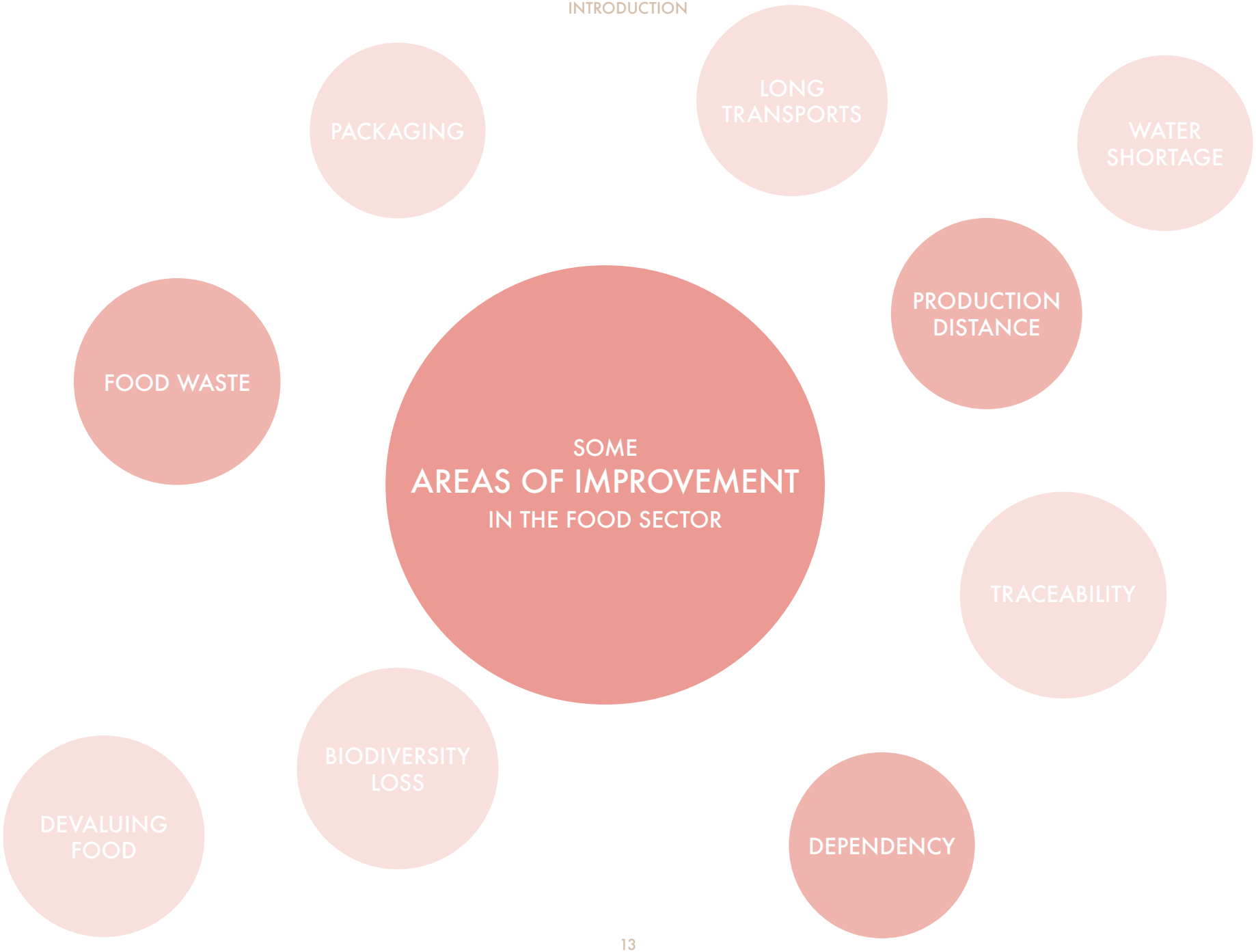
4. Naturvårdsverket. Konsumtionsbaserade utsläpp per person.

EMISSONS IN THE FOOD INDUSTRY

I found it hard to grasp what were the goods and bads in the food industry. What was ideal from one perspective could have a horrendous impact from another point of view. For example, cattle production requires lots of energy, and the animals burp out methane gas several times during the day. On the other hand, they can eat what humans can't and secure open pastures, which is beneficial for biodiversity.[5]

What is clear is that the food industry needs a few greener changes. As of today, food production stands for about 26% of the global greenhouse gas emissions.[6]
At the same time, it is crucial to find solutions to produce more food, as food production needs to increase by 70% by 2050.[7] And it needs to succeed without straining the environment further.

5. Livsmedelsverket. Meat – beef, lamb, pork and chicken. *Livsmedelsverket* https://www.livsmedelsverket.se/en/food-habits-health-and-environment/food-and-environment/eco-smart-food-choice/meat--beef-lamb-pork-and-chicken (2022-08-10)
6. Hannah Ritchie and Max Roser. Environmental Impacts of Food Production. *Our World in Data.* 2020. https://ourworldindata.org/environmental-impacts-of-food#food-production-is-responsible-for-one-quarter-of-the-world-s-greenhouse-gas-emissions (2022-08-10)
7. FN:s regionala informationskontor för Västeuropa. FAO: Klimatförändringen och bristande tillgång till mat kan lösas tillsammans. *FN:s regionala informationskontor för Västeuropa.*https://unric.org/sv/fao-klimatfoeraendringen-och-bristande-tillgang-till-mat-kan-loesas-tillsammans/ (2022-08-10)


SOME
AREAS OF IMPROVEMENT
IN THE FOOD SECTOR
PACKAGING
LONG TRANSPORTS
WATER SHORTAGE
PRODUCTION DISTANCE
FOOD WASTE
TRACEABILITY
BIODIVERSITY LOSS
DEVALUING FOOD
DEPENDENCY

3 MEGA ISSUES

After identifying different areas of improvement within the food industry, I chose the subjects I felt most intriguing. The top three candidates I chose were dependency, food waste and faraway production.

FOOD WASTE

As many as 821 million people go hungry, yet 1/3 of all food produced for consumption globally goes to waste. That equals 1.3 billion tonnes of food becoming trash instead of being eaten.

Besides being a humanitarian disaster, it is a waste of valuable resources. According to the Food and Agricultural Organization of the United Nations (FAO), to grow one tomato requires 13 litres of water and around 50 litres of water to produce one orange. Nevertheless, FAO estimates that up to 45% of all produced fruit and veggies end up as food waste.[8]

Edible food that ends up as waste happens everywhere throughout the supply chain. In Sweden, however, more than 2/3 of the food waste occurs in households.[9] It might happen as the food is forgotten in the dark corner of the fridge, if it doesn't live up to the beauty standard, or if the consumer doesn't show an interest in leftovers. But in the end, it is a lack of respect for the time, work and energy invested into growing that particular item.

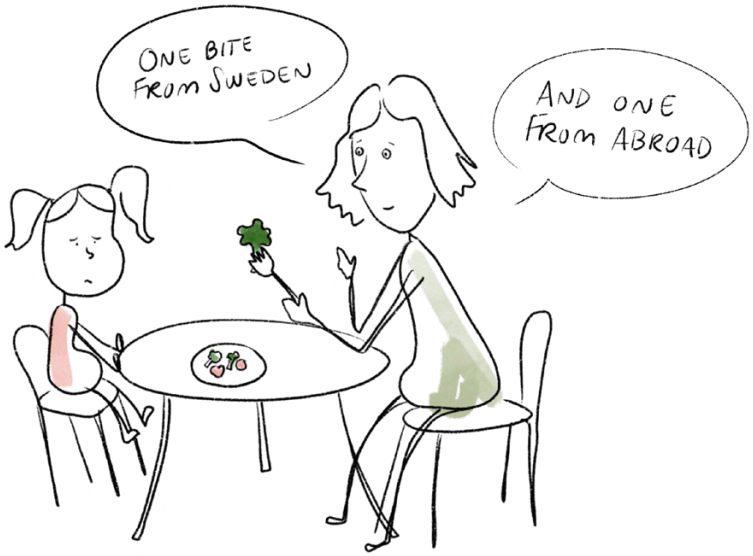
8. FN:s regionala informationskontor för Västeuropa. Matsvinnet ökar samt hunger runt om i världen. *FN:s regionala informationskontor för Västeuropa*. https://unric.org/sv/okad-hunger-och-matsvinn/ (2022-08-10)
9. IVL Svenska Miljöinstitutet. Över en miljon ton livsmedel slängs i Sverige. *IVL Svenska Miljöinstitutet*. 2022-05-30. https://www.ivl.se/press/nyheter/2022-05-30-over-en-miljon-ton-livsmedel-slangs-i-sverige.html (2022-08-10)

DEPENDENCY

In the past 30 years, Sweden's capacity to supply food has fallen by 25%. From 75% in the early 90s to a self-sufficient rate at 50% today. As we have outsourced more and more of our food production, we have become very dependent on surrounding and faraway countries to produce and deliver food to us. According to The Federation of Swedish Farmers (LRF) Sweden is only self-sufficient in three kinds of foodstuff: sugar, carrots and cereals.

While this would ensure our supply of carrot cakes, it would probably not be suitable for a sustainable diet in the long run. Even though the Swedish climate is quite stable, and we have been spared from major natural disasters, this is not always the case for the countries Sweden depends on. Drought, flooding or other catastrophes far away that might not affect us directly can still hugely impact our lives. Because if we couldn't count on imports, the Swedish farmers would only be able to feed half the population.[10]

10. Lantbrukarnas Riksförbund. Sveriges matberedskap. *Lantbrukarnas Riksförbund.* 2022-03-21. https://www.lrf.se/politikochpaverkan/foretagarvillkor-och-konkurrenskraft/nationell-livsmedelsstrategi/sjalvforsorjning/ (2022-08-10)



FARAWAY PRODUCTION

The technical progress of the past century has drastically transformed how we get our food on the table. It feels a bit surreal that just a few generations ago, the typical household relied on being self-sufficient with a strict zero-waste mindset, and that locally produced food was standard.[11]

The industrialisation has enabled us to greater yields and constant access to fresh food from all over the world. But it has also created a distance between us and the food we eat, and the cultivation of crops isn't as present in our everyday life. Instead, we depend on boats, trucks, trains and planes to bring us the food when it's ready to consume. Although transportation only stands for about six percent of the emissions within the food industry,[12] the bigger problem is what the distance does to the relationship with our food.

Most of us have very little or no contact with the food until we meet the particular item in store. This change has created a careless attitude towards our food and ignorance of using preserving methods instead of throwing food. Faraway transports enable access to all kinds of foods regardless of what's in season and makes it normal to fly in asparagus all year round, instead of appreciating it fully when it is in season.

11. Matkult. Om jordbruket och maten. *Institutet för Språk och Folkminnen.* 2018-05-18. https://www.matkult.se/jordbruket-och-maten/om-jordbruket-och-maten.html (2022-08-12)
12. Ritche and Roser. Environmental Impacts of Food Production.

3 MEGA TRENDS

In parallel to researching issues of today's food industry, I also investigated future trends on how society might develop in future. The trend research led me to three mega trends that might affect our future daily life.

POPULATION GROWTH

We are currently 7.7 billion people living on Earth, and we expects to become even more in the coming decades. Although the UN projects the growth rate to slow down, we will still be more people sharing the same planet. In a study from 2019, the UN predicts that the world population will grow to 9.7 billion in 2050, to then increase to almost 11 billion at the end of this century.[13]

More people means more people to feed, and FAO estimates that global food production needs to increase by 70% by 2050 in order to suffice for all 9.7 billion people.[14]

13. UN Department of Economic and Social Affairs. Growing at a slower pace, world population is expected to reach 9.7 billion in 2050 and could peak at nearly 11 billion around 2100. *UN Department of Economic and Social Affairs.* 2019-06-17. https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html (2022-08-13)

14. FAO Nordic. Högre livsmedelspriser förväntas under de kommande tio åren, osäker tillgång till mat fortsatt skäl till oro. *FAO Nordic.* 2010-06-15. http://www.fao.org/liaison/nordic/70908/se/ (2022-08-13)

RAPID URBANISATION

It might not be a new trend, but urbanisation is not likely to subside in the coming years. On the contrary, more people are expected to move to urban areas and at a faster pace. There are today 33 megacities in the world, which defines as cities with at least 10 million habitants. The UN believes that the megacities will grow even bigger, and the next ten years will give us ten new megacities. In 2050 the UN projects that 67% of the world population will live in urban areas.[15]

For this to be a successful development, it is crucial that it's done sustainably. One way is to investigate how a city can become more self-sufficient, as this would make it less vulnerable if a crisis hit.

15. Henrik Höjer. Här växer megastäder fram. *Forskning & framsteg.* 2020-07-02. https://fof.se/artikel/har-vaxer-megastader-fram (2022-08-13)

NEO-ECOLOGY

More and more people are becoming aware of the difficulties that we and the climate are facing. Climate change is not a subject that only concerns scientists or worrisome teens anymore. Even bigger corporations are realising that acting ecological is being economical and that a sustainable change can create great value for a business.[16]

Everyone, from the big industry to the end consumer, needs to explore solutions on how we can operate and use resources in a more sustainable manner.

16. Daniel C. Esty and David A. Lubin. The Sustainability Imperative. *Harvard Business Review*. 2010-05. https://hbr.org/2010/05/the-sustainability-imperative (2022-08-12)

URBAN FARMING!

GROWING OR PRODUCING FOOD IN
A CITY OR HEAVILY POPULATED AREA

URBAN FARMING

While I dug deeper into the problems and possibilities of today's food production, one term kept popping up more and more. It felt like it was right on the sweet spot between the issues and trends that I was searching for.

Urban farming or urban agriculture is the notion of "*cultivation, processing and distribution of agricultural products in urban and suburban settings*".[17]

Though it felt like a revelation to me and my project, it is hardly a new concept. Urban farming has been a concept for as long as urban areas have been around, and evidence has been found of developed garden systems in Mesopotamia, 3500 BC.[18] It just seems like it got lost on the way.

17. National Agricultural Library. Urban Agriculture. *National Agricultural Library.* 2022-02-01. https://www.nal.usda.gov/legacy/afsic/urban-agriculture (2022-08-13)
18. Anisa Holmes. A brief history of urban farming… to urban gardening. *The Green Conspiracy.* 2018-09-13. https://thegreenconspiracy.com/history-urban-gardening/ (2022-08-12)

Anna Lindhagen, 1870-1941.

A LITTLE BIT OF HISTORY

As said, urban farming isn't something new. One example is allotments, a concept that has its roots in 1860s Germany. At first, they intended to be a place of play for working-class kids, but the primary purpose quickly shifted to be a plot for growing crops. The idea rapidly grew in Europe and spread to Denmark and Sweden. The nurse Anna Lindhagen brought the concept to Stockholm as she was worried about the health of the kids living in cities. She saw allotments as an opportunity to access fresh air, fresh food and new social connections.[19]

A lecture in the art of growing potatoes, at Sveavägen, Stockholm, 1942.

Allotments have played an important part for cities during times of crisis, in Sweden and abroad. During the two world wars, the UK and US governments promoted war gardening as a supplement to the farmers' food supply.[20] In Stockholm, the 5800 allotments of the city manage to produce 870 000 kg of potatoes in 1917 alone.[21]

As the living standard improved after WW2 ended, the interest and need for allotments steadily declined. However, the last 20 years of environmental awakening have broken the declining trend. Allotments have once again caught people's interest, with an extra boost when the Covid crisis hit.[22]

19. Folke Schimanski. Stadsbornas kolonilotter livsviktiga vid kriser. *Populär Historia*. 2008-07-28. https://popularhistoria.se/vardagsliv/stadsbornas-kolonilotter-livsviktiga-vid-kriser (2022-08-13)
20. Ellie Howard. Victory gardens: A war-time hobby that's back in fashion. *BBC*. 2020-05-26. https://www.bbc.com/travel/article/20200524-victory-gardens-a-war-time-hobby-thats-back-in-fashion (2022-08-13)
21. Folke Schimanski. Stadsbornas kolonilotter livsviktiga vid kriser.
22. Charlie Olofsson. Kolonilotten – en odlingsplätt med lång hållbarhetshistoria. *Extrakt*. 2022-04-21. https://www.extrakt.se/kolonilotten-en-odlingsplatt-med-lang-hallbarhetshistoria/ (2022-08-13)

An American propaganda poster.

"ALL CITIES, BIG OR SMALL, CAN AND MUST HELP BUILD SUSTAINABLE, RESILIENT FOOD SYSTEMS OF THE FUTURE"

José Grazianao da Silva,
former Director-General of FAO, 2016

SELF-SUFFICIENT CITIES

Food is a basic need and we need to eat every day to function properly. Yet food security has not been a priority in the planning and development of urban areas for a long time.[23] The food supply chain we rely on is fragile and dependent. A shortage of energy, a closed border or another unforeseen instability could have a huge impact on our access to food. Consequently, urban farming will become a necessity in the future to make cities less vulnerable to unexpected crises.

To achieve a total self-sufficient city might be tricky though, since crops such as cereal require large areas.[24] But living in a city that covers its need of veggies, berries and legumes could be a possibility in the future. According to a study by The Swedish University of Agricultural Sciences (SLU), the gardens, allotments and green urban areas could provide a vegetarian diet for over 5 million Swedes.[25] And a study by Sweco show that the city of Gothenburg has potential to be self-sufficient of vegetables.[26]

Utilizing unused but existing places such as rooftops as cultivation areas and investigating alternative gardening methods could also increase urban agriculture. But for that to become a reality ruling authorities must make room for the green boom in urban planning.

23. Food and Agriculture Organization of the United Nations. Feeding the cities of the future. 23. *Food and Agriculture Organization of the United Nations*. 2016-10-14. https://www.fao.org/news/story/en/item/446763/icode/ (2022-08-14)
24. Mia Sjöström. "I framtiden måste vi odla i städerna". *Svenska Dagbladet*. 2012-06-26. https://www.svd.se/a/eff1b38f-3ead-3cfe-a798-4bb4532f1886/i-framtiden-maste-vi-odla-i-staderna (2022-08-14)
25. Karin Svensson. Den lokala maten – En kartläggning över initiativ och möjligheter. *Mistra Urban Futures*. 2014, s. 8. https://www.lansstyrelsen.se/download/18.3da1c377162bd90d9ee129ed/1526068465075/karin-svensson-den-lokala-maten-kartlaggning.pdf (2022-08-14)
26. Sweco. Göteborg kan bli självförsörjande på grönsaker. *Sweco*. 2022-07-26. https://www.sweco.se/aktuellt/nyheter/goteborg-kan-bli-sjalvforsorjande-pa-gronsaker/ (2022-08-14)

A community garden, Brooklyn NY.

RECONNECTION TO WHAT WE EAT

Though self-sufficient cities still are a hope for the future, urban farms give us access to a soft yet crucial value today. It gives you a better understanding of the natural systems we are a part of and a much deeper appreciation for the food you eat.

It is easy to forget all the hard work invested in agriculture when you only pick up your veggies at the store. But once you grow your own broccoli, it is hard to ignore the great effort of the people who bring us our food.[27]

27. Nathanael Johnson. Urban farms won't feed us, but they might teach us. *Gist*. 2014-04-29. https://grist.org/food/urban-farms-wont-feed-us-but-they-just-might-teach-us/ (2022-08-14)

inital brief

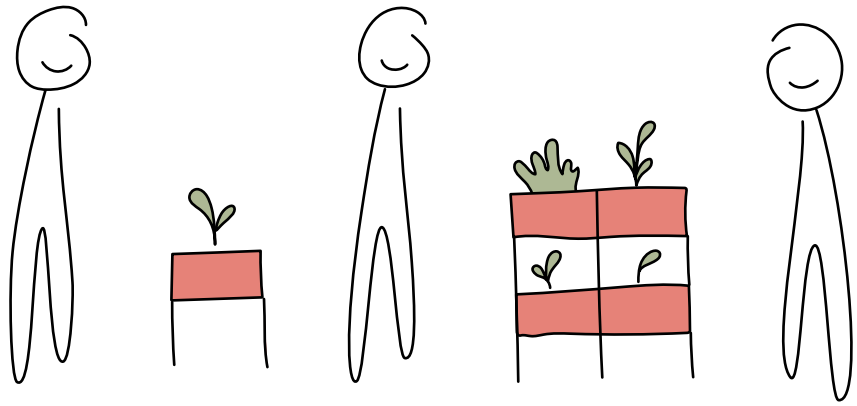
Design a product which enables self-sufficiency in urban areas and that can help the consumer to reconnect with their food.

CONFLICT OF INTERESTS

I wanted a product that could utilize the cities as cultivation areas. At the same time, I wanted to help people reconnect with their food and thus value it more.

Initially I had an idea of a product which could grow, as you want to grow more vegetables. My idea was a gardening product for a sole user, that could connect to a larger system in a shared community to get greater yields. However, gardening can be a complex area. My supervisor Anna made me realize that I had to decide who my user would be and the scale of the product. How many people does it need to feed for it to make a change and be a challenger to the existing food production?

If I would focus on a product for a bigger scale, my target would be the producer rather than the end-consumer. And that might not necessary mean that I could help people reconnect with their food. If concentrating on the end-consumer, the mission would be to create an awareness about self-sufficiency rather than making the user totally independent.



THE TIPPING POINT

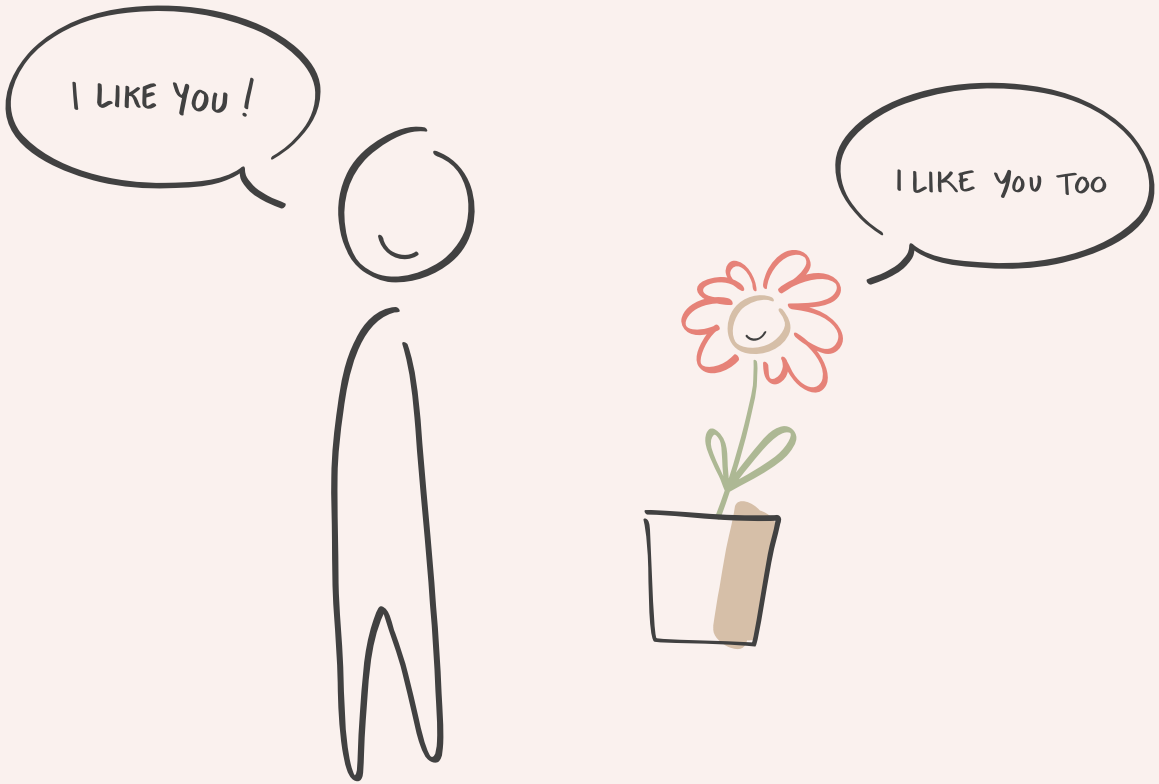
While debating with myself which direction I should go, I came across the theory of biophilia. The word comes from Greek and simply translates to the love of life and living things. The concept is from the 60s and suggests that humans have an intuitive love of nature. That it is in our DNA to care for and cultivate plants to grow food. That we have a physiological need to feel connected to nature. Being in contact with the natural world is beneficial for our mental health and wellbeing.[28]

Shortly after discovering biophilia, I found out about gardening therapy, where gardening is a complement to the treatment. The combination of ordinary talk therapy and gardening has proven to be very successful for burnout and depression, and more effective compared to other treatments.[29]

I really liked the concept of biophilia, and how it could improve one's health being around plants. Biophilia became the tipping point I needed, and I decided to focus on the end-consumer and how to create a growing interest in gardening.

28. Planteria Group. Biophilia – What is it and why is it important? *Planteria Group.* https://www.planteriagroup.com/blog/biophilia-what-is-it-and-why-is-it-important/ (2022-08-14)
29. Jenny Lagerstedt. Forskning visar: Trädgårdsterapi effektivt mot utbrändhet. *Svt Nyheter.* 2018-11-25. https://www.svt.se/nyheter/inrikes/forskning-visar-tradgardsterapi-effektivt-mot-utbrandhet (2022-08-14)

LOVE OF LIFE AND LIVING THINGS



2. analysis

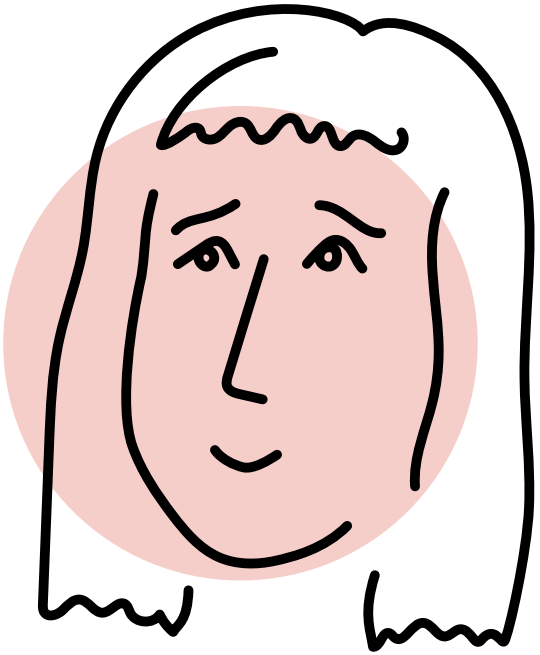
2nd brief

Design a product for home usage that promotes
a self-sufficient crop production and enables a growing interest.

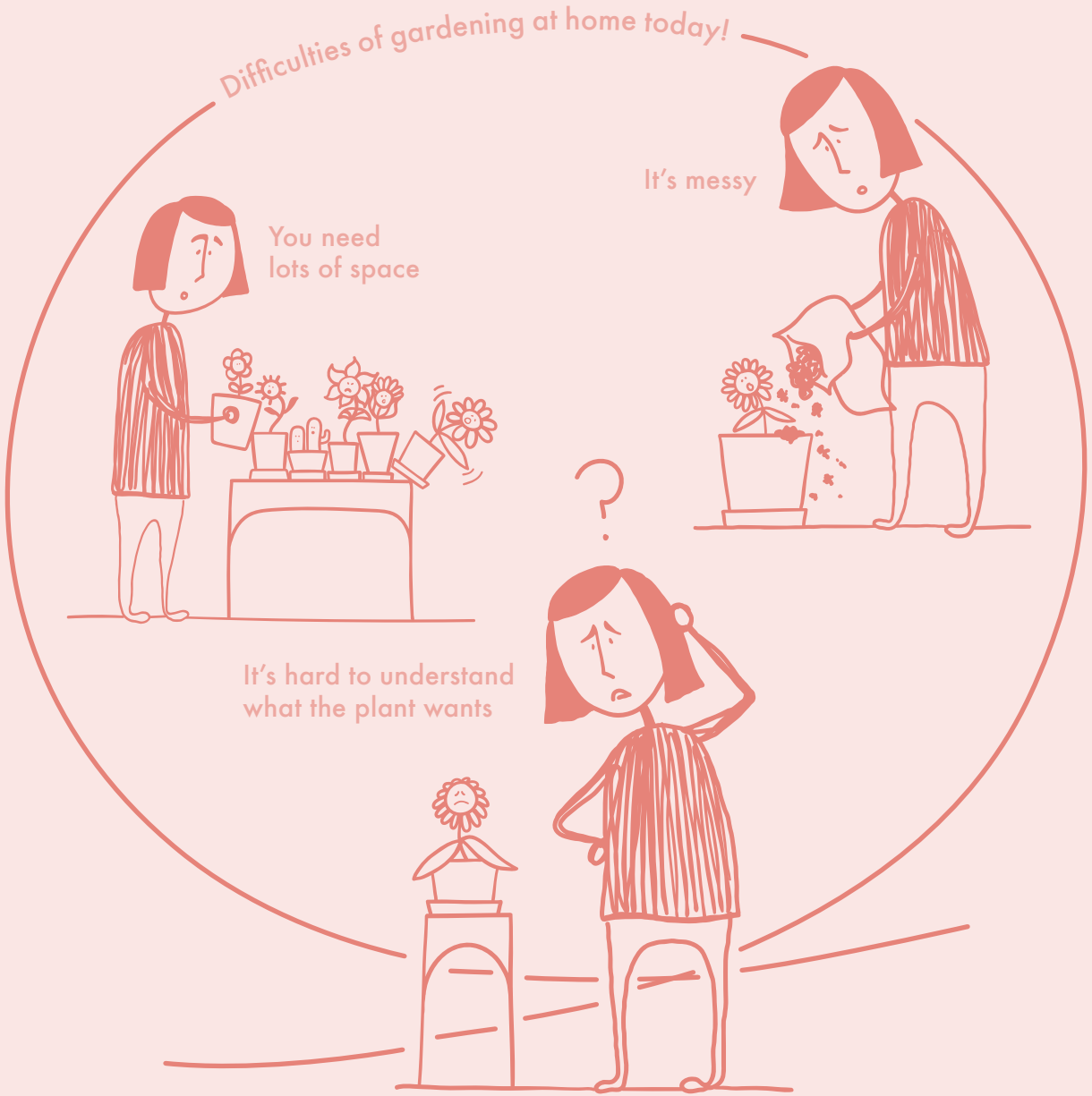
TARGET GROUP

In a trend study from 2018, I learned that millennials, Generation Y, has a rising interest in growing their own food. Gen Y worries about climate change, and veganism or a vegetarian diet is the new normal. This has sparked an interest in gardening among the millennials, and up to 27% grow their own veggies or herbs. Some of them dream of being self-sufficient.[30]

30. Hasselfors Garden. Framtidens odlare. Hasselfors Garden. 2018. https://mb.cision.com/Public/14723/2683204/b27a72ed644e162f.pdf (2022-08-14)



- 20-35 years old
- Lives a smaller urban apartment
- Worries about climate change
- Has a recent interest of gardening, but no knowledge about it


Difficulties of gardening at home today!
You need lots of space
It's messy
It's hard to understand what the plant wants

PLANT PROBLEMS

To understand difficulties when gardening at home I asked a few of my friends that are interested in plants. I identified three common problem areas regarding home growing.

YOU ALWAYS LACK SPACE

As most veggies are sown in Spring, your apartment will be overflooded with small containers. The windowsill fills up quickly as the seedings require lots of light. Since all seedings might not be successful it's safer to sow a few of each kind. Hence the overflooding.

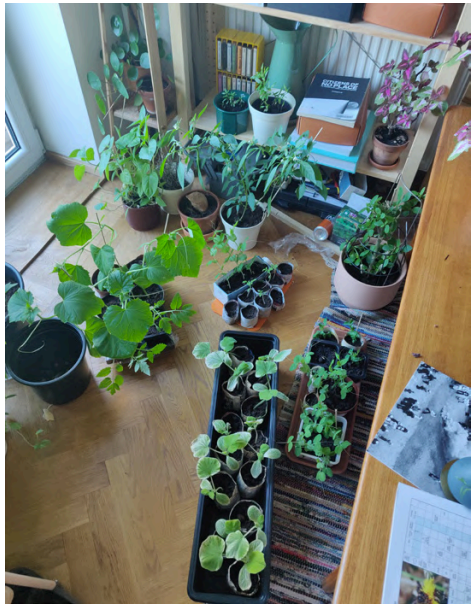
REPOTTING EQUALS MESS

A shared experience when repotting plants is that you get soil everywhere in your home. Not to mention the dirt under your fingernails.

YOU SPEAK DIFFERENT LANGUAGES

Understanding why the plant isn't thriving can be tricky to figure out. It is often easy to see when a plant is feeling blue, but harder to understand why it is sad. Is it a lack of water? Or is it drowning? Does it need nutrients or is it overfed? Does it need more sunshine or has it had enough? Has it become a hotel for unwelcomed pests? And so on.

An example from a dear friend. When the seedings had occupied the available space at the windowsill, they began to take over the floor.



FUNCTION ANALYSIS

Based on what I found in my trend research, and the insights I got from my friends I decided to make a function analysis. It needed to be easy to use and space-efficient. Hopefully, it could also spark an interest in gardening edible greens for someone that yet didn't have green thumbs.

function analysis

Grow	vegetables	MF
Be	easy to maintain	N
Fit	in a smaller apartment	N
Require	little knowledge about gardening	N
Promote	interest of self-sufficiency	D
Promote	a growing interest	D

MARKET ANALYSIS

I found a lot of different variants when I analysed the market for home growing. Some of them were very simple. They were made of cheap materials and didn't require electricity, but show that you don't need much to start your home growing. Others had more refined materials and offered a light source to boost growth. A few of the ones I examined more were hydroponics systems. Hydroponic gardening is a soil-free method, I found the technique very intriguing and decided to investigate it further.

expensive

high-tech

low-tech

cheap

HYDROPONICS

I have always thought that soil is necessary when growing plants, but through my research, I learned that the soil is only a medium for carrying nutrients to the plant. Essentially, plants need sun, oxygen and nutrients to thrive. And of course, water. The word hydroponic comes from Greek and translates to working water. Hydroponics gardening is a soil-free method. Instead, the plant accesses the nutrients via nutrient-infused water.[31]

BENEFITS

Hydroponic gardening comes with several benefits. It often results in a greater yield as the crop grows faster. You have more control over how much nutrients to give the plant and it eliminates the risk of soil-borne diseases. It is considered to be space-efficient, as you can grow more in a smaller area.

LIMITS

However, there are some drawbacks to hydroponics. It can be a bit tricky to start with, compared to using soil. Some hydroponic systems require electricity, which means that you need special gear to get started. Hydroponic is great for crops that grow fast, such as herbs, salads and tomatoes. Crops that grow below ground, like potatoes are often not suitable for hydroponics.

DIFFERENT ALTERNATIVES

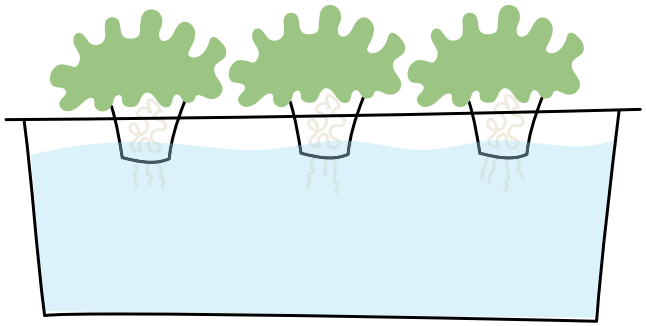
There exist a few different hydroponic systems. They are all based on the same idea, with nutrient-infused water, but the setup can differ quite a lot. Some are better for home growing, whereas others are more suitable for big-scale production.[32]

31. Niklas Hjelm. Vad är hydroponisk odling? *Hemmaodlat.* 2020-11-25. https://www.hemmaodlat.se/odla/vad-ar-hydroponisk-odling/ (2022-08-15)
32. NoSoilSolution. 7 different types of hydroponic systems. *NoSoilSolution*. https://www.nosoilsolutions.com/6-different-types-hydroponic-systems/ (2022-08-15)

ONE LEVEL SYSTEMS

DEEP WATER CULTURE

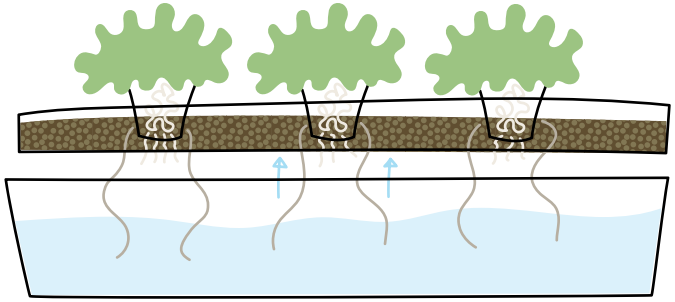
In a DWC system, the roots are suspended directly in the water. As the roots constant have access to both oxygen and nutrients this method can give a great yield.



- The most basic one
- Does not recirculate the water
- Does not require a water pump
- Suitable for beginners
- Suitable for plants that love water

WICK SYSTEM

Similar to the DWC, but instead of the roots being suspended in the nutrient solution uses one or several wicks that leads the solution to the roots.

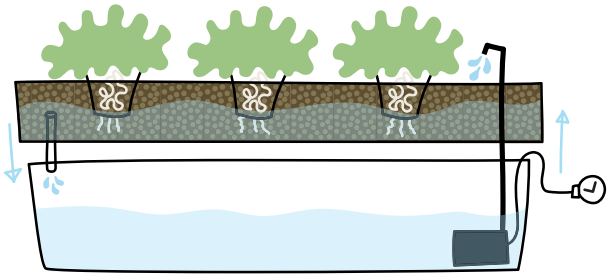


- Does not require a water pump
- Does not recirculate the water
- Suitable for beginners
- Suitable for crops that don't want too much water

TWO LEVEL SYSTEMS

EBB & FLOW

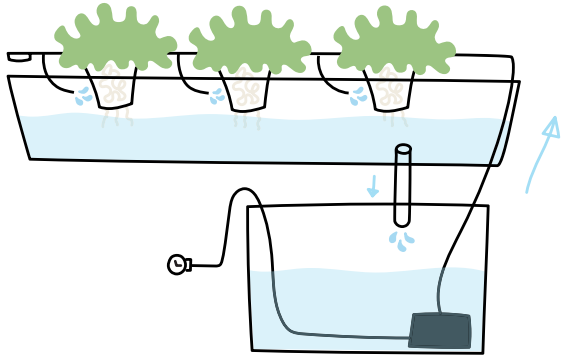
In an ebb & flow system, the plants are placed in a grow bed that is either flooded or drained. A timer controls when the beds are flooded, and a drain makes sure that it doesn't get overflooded.



- Recirculates the water
- Require a water pump and timer
- Suitable for most plants, even some root vegetables

DRIP SYSTEM

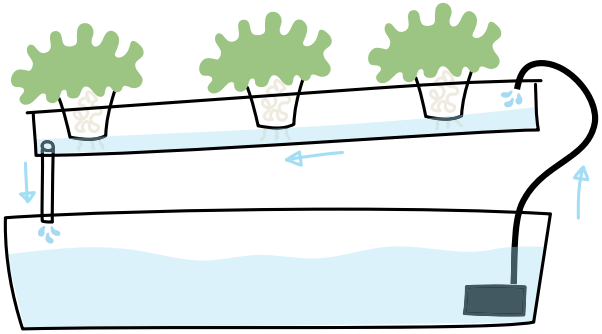
The drip system uses tubes that water directly on the base of the plant. The excess water runs down back to the water bank before being pumped up again.



- Recirculates the water
- Require a water pump
- Possible to tailor the flow
- Suitable for most plants

NUTRIENT FILM TECHNIQUE

Here the plants are placed into slightly sloped channels. A water pump transports the nutrient solution to the channel and passes the roots before flowing back to the water tank.



- Requires water pump
- Easy to scale up
- Suitable for plants with small root systems, like leafy greens.

TESTING HYDROPONICS

In the past years, my interest in plants has grown and I really enjoy taking care of my indoor plants. Despite my interest, I wouldn't go as far as to say that I have green thumbs. More than once a plant has left my home in a trash bag after being in my care. Nor have I tried out growing edible plants, so I was eager to try out after reading all the praise about hydroponics. I decided to test a DWC system, as it would be the fastest one to get started with.

The growth didn't quite live up to my expectation. It didn't require much energy to set it up, but it didn't give at all the yield I had imagined. This outcome can have numerous reasons. At the store, I noticed at they sold seeds specifically for hydroponics. I didn't choose them as they were more expensive than the ordinary seeds. Another explanation might be that I didn't change the water often enough, which could make it low in oxygen. It is also possible that the environment wasn't ideal. My window faces east and doesn't offer many sun hours. Or maybe my thumbs just aren't green enough.

In hindsight, I didn't put in all the effort I should have for my first hydroponic garden. So with that in mind, maybe the yield was alright after all.

FOUR WEEKS

SIX WEEKS

THE COMMUNITY

Even though my knowledge of growing plants is quite limited, it turnes out that there are lots of people out there who do know what they're doing. The more I read about hydroponics, the more I realised how big the hydroponic DIY-community was. To compensate my pitiful result, I spent a lot of time at hydroponic forums and watched many youtube videos. It did give me many valuable insights and some ideas too.

Cheap & Easy, DIY Flood And Drain Hydroponic System

30 647 981 OGILLA DELA LADDA NED THANKS KLIPP SPARA ...

How to make a Hydroponic System at home using PVC Pipe

2 635 2 45 727 OGILLA DELA LADDA NED THANKS KLIPP SPARA ...

#mrduzee1

Cheap & Easy DIY Hydroponics | Ditch the expensive stuff for a $1 Pool Noodle

Spara

1 909 ! 35 261 OGILLA DELA LADDA NED THANKS KLIPP SPARA ...

Basement Hydroponic Tower Garden Version 2.0

1 438 232 visningar... 21 204 OGILLA DELA LADDA NED KLIPP SPARA ...

#NYMO #Nyhetsmorgon

Nya trenden bland hemmaodlare – odla utan jord - Nyhetsmorgon (TV4)

46 744 visningar • 21 feb. 2019 297 OGILLA DELA LADDA NED SPARA ...

A very small fraction of all hydroponic community.

AEROPONICS

As I dug deeper into the world of hydroponics, I discovered the aeroponic system. This technique is also soil-free but has a crucial difference from the other hydroponic methods. In an aeroponic system, the roots are never submerged in water, instead, they dangle in the air. The nutrient solution is regularly sprayed on the roots with a mist nozzle.[33]

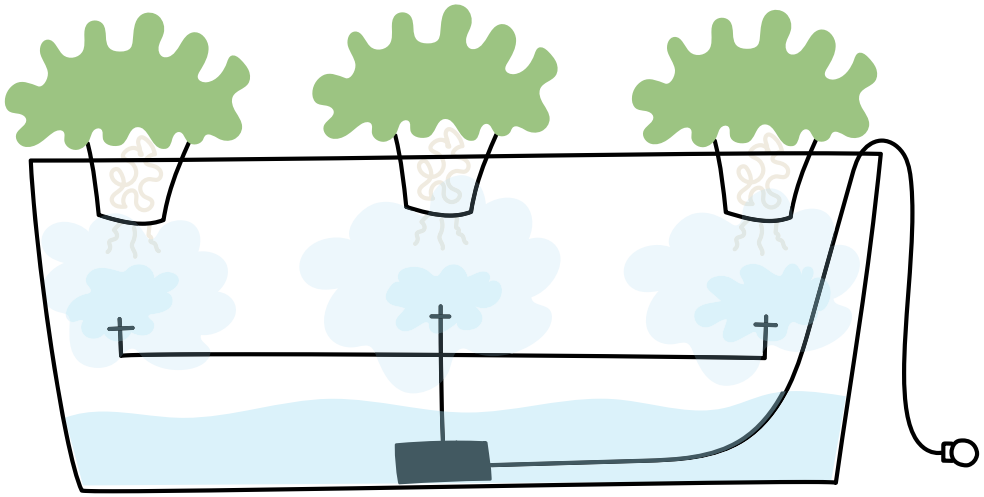
BENEFITS

Aeroponics has two primary benefits. First of all, it is very water-efficient. Compared to plants grown in soil aeroponics uses 95% less irrigation. The closed-loop system also requires less water than other hydroponic methods, as the water is sprayed on the roots.[34] Secondly, the roots are constantly exposed to oxygen, which gives a great growth boost. Since the roots have more space in an aeroponic system, it is possible to grow root veggies too. The system is also easy to scale up and very compatible with vertical setups.

LIMITS

In comparison to hydroponics, the aeroponic ones are a bit more complex to set up and maintain. The roots can't go long without misting, so if the nozzles clog up or the system fails, the crop will likely die.[35]

33. Brian Barth. How Does Aeroponics Work? *Modern Farmer.* 2018-07-26. https://modernfarmer.com/2018/07/how-does-aeroponics-work/ (2022-08-15)
34. Brio Hydroponics. Hydroponics vs aeroponics – which is better? *Brio Hydroponics.* 2020-03-27. https://briohydroponics.com/blog/hydroponics-vs-aeroponics (2022-08-15)
35. Barth. How Does Aeroponics Work?



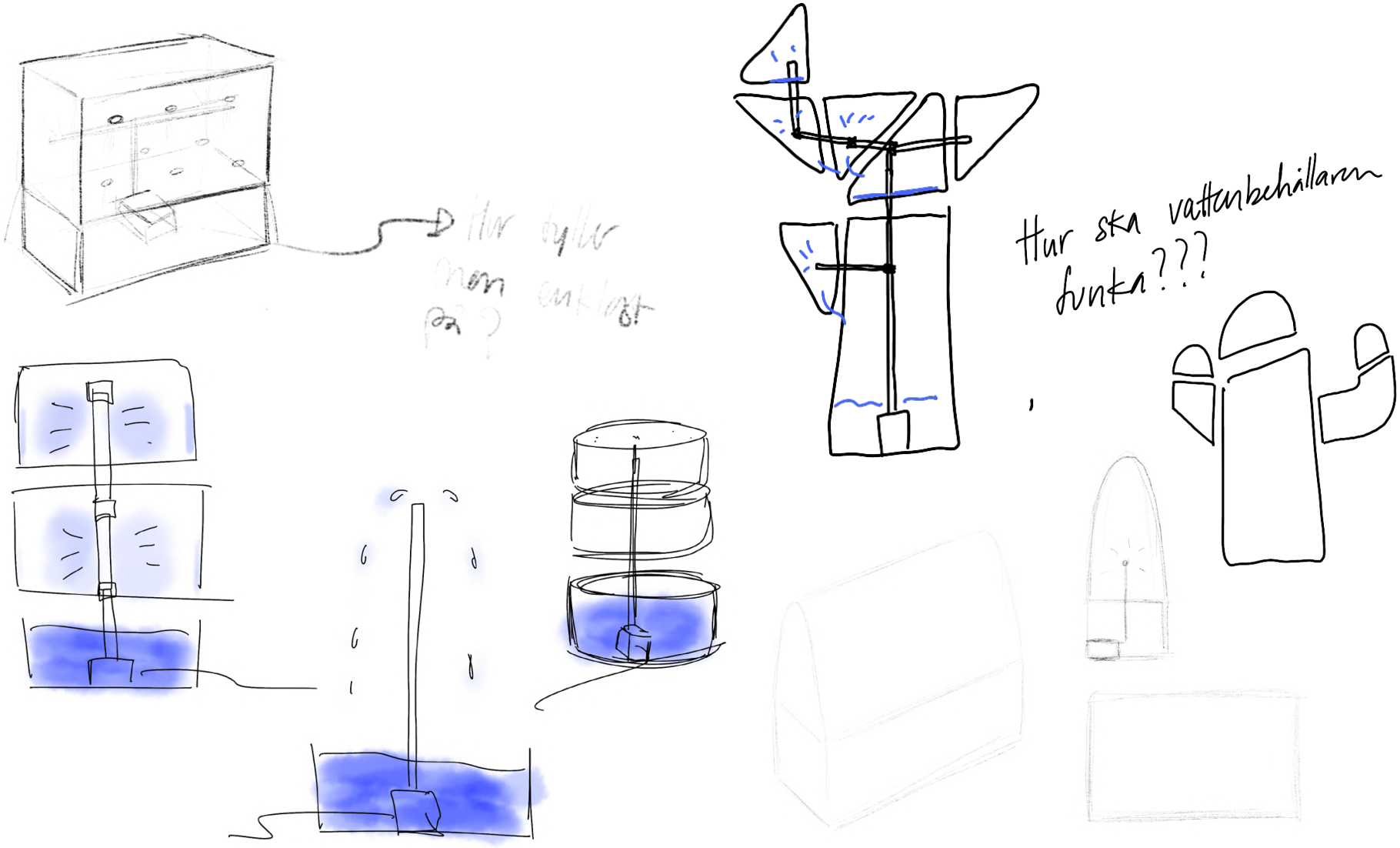
- Uses less water
- More space-efficient
- Expected greater yield
- Requires water pump and mist nozzles
- Higher level of maintenance
- Suitable for plants most plants

STUCK IN SKETCHES

I felt very intrigued by the promises of aeroponics. Even though it wasn't the easiest system, it seemed to have the most potential. At this point, I'd decided I wanted to incorporate modularity into my project. A modular product could grow as the interest in gardening grows, and I was very fond of that idea.

While looking at more DIYers and their homemade aeroponics, I started to sketch loosely. I wanted something different from the IKEA box most people used, and something else than the aeroponic towers.

But the more I sketched, the more stuck I got. I struggled with how I could combine aeroponics with modularity, and still ensure that the roots would have it nice and misty. And didn't it seem a bit too complicated to maintain such a system? After spending too many hours (days!) on the same problem it was time to make a decision, and I decided to ditch the aeroponic concept in favour of modularity.



A collection of struggling sketches, no wonder I was confused.

FOGPONICS

As I still didn't know which technique I wanted to focus on, I once again tried to find answers in the hydroponic community. After many youtube videos, I learned about fogponics, the technique considered to be aeroponics 2.0. A fogponic system is similar to the aeroponic one, both allow the roots to hang freely. But where an aeroponic system constantly sprays the roots with nutrient solution, the fogponics one relies on a thick fog to do the job. A mist maker is needed to create the fog. The mist maker has discs at the top that vibrate at a high frequency, which turn the water surface into tiny droplets. After just a few minutes, the mist maker has generated a thick fog.

BENEFITS

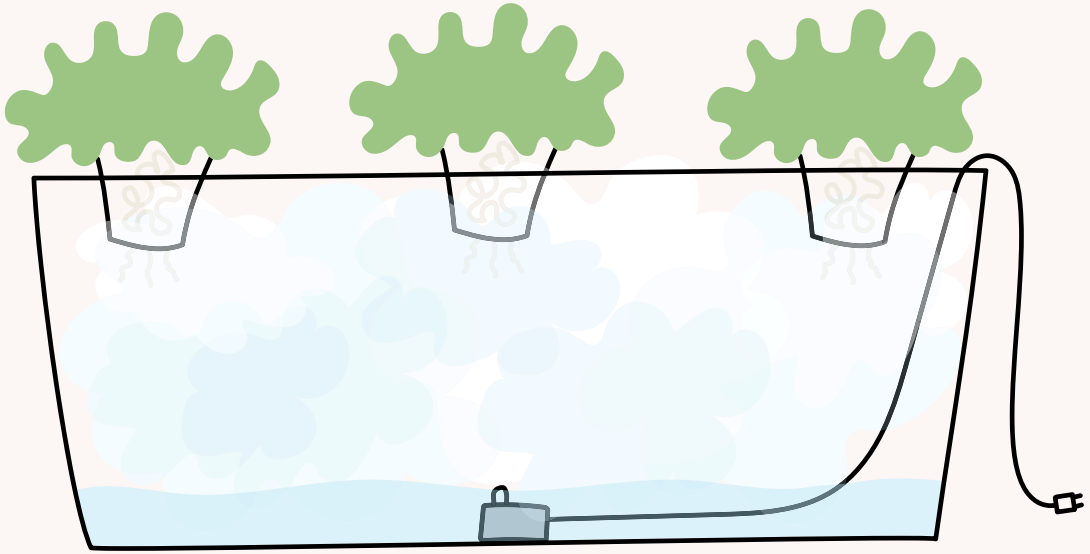
One of the advantages of fogponics is the tiny droplets of the mist. Smaller droplets are easier for the plant to absorb. That is especially beneficial for seedings and clonings, as their undeveloped root system is very sensitive.

A fogponic system is also easier clean compared to aeroponics. Instead of many nozzles that might clog, it is only one unit to maintain.

LIMITS

Just like aeroponic, electricity is needed for the system to work. Being turned off for just a few hours can result in withering plants.[36]

36. Trees.com. Fogponics – How to Grow with Fog. Trees.com. 2022-05-26. https://www.trees.com/gardening-and-landscaping/fogponics (2022-08-15)



- Very water-efficiant
- Expected greater yield
- Requires mist maker
- Needs a bit of maintenance
- Suitable for plants most plants
- Great for seedings

fogponics

Here is a big area to fill!

high-tech

low-tech

hydropnics

THE (NON-EXSISTING) FOGPONIC MARKET

Based on my research about the different hydroponic systems, I decided to continue to explore fogponics. Compared to the other techniques, it seemed fairly easy yet still gave a big yield. Whereas other systems require pumps and pipes to transport the water, a fogponics system only needs the mist maker to deliver the nutrient solution to the roots. I also learned that the systems that needed water pumps were quite noisy. That felt like a major disadvantage as I was focused on a product for home usage. The mist maker on the other hand was completely silent.

Furthermore, I couldn't find many existing fogponics products when examining the hydroponic market. And the only one I found didn't have much of a form factor.

3. ideation

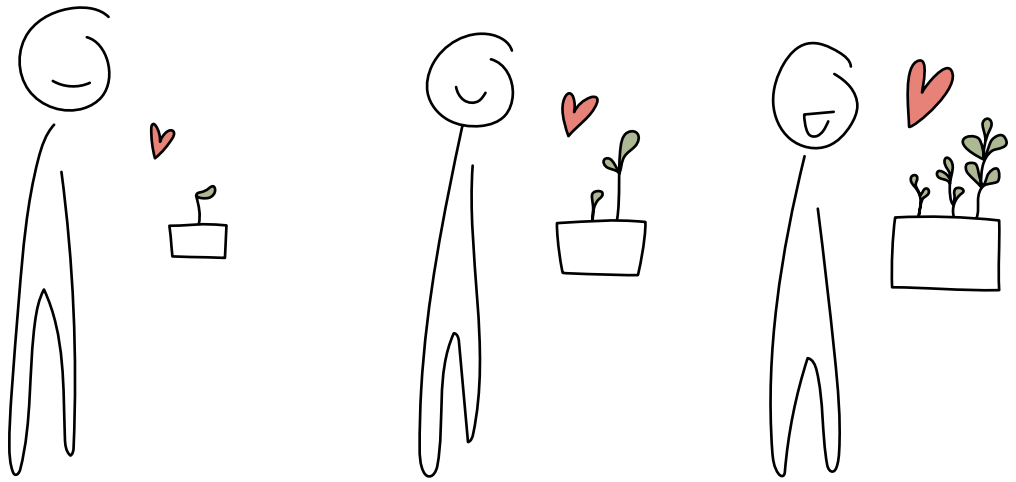
final brief

Design a product for home usage that promotes a self-sufficient crop production, enables a growing interest and uses fogponic technique.

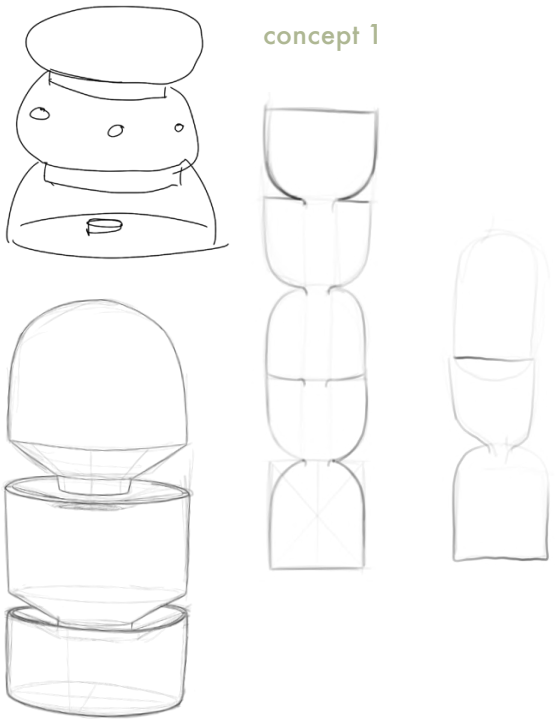
CONCEPTS

After settling on fogponics, I began to ideate how it could be fused with modularity into one concept. I doodled a bit to come up with ideas. The doodling gave me two types of modularity. In the first concept, all the modules would be the same or roughly the same size. The second concept would consist of one main compartment with smaller add-ons. That would make the product more interesting as the user grew more plants. I liked the idea that the modularity corresponded with the growing interest. It also connects how a plant changes its look as it grows bigger.

Although the first concept would probably be easier to manufacture, it felt like it had been done before. The second concept felt more fun to explore, and I decided to continue with that.



concept 1



kan man blanda geoforms?

like a cactus!

Baby sloths

concept 2

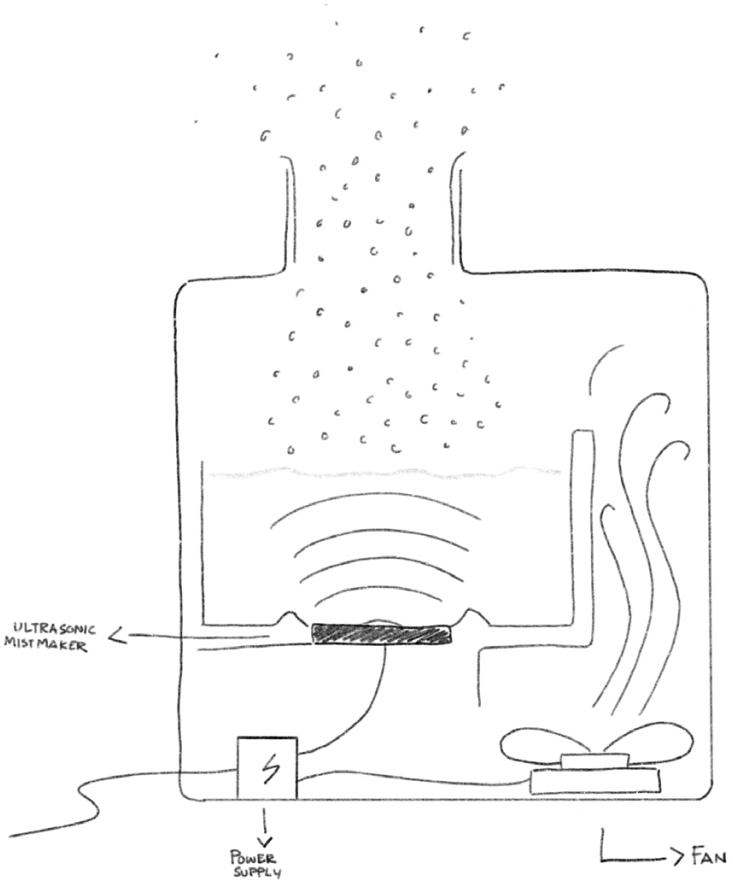
CONCEPT TESTING

Although fogponics felt very promising, I was a bit unsure if it would work. In most of the DIY videos I watched, people seemed satisfied with a one box-solution. In these videos, the mist makers filled up the box with thick fog easily, but I was worried that the fog wouldn't travel to the added modules. It was definitely time to test the concept.

1ST ROUND

I bought a cheap humidifier for the test. It didn't create fog the same way as a mist maker, but since I was only interested in the fog, I figured it would suffice. Then I attached two small PET bottles to a big one, to represent the main compartment and two modules. I hoped that once the first compartment was full, the fog start to fill up the second one, and so on.

The test was a fail. The humidifier managed to fill up the big bottle with fog, but as I feared, the fog wouldn't move to the added compartments.



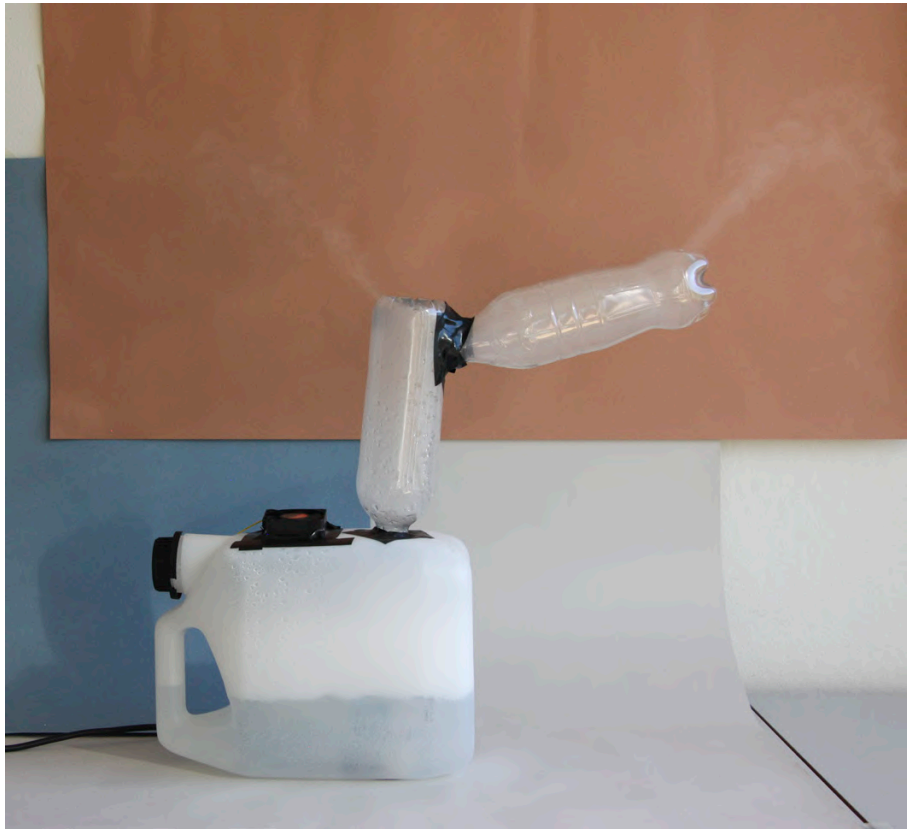
OTHER FOGGY PRODUCTS

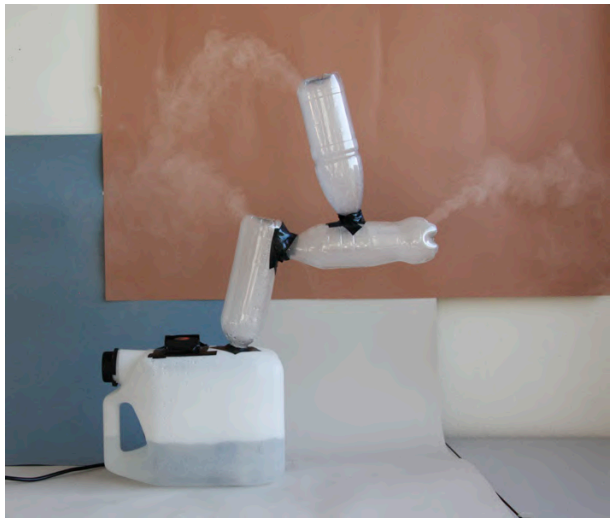
It was very disappointing with the failed test, as I badly wanted the concept to work. I didn't want to give up on the idea and began to look for other products that also use fog to see how they were designed. I found the answer I was looking for in the world of humidifiers and aroma diffusers. They too use a mist maker to create fog, and manage to move it out from the container. They have another crucial component, a fan, and I realised that was what I needed to my concept work.


Quiet
VITRUVI

2ND ROUND

I decided to try again, but this time with a fan and the real deal. I bought a mist maker and a small computer fan, that I attached to a 3V battery. For the second test, I really wanted to make sure that the modularity concept worked. I placed the mist maker in a water can and attached the first module. At first, the fog stayed in the can but as soon as I turned on the fan the fog quickly filled up the module. I added modules one by one, and to my delight the fog had no problem filling them up. This functional prototype proved that the concept worked. And it was a great boost for me!





CHOICE OF CONTEXT

It was time to decide the context, and I needed a bit more clarity than just the home. If it intended to sit on a windowsill, I could utilize the sun as light source. That would make the possibilities of placement a bit limited. If I incorporated LED lights into my design the product could be placed everywhere, but that would require more energy. I also had a hard time figuring out how a light source could fit with the modular design.

After a lot of debate with myself, I chose to go for the windowsill. I didn't want the product to look to complex, and grow lightning doesn't always have the nicest light.

Another perk of the windowsill was that it gave me a size restriction, it couldn't be too big or it couldn't fit a windowsill. Although windowsills come in different sizes, they are rarely wider than 250 mm. The standard is between 150-200 mm, whereas attached windows are usually between 150-180 mm.

SCULPTURAL

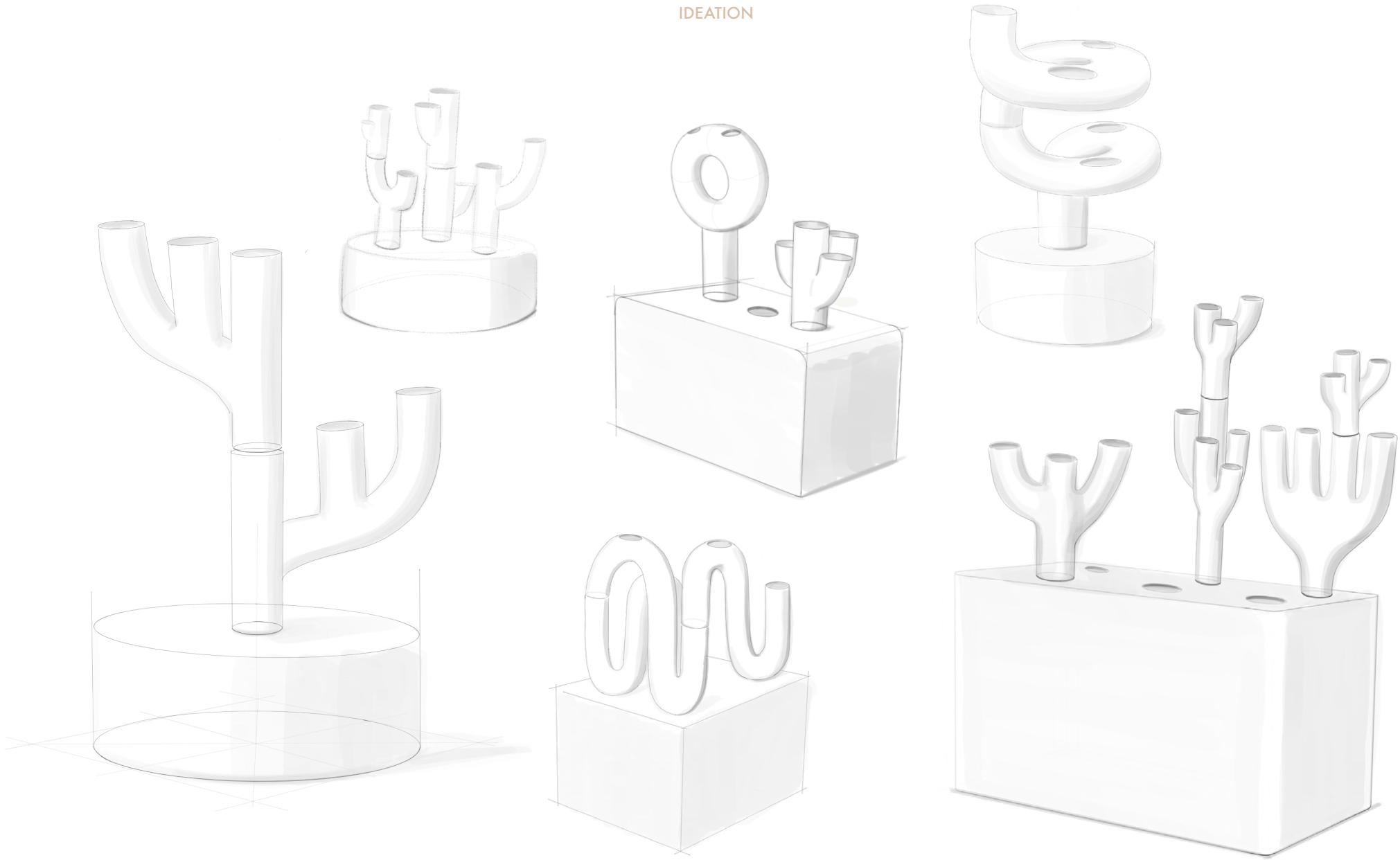
MOOD BOARD

PLAYFUL

SCULPTURAL INSPIRATION

As it would be placed indoors I wanted it to look more like an interior piece rather than a typical garden product (and far away from the DIY equivalents). I was inspired by how sculptures often are displayed at museums, standing on a white podium that puts the artwork in focus. I liked this idea and wanted to implement it in my design.

I wanted a simple base, so I began sketching. I decided that it should either be cylindrical or a box, other shapes felt too complex to keep the simplicity. The cylindrical podium had a friendly expression, which I appreciated. But a cylindrical base wouldn't be as space-efficient when sitting on a rectangular windowsill. With the right proportions and radius, a box could also have a friendly feeling. In the end, I decided to go for the simple box as the main compartment, allowing the modules and plants to be the centre of attention.



COLOUR, MATERIAL AND FINISH

The material choice was essential for it to be perceived as an interior piece. I wanted to avoid shiny plastics as it would spoil the impression. A material that I gotten to know pretty well during my BA is porcelain. It has a nice touch to the hand, is durable and waterproof. Porcelain is not a conventional material for hydroponic products but often used for interior objects. Picking porcelain as the main material was a suitable choice to distinguish my design from the existing products.

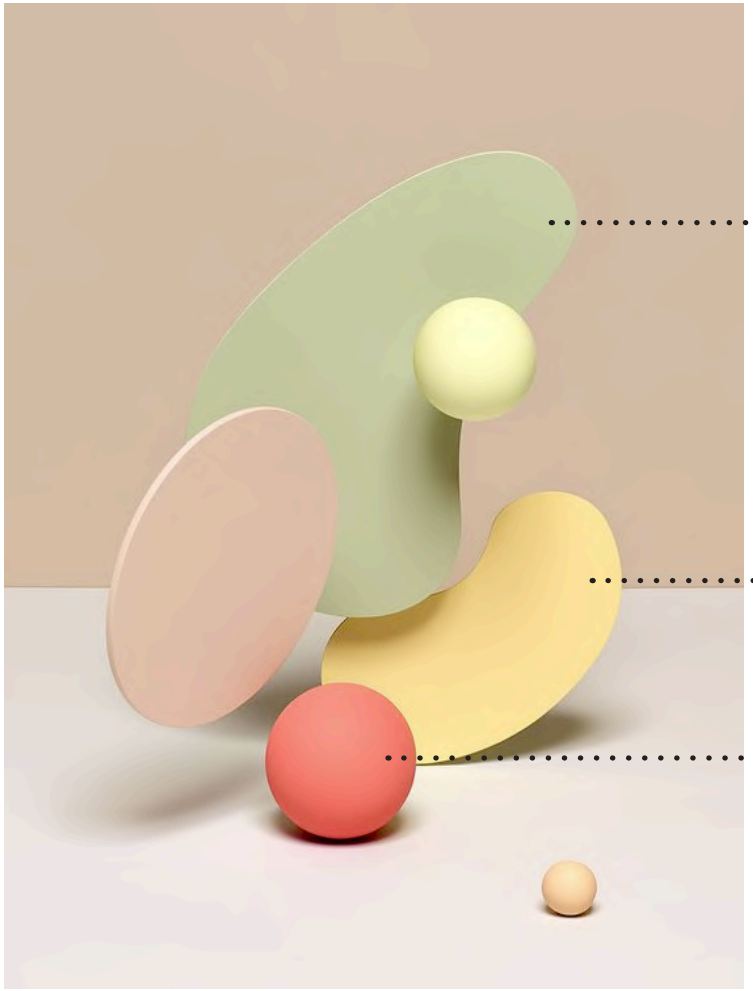
Selecting the right colours was another vital step. I had already decided that the main compartment should be white, but I wanted the modules to stand out. I wanted hues that would give a playful and happy impression and fitted well with each other and the greenness of plants.

One thing I love about porcelain is that it looks good both as glazed and unglazed. I like the contrast between the matte and the glossy, and how it affects the expression. To keep the simplicity of the base, it suited to leave it unglazed, as reflections could draw attention to it. For the modules I liked the idea that some of them were shiny, and others were matte.

This is more fun!

Matte, white porcelain for the maincompartment.

Glossy, transparent glaze as option for the modules.



The chosen colours for the modules

INTERFACE

A part that I struggled with was the interface. Some of the hydroponic systems felt very advanced, with the possibility to control the PH-level, water temperature and probably much more on small screen. I thought of applying something similar to my design but immediately felt that a small screen would ruin the sculptural look.

I also felt that all different kinds of measurement were far too advanced and nerdy for my user, someone quite new to gardening. And after all, the plant would be happy as long as it get some sunshine, water and nutrients. The only thing the user needed to know was whether it was on and if it was running out of water. I wanted it to be as easy to use as possible, and decided that a single button with a LED light would do the job.

DEVICE IS ON

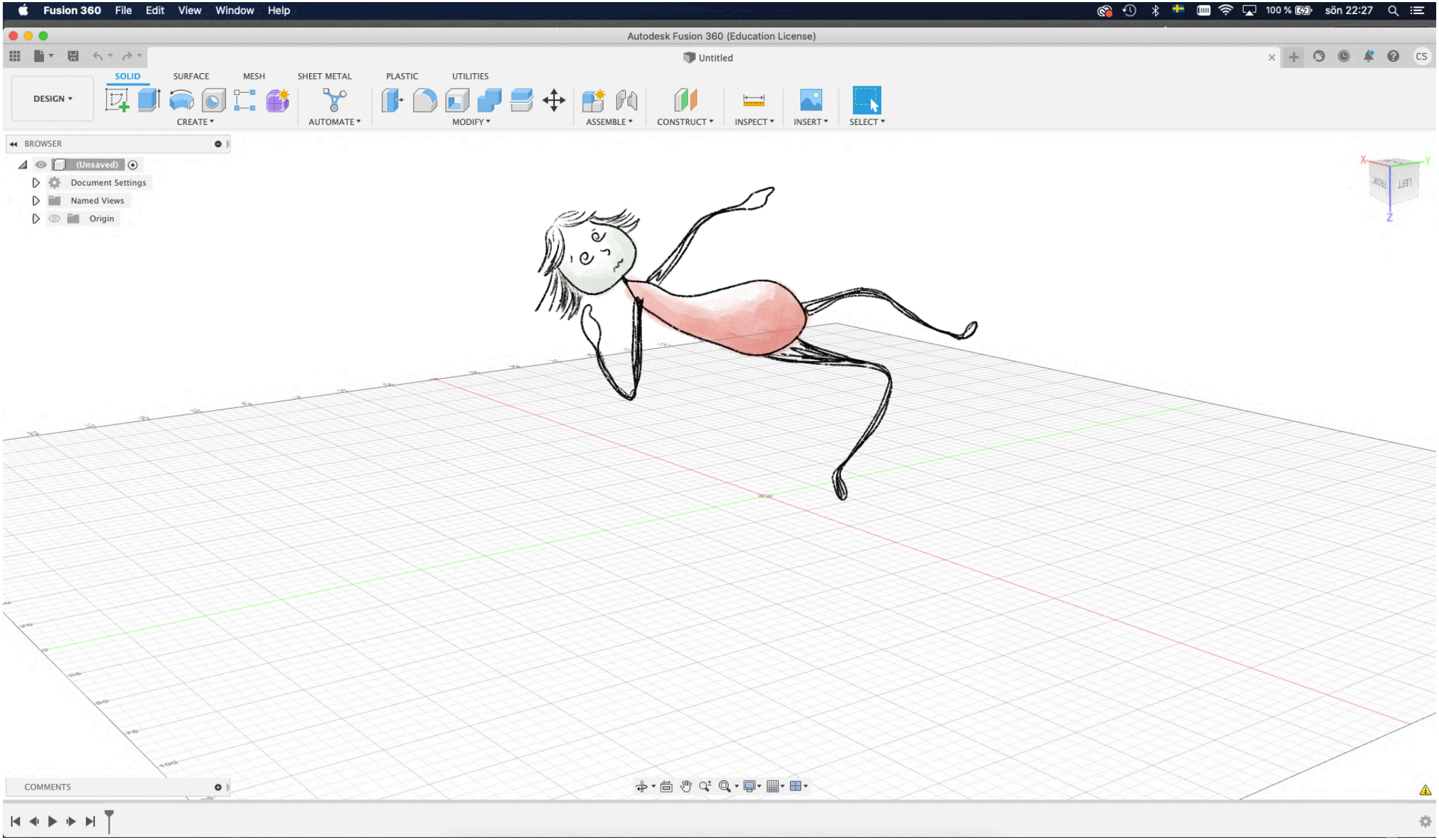
LOW WATER LEVEL

KEEP IT SIMPLE STUPID

FIGURING OUT FUSION

When the Covid pandemic hit the world mid-project, the workshop at school suddenly closed. The requirement of a physical model didn't exist anymore, and I realised my project would only come to life through CAD. After almost three years at a design school, I still had trouble orienting myself in the CAD world. This time I had no choice but to learn my way around the 3D workspace. I decided to team up with Fusion 360 (I still hadn't forgiven Alias for letting me and my screwdriver down in the first year).

It took lots of trial and error in combination with youtube tutorials before I slowly began to grasp the software. It might not have been the most time-efficient approach, but I learned a great deal. And it was a neat way to explore different details before settling on the final design.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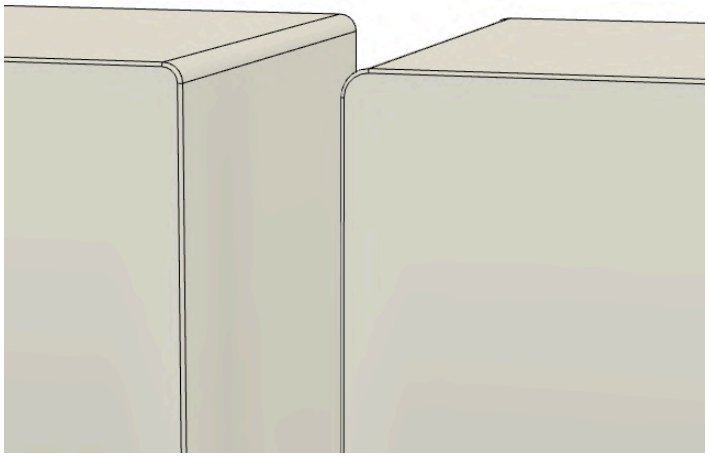
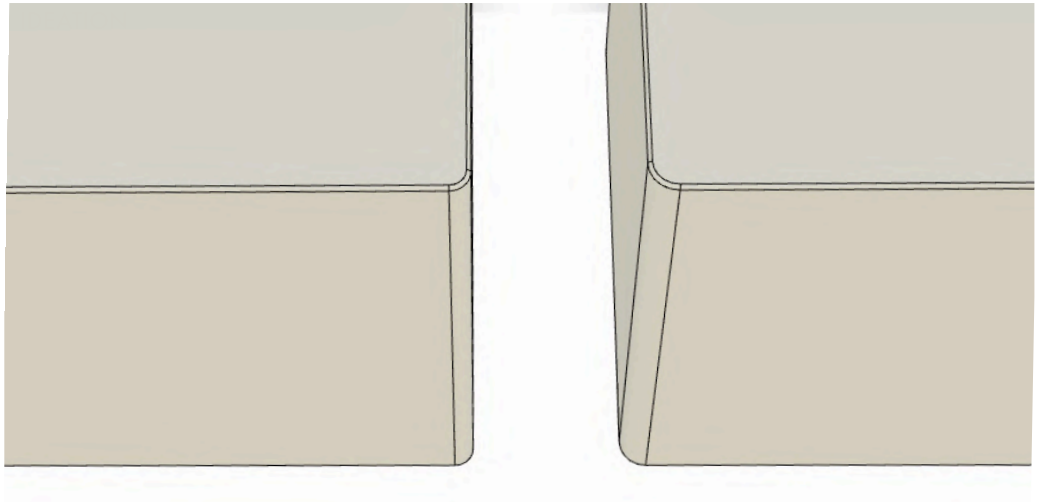
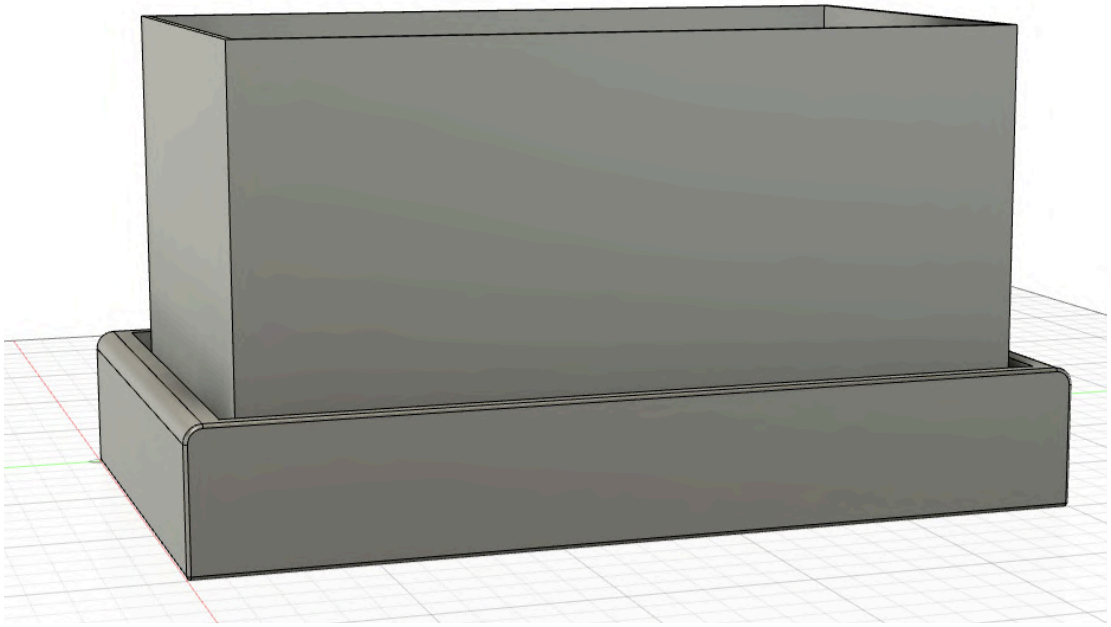


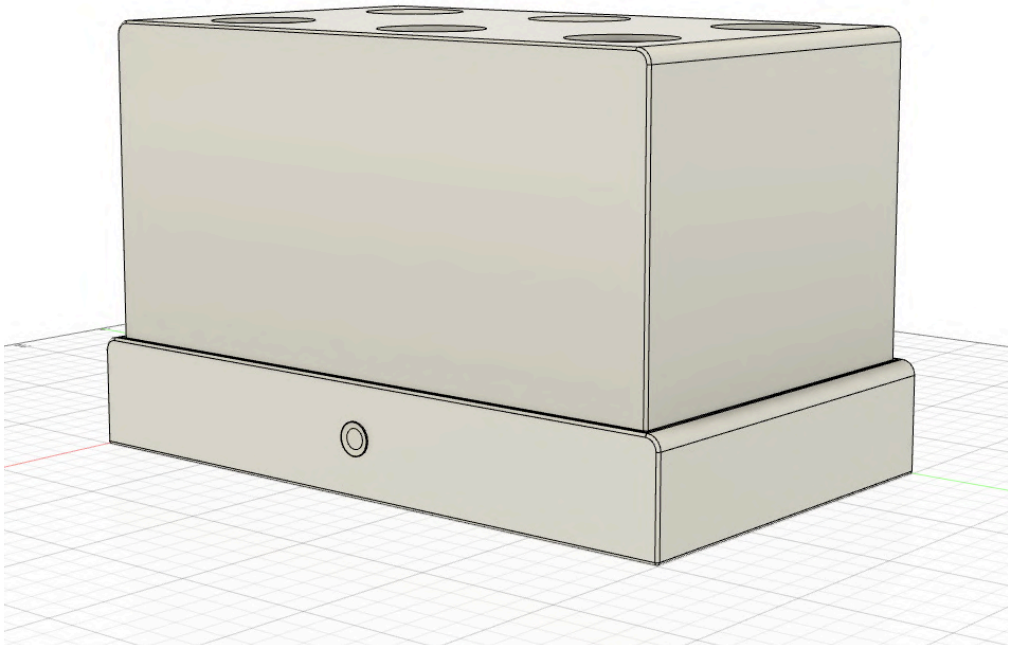
The bigger radius feels friendlier, but maybe not on that edge.



It looks nicer on that one!

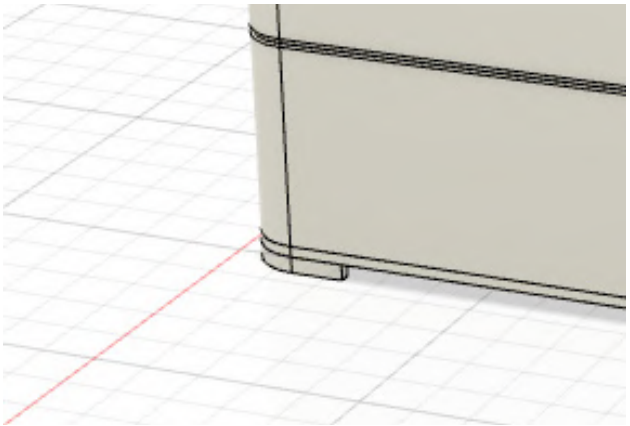


This bottom was a total disaster.

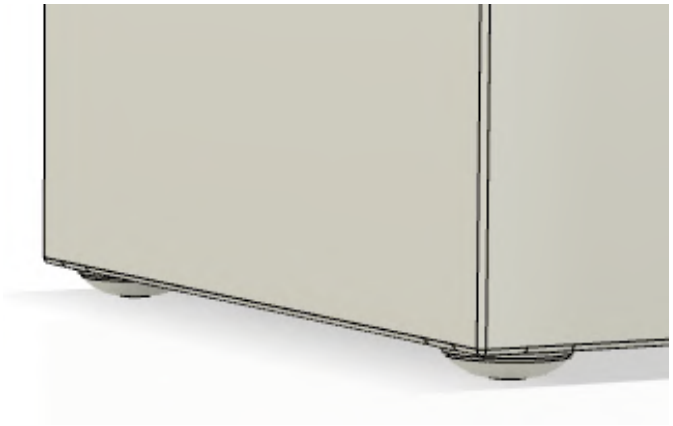


Still nope.

Hmm, a bit too distinctive feet.

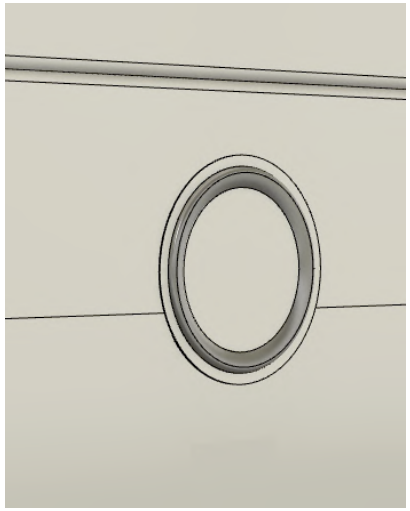


Cleaner but doesn't feel so friendly.

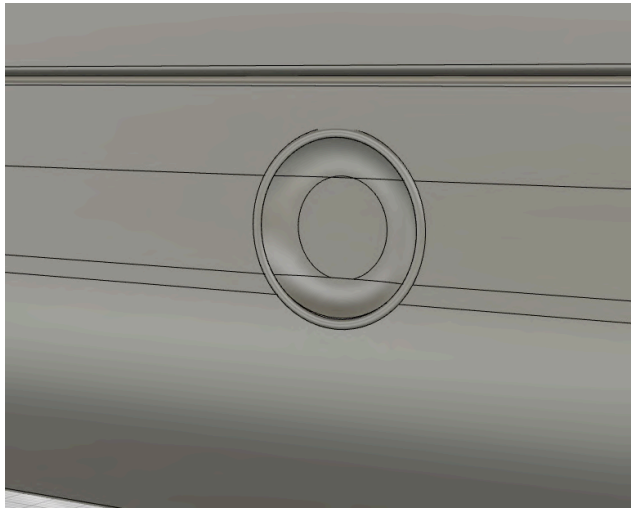


I like the low feet, but the meeting is outrageous.

I like the softness here, it feels kind.

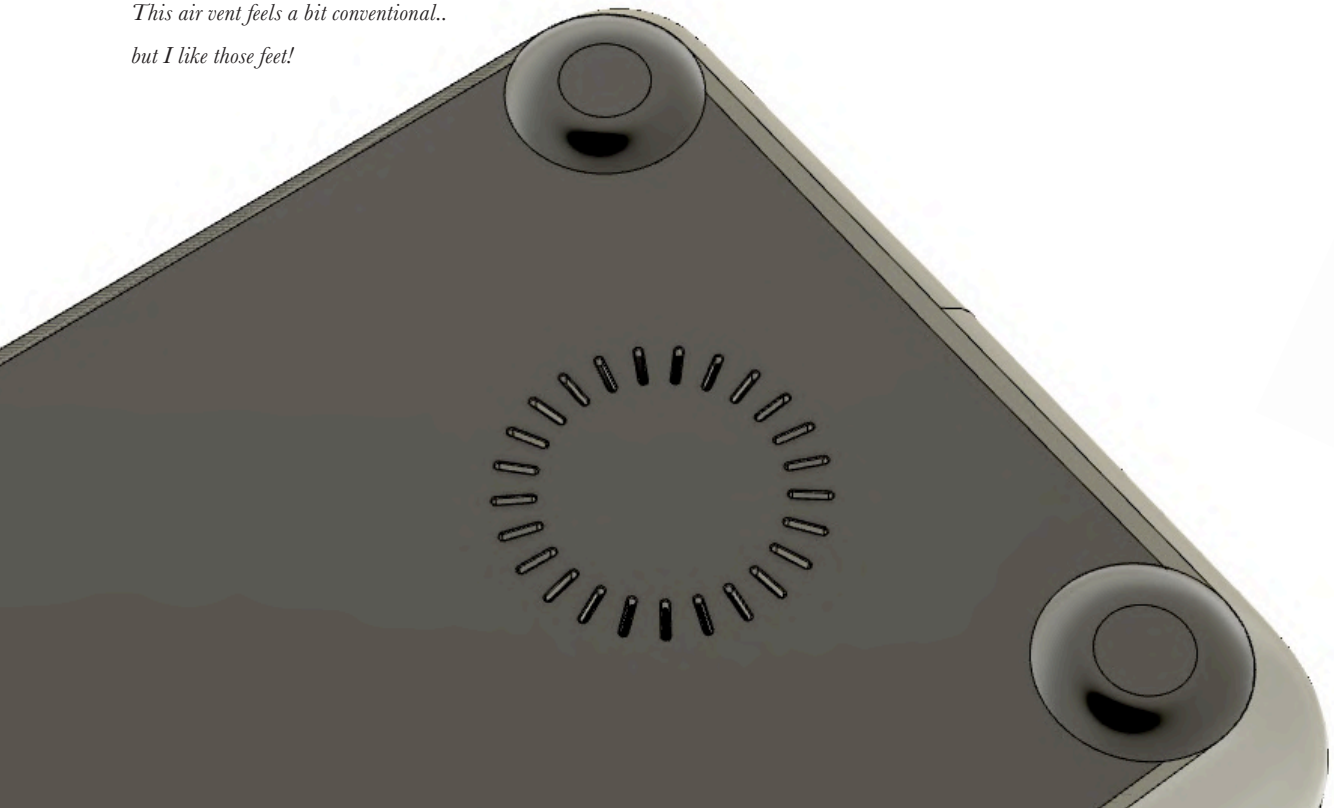


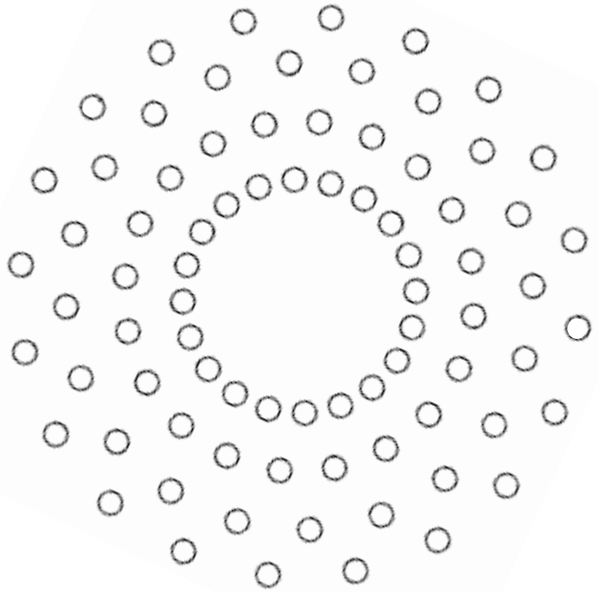
A flat button is not so nice.



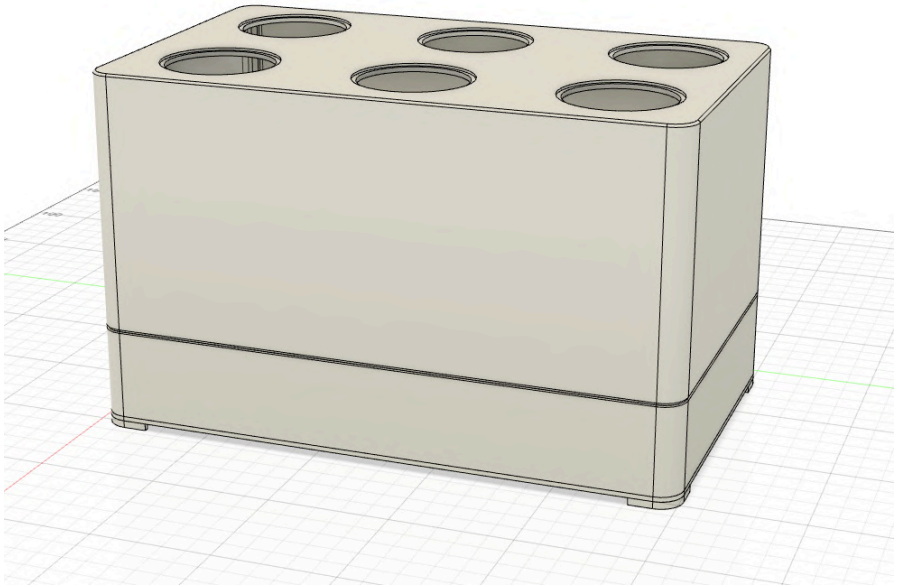
A recessed button feels more inviting.

This air vent feels a bit conventional..
but I like those feet!

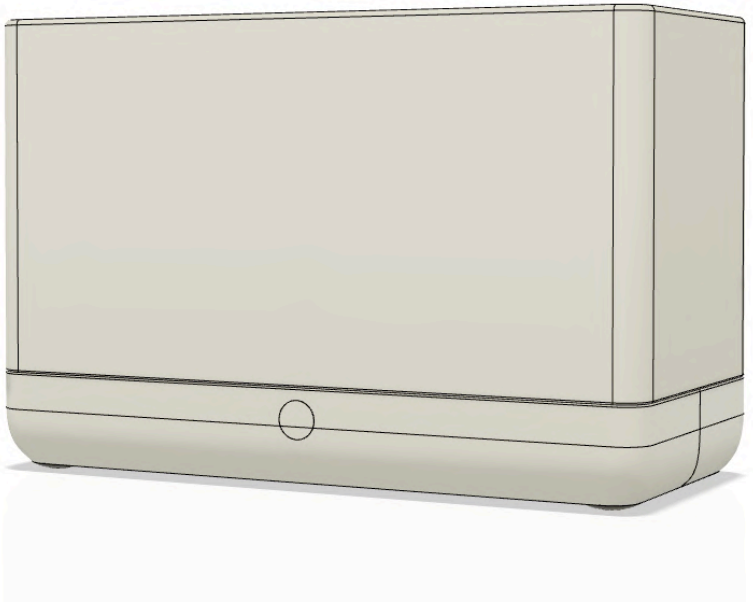




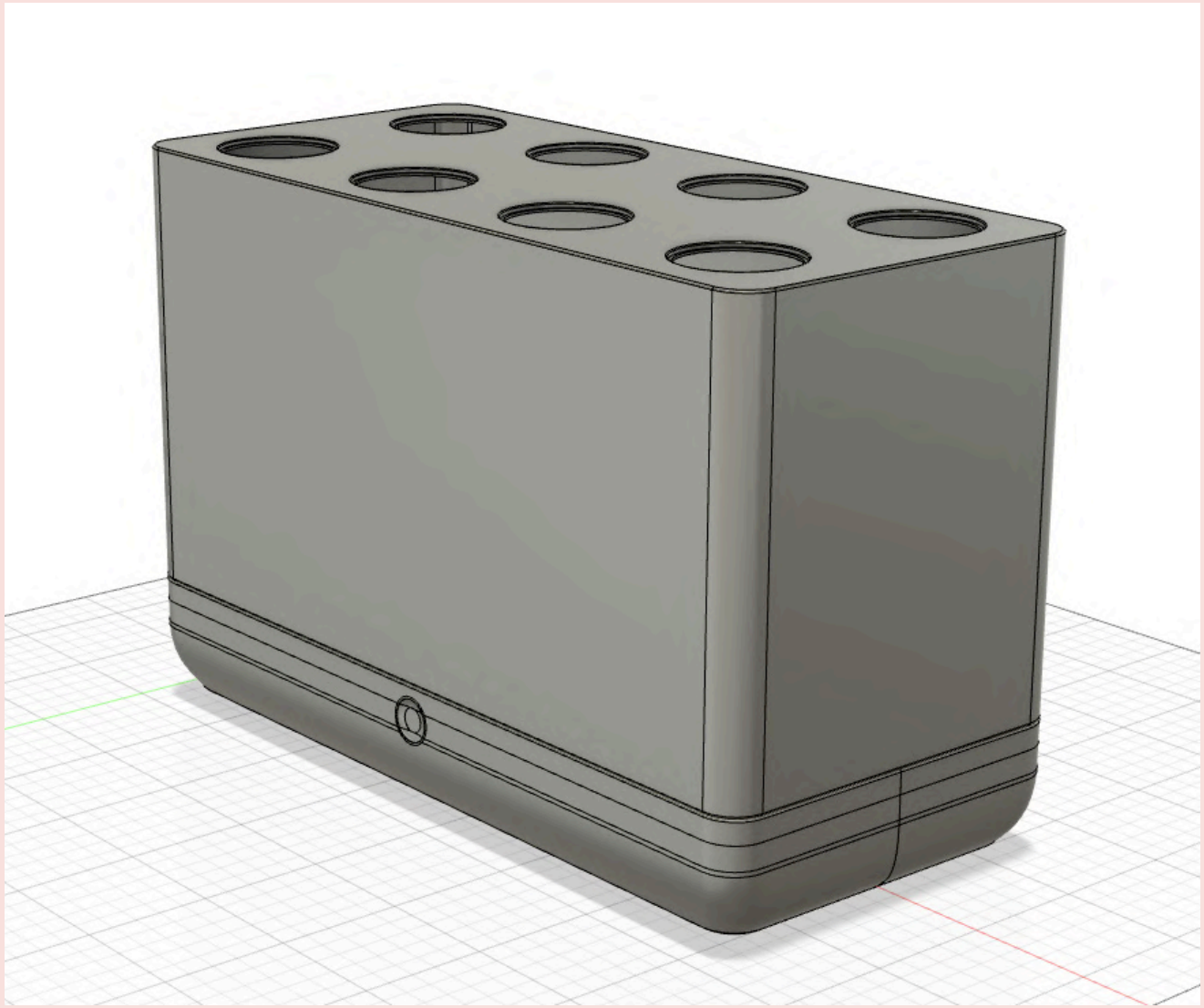
I like that this air vent resembles fog.



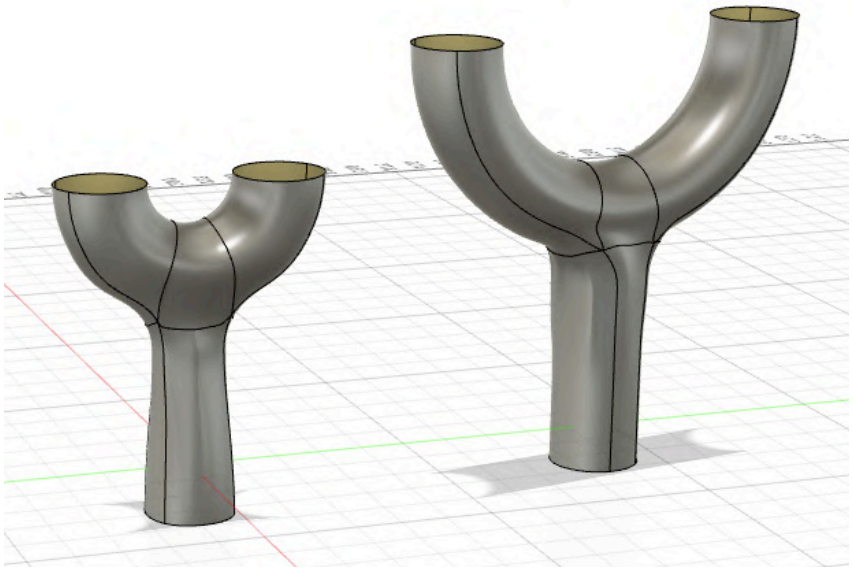
It is more podium-like, but it's too stiff.



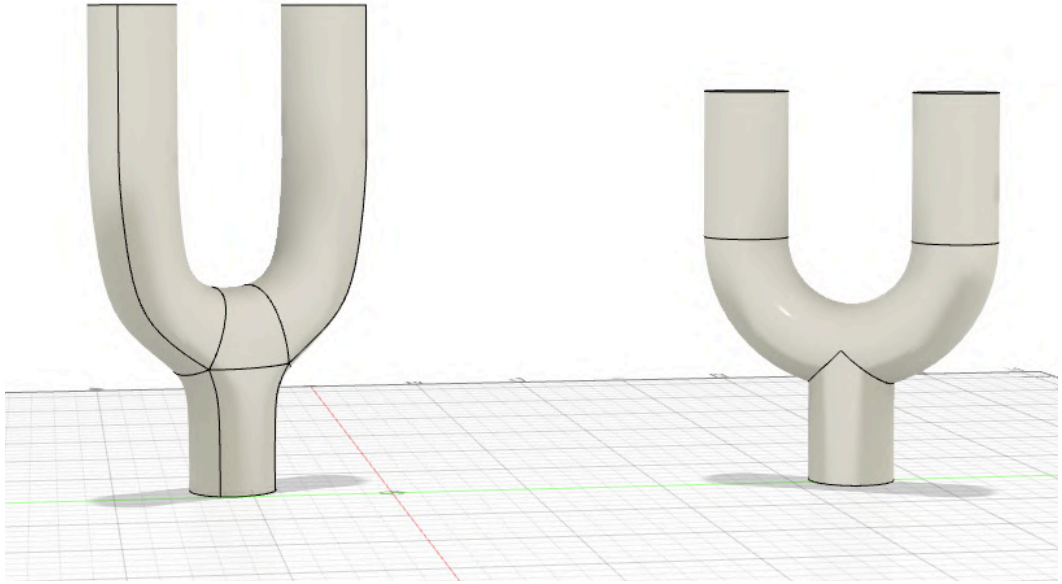
This is something!



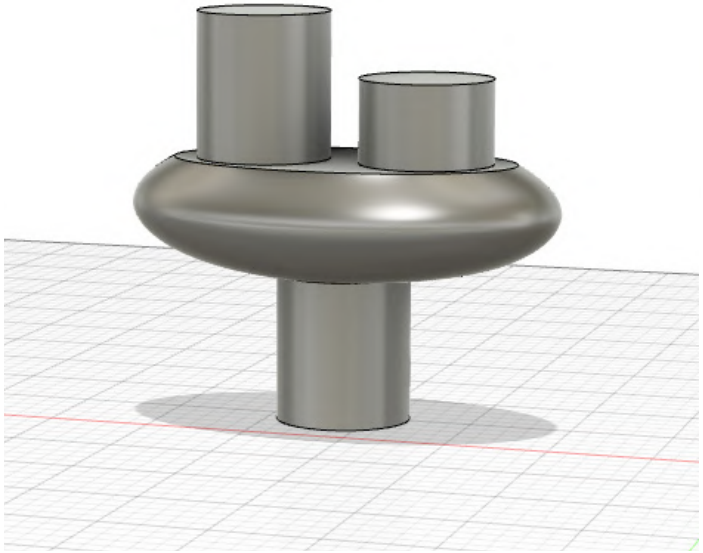
I choose you as my main champion!



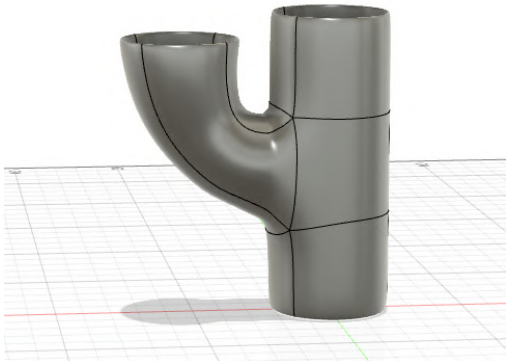
They have potential, but they need some tweaking.



Now they look like tuning forks.

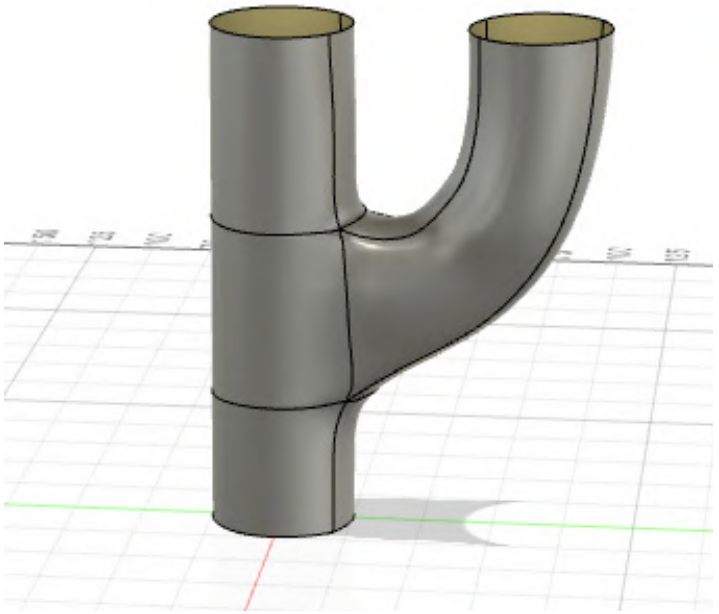


Just no.

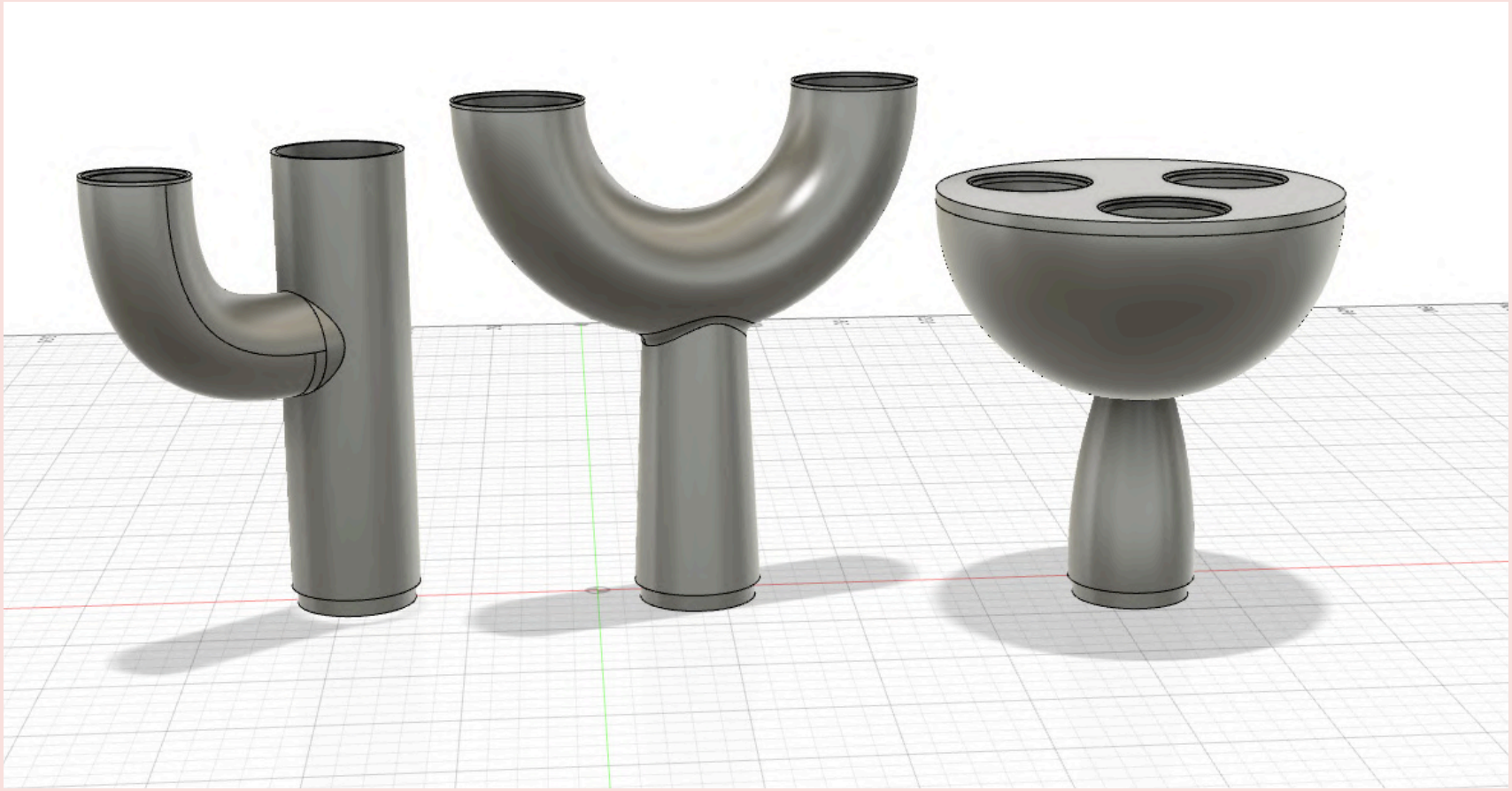


Way too chunky, and not so sculptural.

Resembles a tree branch, but don't the proportions feel off.



I like this more, though it looks clumsy.

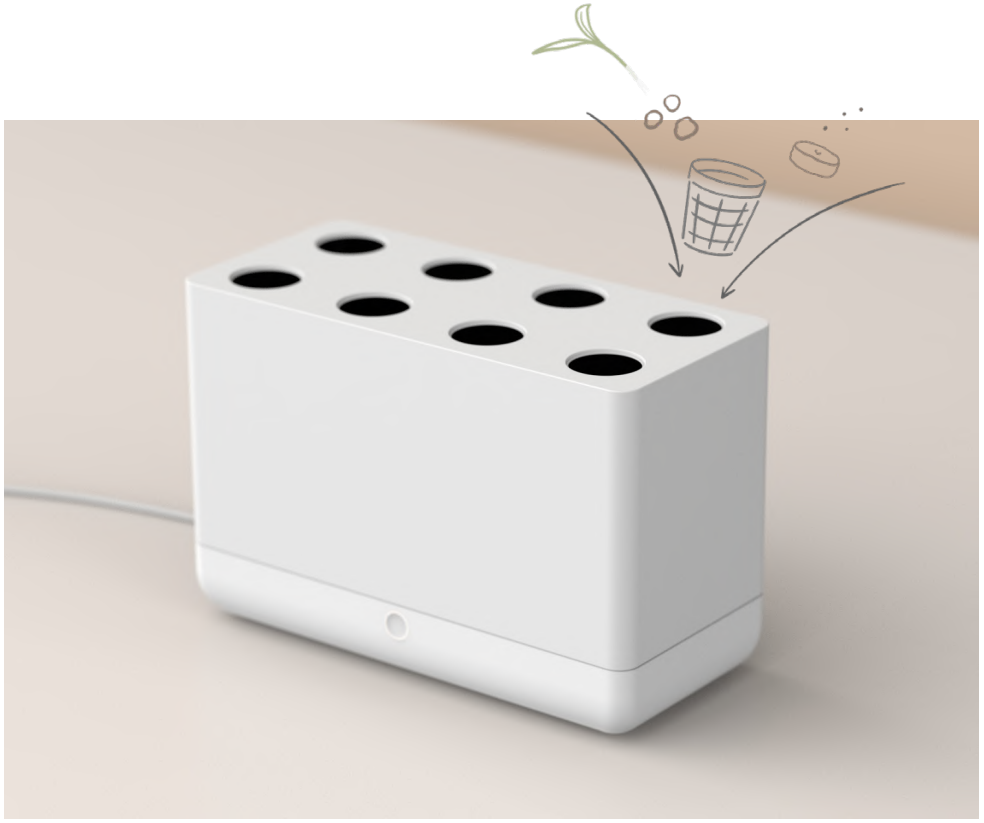


These ones make me happy!

4. result

FOGPOD

The project resulted in Fogpod, a modular in-home garden system. The fogponic technique is easy to use for people with no prior knowledge of gardening. The playful expression is invites the user to create a close connection to the food by growing it themselves. The friendly look and sculptural appearance contrast existing products at the in-home gardening market. The modular design is space-efficient and encourages the user to cultivate their growing interest.



The openings of the base and modules are sized to fit a standard net basket for seedings. The modular design encourages the user to start growing herbs, kale, and much more. Fogpod gets more enjoyable for every new plant and module to keep the interest as it grows.

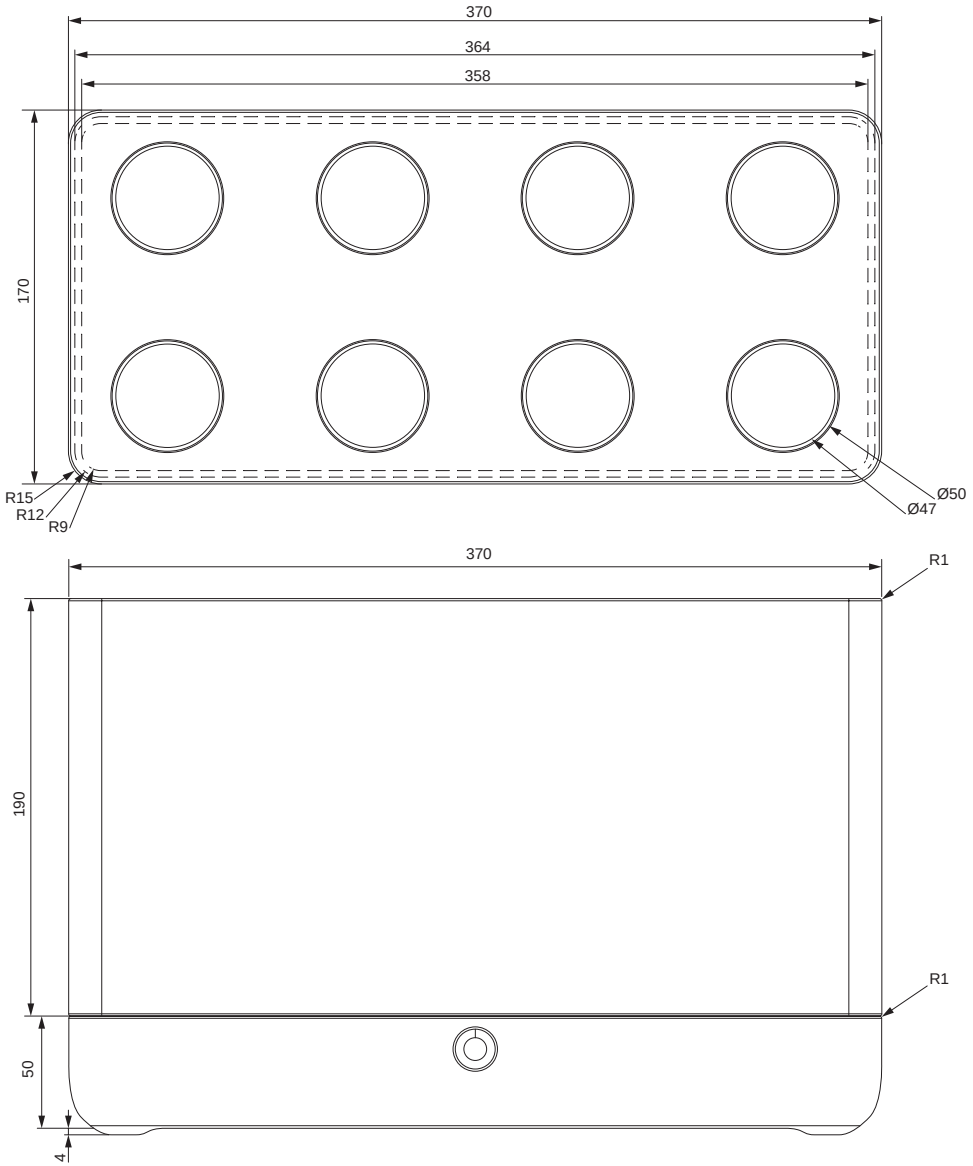
I’m on!

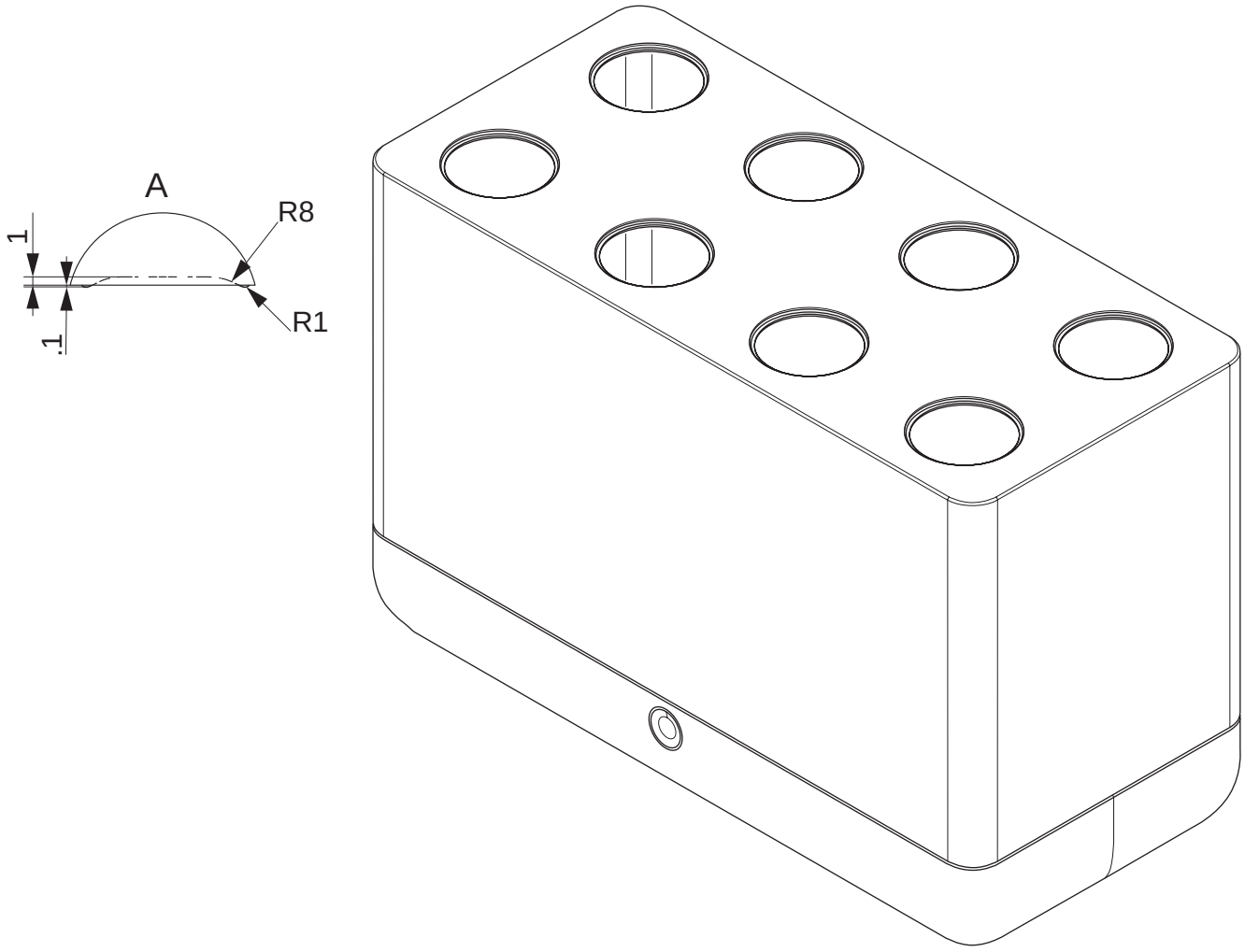
I need water!

Detail of the air vents.

TECHNICAL DRAWINGS

Main compartment

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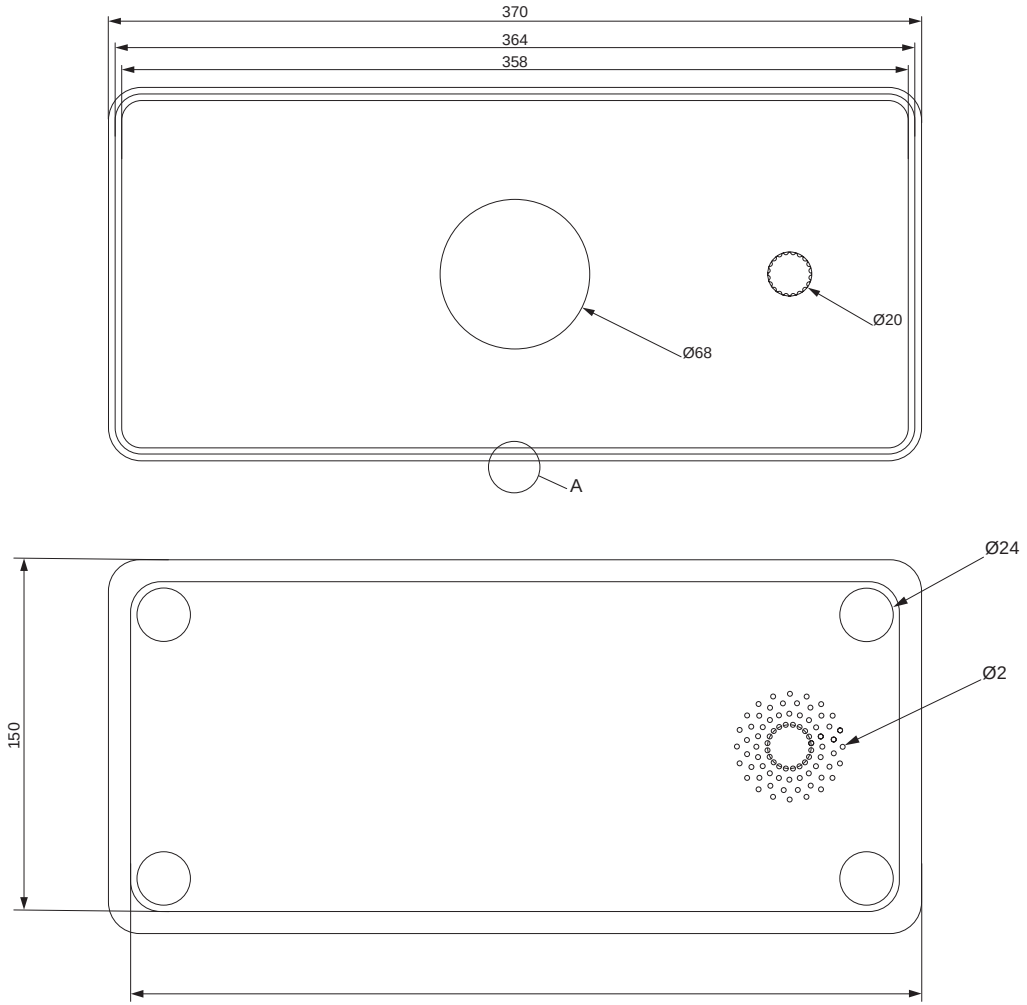
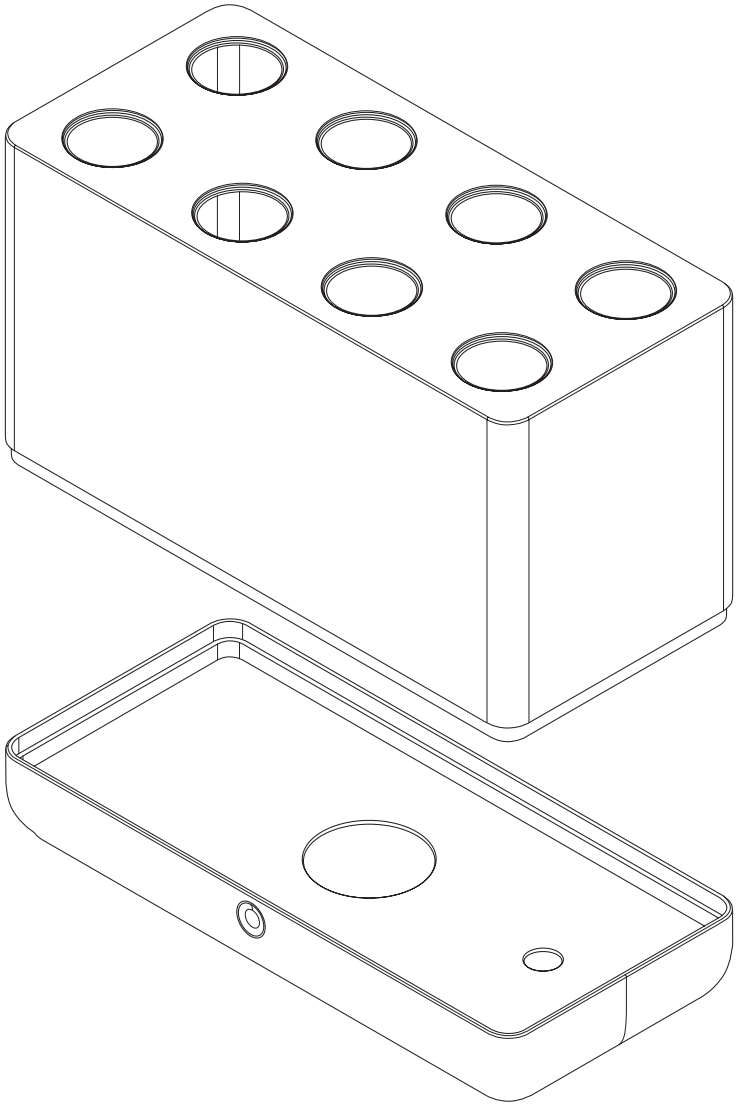
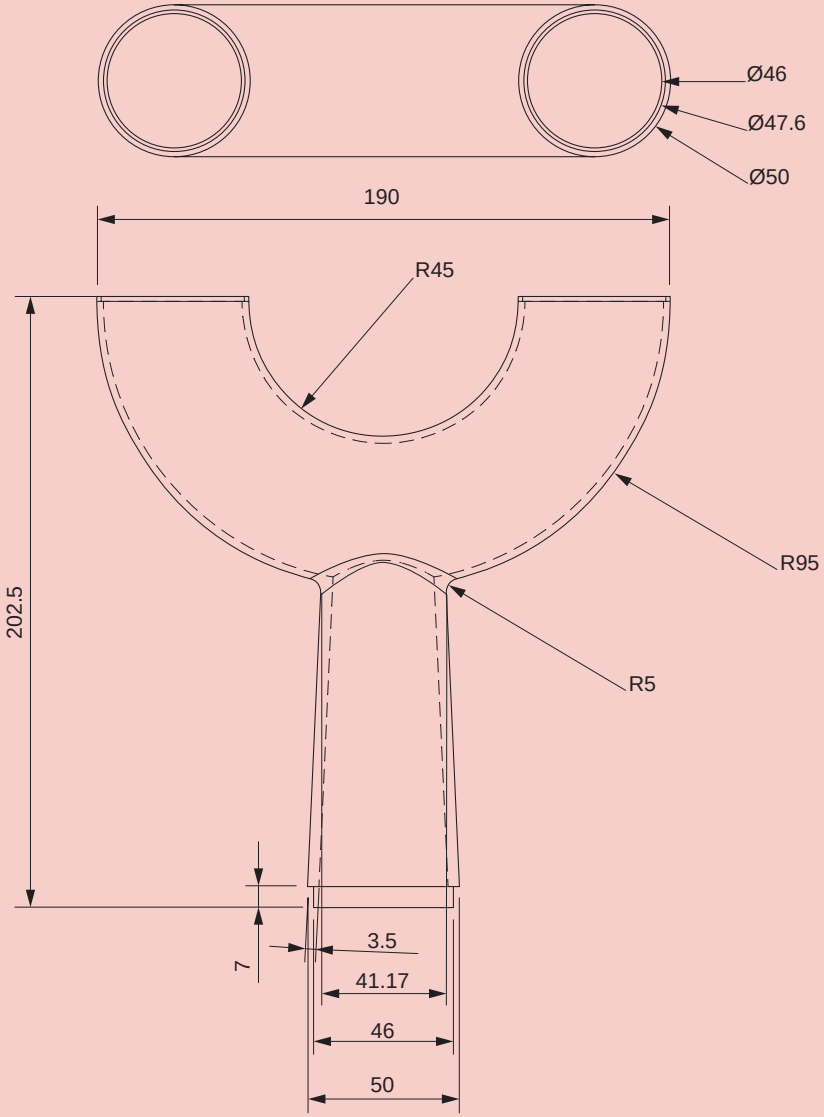
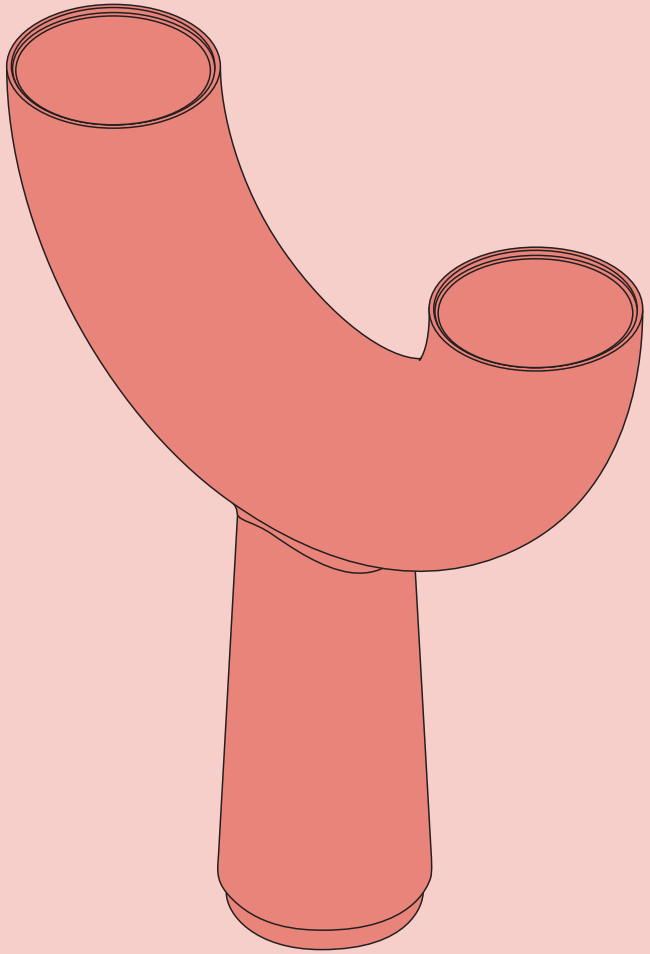
Main compartment



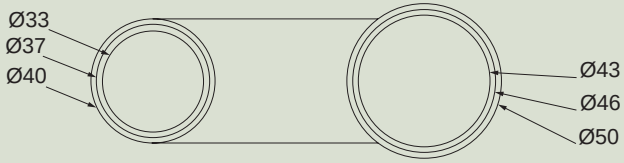


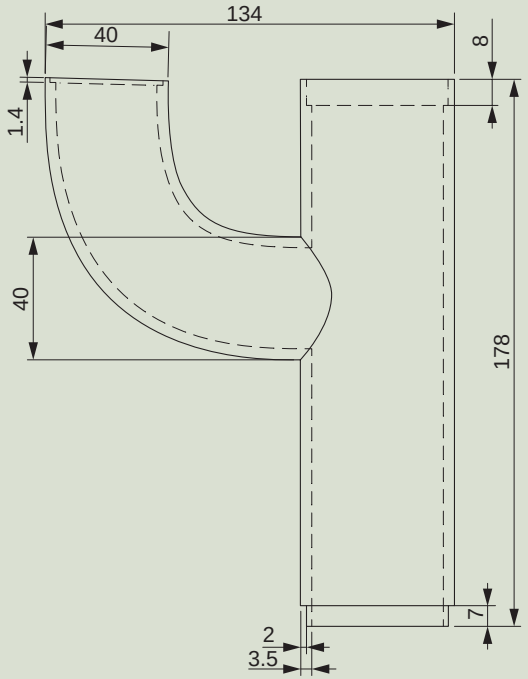
Module 1

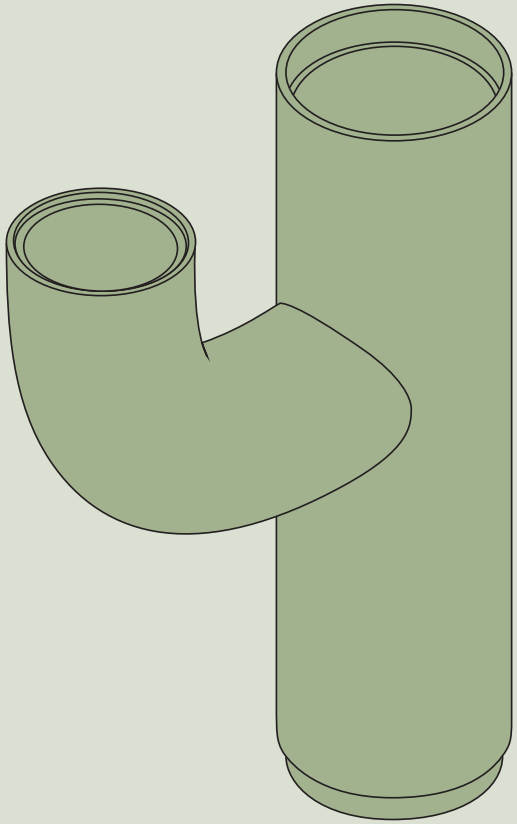




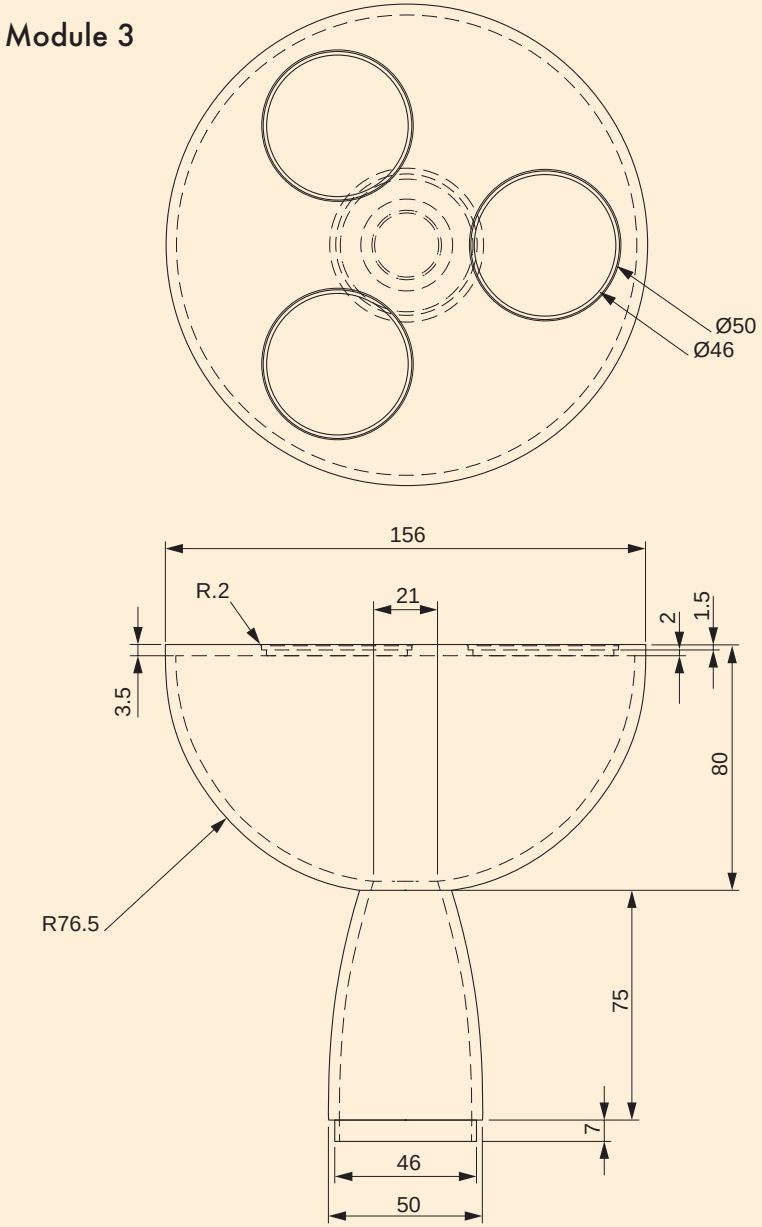
Module 2

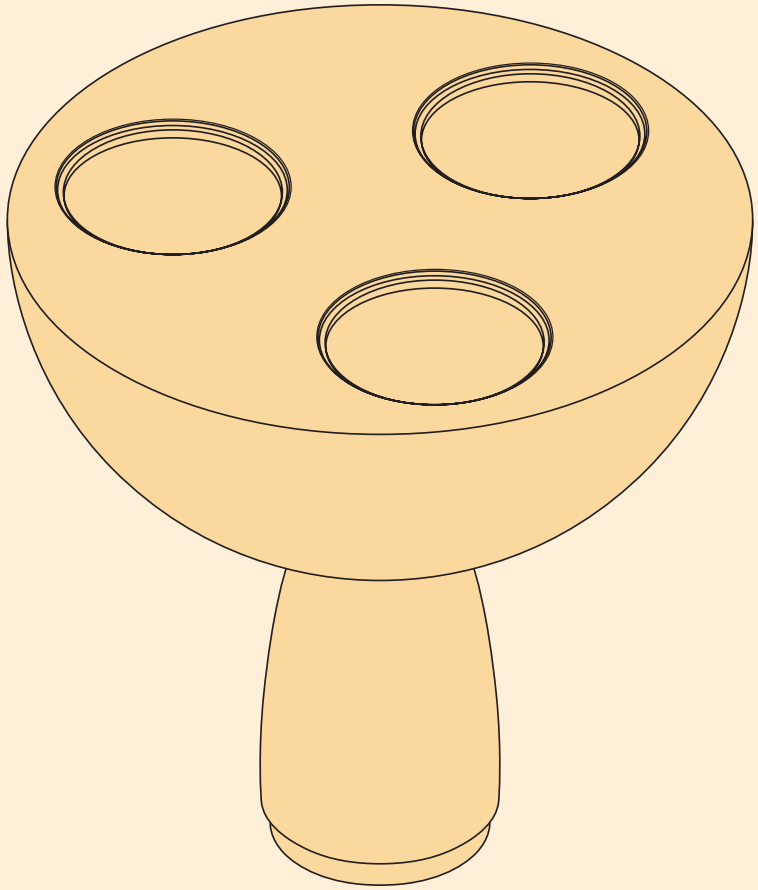






Module 3



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PORCELAIN OUTER CASE
WATER RESERVOIR
CIRCUIT BOARD
ULTRASONIC MIST MAKER
FAN AND FAN HOUSE
COMPONENT COMPARTMENT

5. reflection

INTENDED OUTCOME VS. ACTUAL OUTCOME

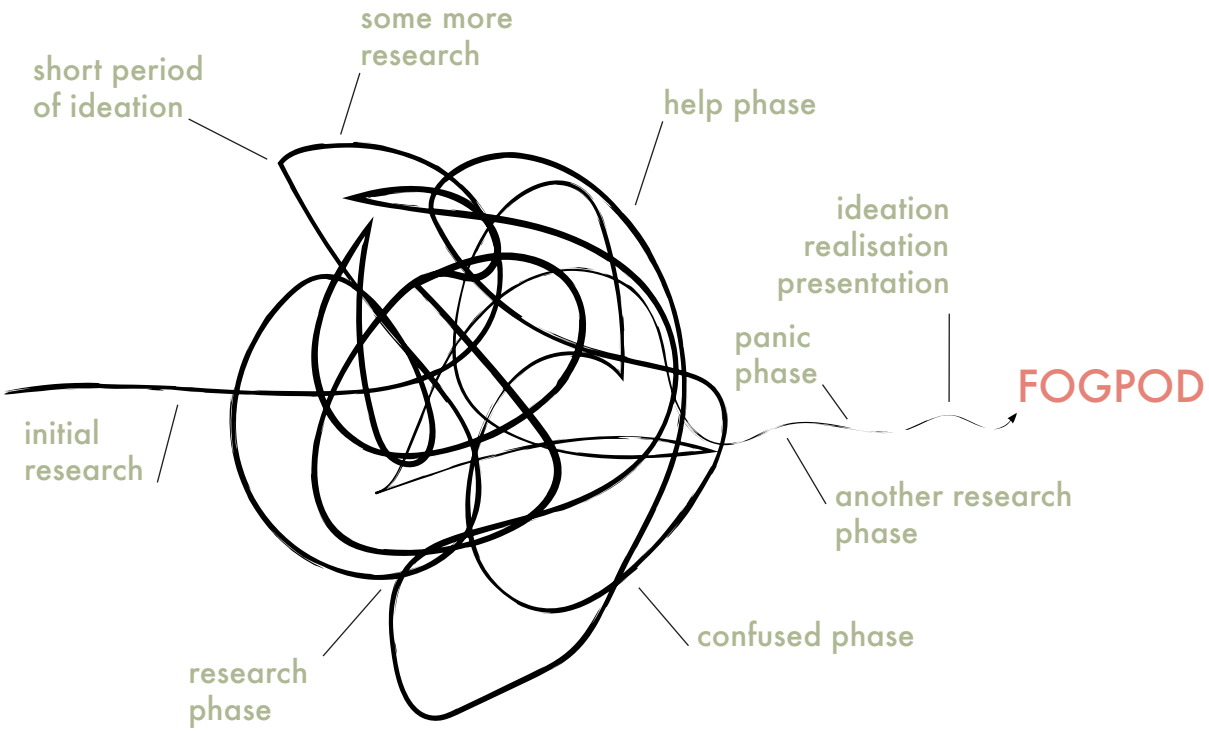
During the brief presentation at the beginning of the project, I said that I wanted to work with urban farming in some way. I had a small idea that I wanted it to be modular or scalable, and make cities self-sufficient. My initial research indicated that it was a need for such a product. However, looking too much into future trends can be risky, as it is easy to get overwhelmed by the "save the world"-aspect as a new designer. The bachelor project is the big finale of a three-year education, a time to show all the skills you acquired. This, in the combination of wanting to create something new and innovative, is not the best pressure to put on yourself. It sure didn't help me come up with ideas for my project.

But a product doesn't need to save the world. It can still add value in its context, even though it might not solve all the big problems. I am happy that changed the self-sufficient level of the project from "enable" to "promote" because it made it easier for me to grasp.

In the end, I did design a modular product for gardening in urban areas, with a technique that doesn't really exist in the current market. So maybe I did manage to make something a little bit innovative.

Time plan

How I planned my process would look like.

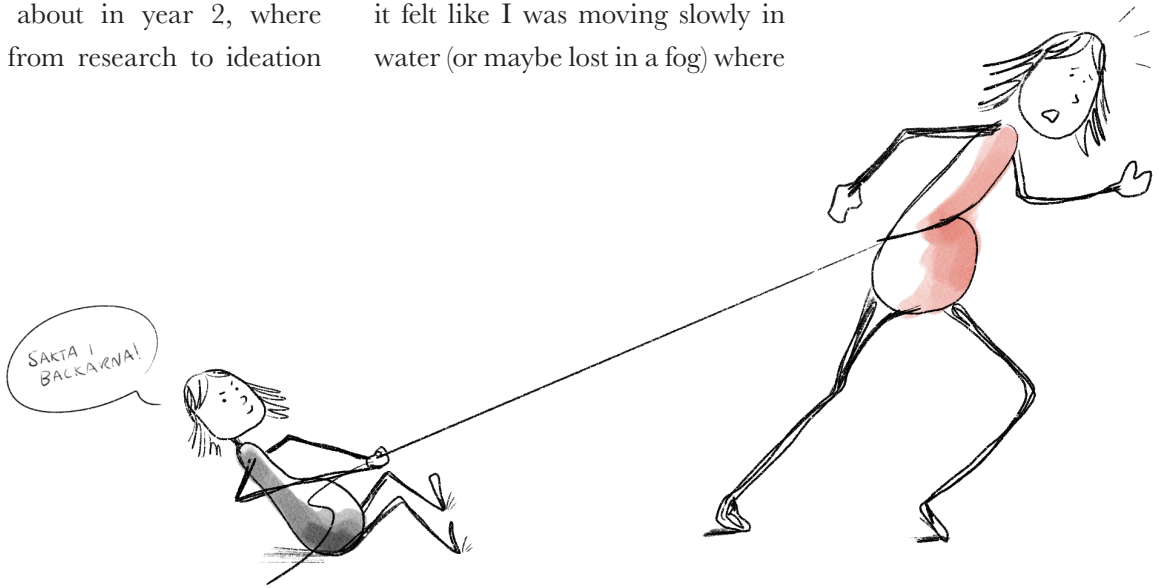


How my process turned out.

INTENDED TIME PLAN VS. ACTUAL TIME PLAN

I think my process can be perceived as a bit chaotic, and maybe even hard to follow. And at times it really was a mess, and I was unsure whether I would manage to produce something at all. Instead of the straightforward process, we learned about in year 2, where you go from research to ideation to finalisation in neat steps, my design phases felt very intertwined. One step forward often resulted in two steps back, and I had a lot of problems leaving the safety of the research stage for the scary and uncertain synthesis. Sometimes it felt like I was moving slowly in water (or maybe lost in a fog) where I couldn't visualize the end result.

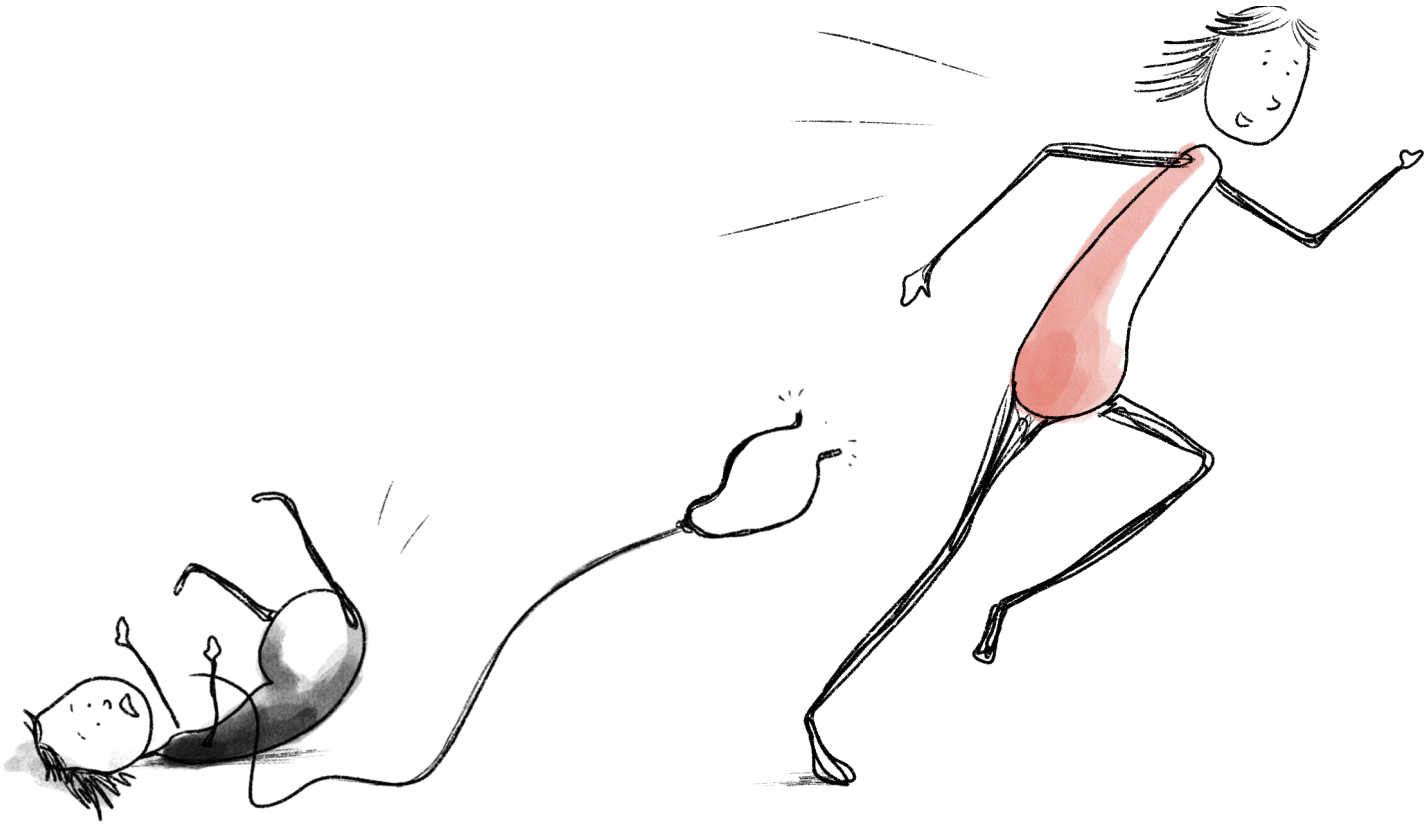
This resulted in a very hectic ideation phase, where I was forced to make fast decisions. But nothing gives me clarity like a tight deadline, and I am proud of what I managed to present in the end.



My self-doubt dragging me back to the research phase.

CONCLUSION

This project has been a great learning experience, and it taught me everything from hydroponics to Fusion 360 to an understanding of my design process. If I hadn't listened so much to the nasty little voice in my head, I am sure that I could've come up with so many more ideas. But I've also proved that I can produce a lot under stress. So maybe it is time to come to terms with being more of a design sprinter than a design marathoner.



Me leaving my self-doubt behind.

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