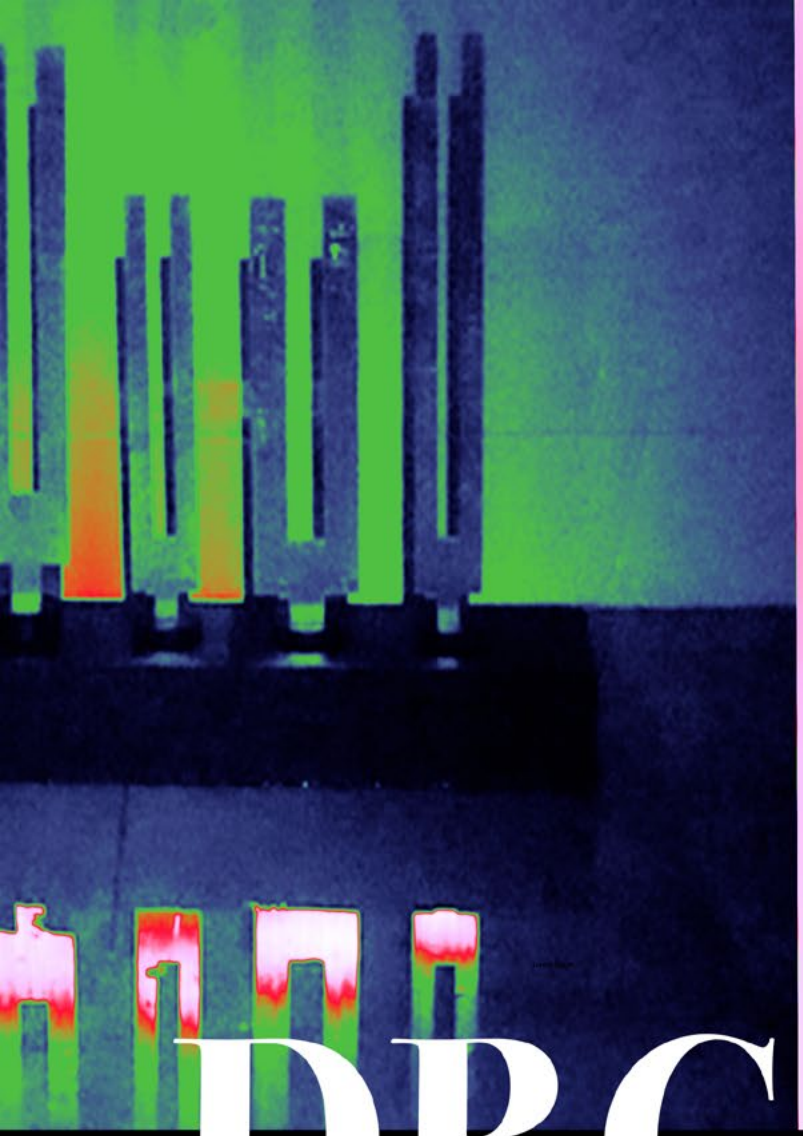


DRC.

Construction of perception

Anne Jenster
S3961044

MD IT

Index.
(From A to Z)

Introduction.

Construction of Perception

As defined in the brief, Construction means the action of building something, the style or method used to build this, or the creation of an abstract entity. With Perception, we mean the ability to see, hear or become aware of something through the senses or the way in which something is regarded, understood or interpreted. When designing an immersive experience the construction of perception is extremely important. An experience is successful when it speaks to someone's senses and makes them think. It can be connected to phenomenology which is a philosophy of expertise. For phenomenology, the ultimate source of all meaning and value is the lived experience of human beings (Armstrong, 2011).

How we perceive this experience says a lot about what we think about it, when an interaction is rich and makes sense and an opinion can be formed or even changed. As designers, we are the constructors of perception, and when we understand this we can connect and form the users of our products. The principles of construction of perception can be seen as a way or tool to make people aware of complex societal issues through physicality and intrinsically motivate them to take action.

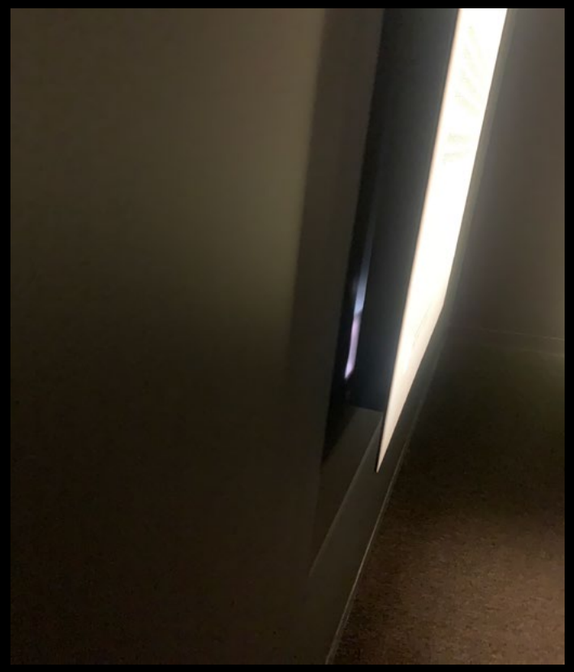
In this DRC you can see my development as constructor of perception.

Light.

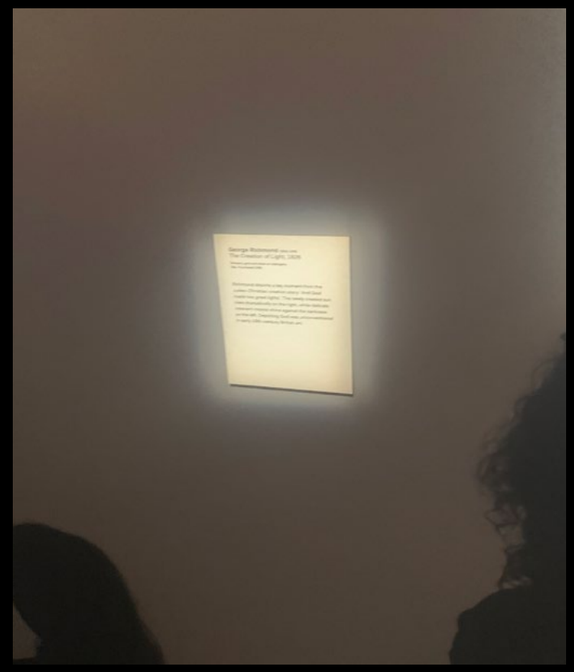
Construction of perception
Anne Jenster
S3961044

Introduction.
(Accidental Light)

When I am designing, I am often looking for surprising effects, something that we do not expect. When observing light, I noticed that it has its accidents, not only in nature, but also when designed by humans. I started looking for these effects and next to seeing this in the ACMI, where I paid attention to the light that was not supposed to be there (img 1), and the light that was supposed to be there but just a part of the environment (img 2).



Img 1 Accidental light ACMI

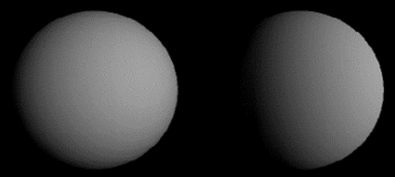


Img 2 Background light

Interactive Light

I got interested in the effects our eyes and brain create where we normally do not pay attention to, the accidental light in our brains. To get inspired, I played around with coding light effects. I had the idea of making an interactive light experiment to let the viewer really understand the effect that was happening, however there was too little physicality in experiment because it was just happening on screen. However coding this helped understand light direction and shadows. These examples would change with hovering the mouse over them, they were coded using processing (img 3,4,5).

Img 3 Graphic 2d equation



Img 4 Directional light experiment

Img 5 Spot light experiment

Auras and After image

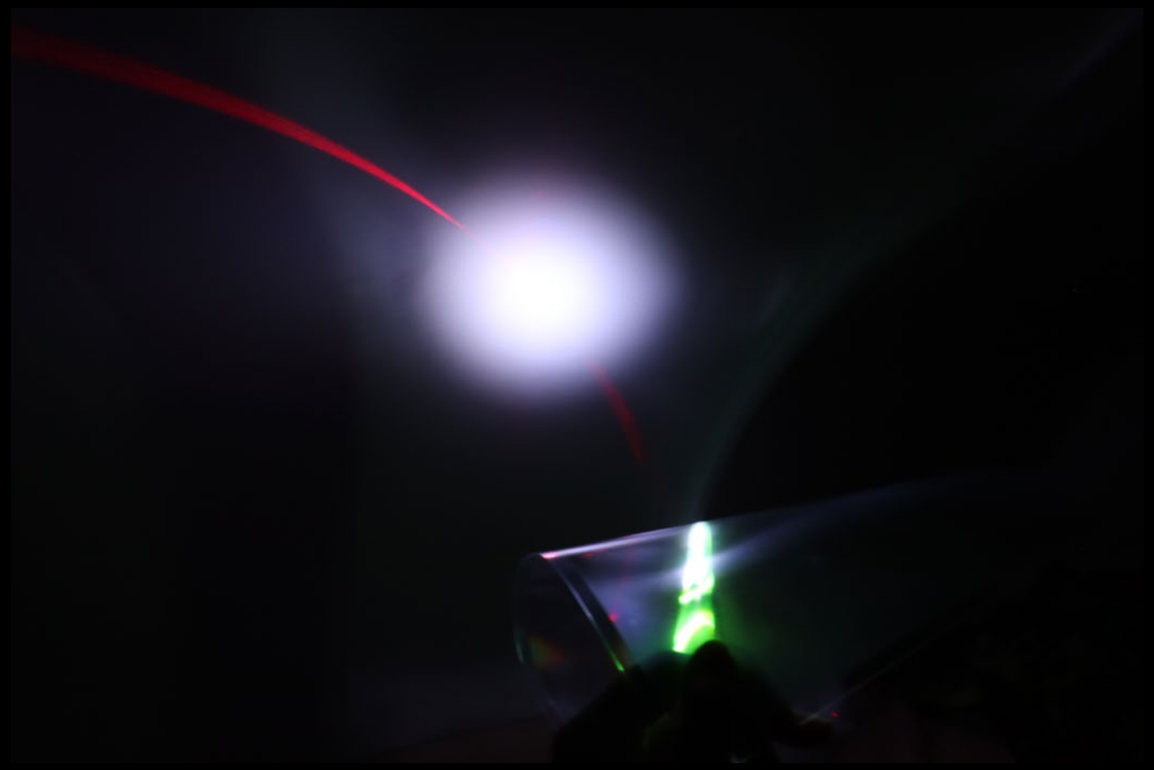
I did some further research into some effects our brain and eyes create, such as migraine auras, photo-beaching / photopsia, and after images.

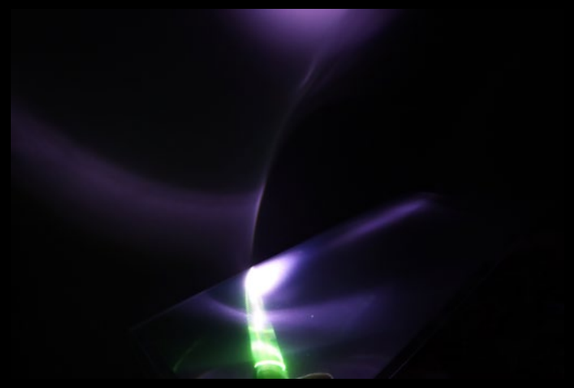
Migraine auras are created in the brain and are created by an electrical or chemical wave that moves across the brain. The part of the brain where the wave spreads determine the symptoms you might experience, for the aura this is in the visual cortex (Migraine with aura - Symptoms and causes, no date).

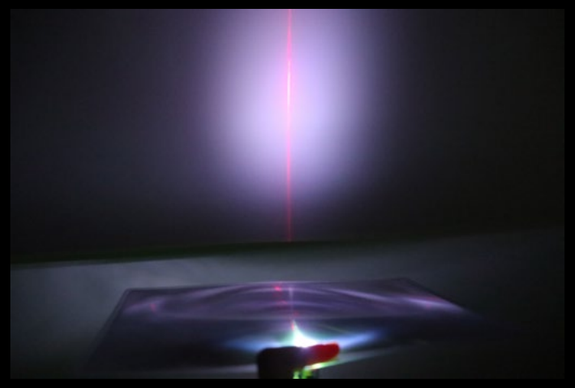
Photo-bleaching/photopsia is something that happens in your eye, when you look into a bright light the cells in your retina get overexcited, which needs a little time to readjust; this is why you can see black spots when you look away from the light (Why do we see blotches after looking at lights?, 2011).

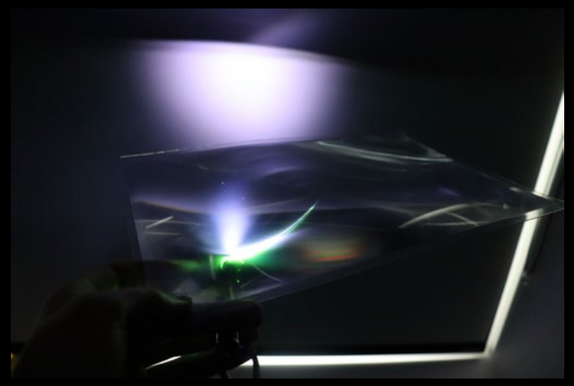
Photo-bleaching/photopsia is similar to an after image. There are two types of afterimages:
Positive afterimages are when the colors of the original stimulus are retained
Negative afterimages are when the colors are reversed. These afterimages can be created when you look into bright light or stare at a surface with colors and correct lighting.

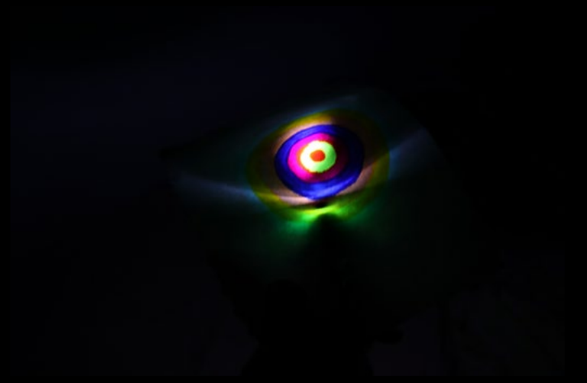
With positive afterimages, the original image stimulates nerve impulses, which continue for a small window of time after you close your eyes or look away. The same happens as photo-bleaching, the cells in the retina take some time to respond, which results in seeing spots or images (Cherry, 2020).
I tried to recreate the auras of migraine and was playing with refraction and reflection. With a magnifying sheet and lights. Especially with the colored paper, I tried to create an after image, my goal was to manipulate the after image you see. With the magnifying sheet I was able to distort the picture but I needed a brighter light and to know more about how to create this after image with colors (see images next spread).

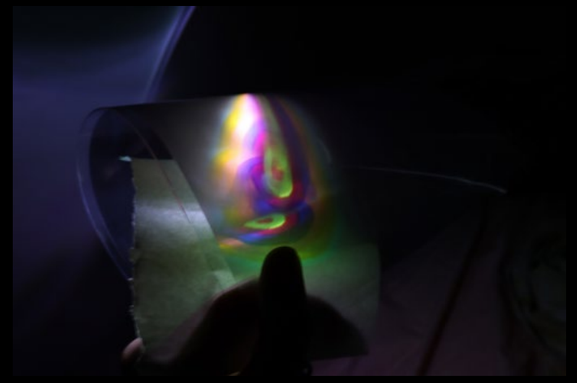












Fundus Photography

When doing research into these effects, I frequently read about the retina, which interested me. Next to your retina being the light receiver of our bodies, I was intrigued by its appearance. It looked like art, and got me inspired to capture my own retina. I found out you can see your own retina if you shine a dimmed light into your eye in the dark and look at a black surface. This kind of worked when I tried it, but I was of course not able to capture it.

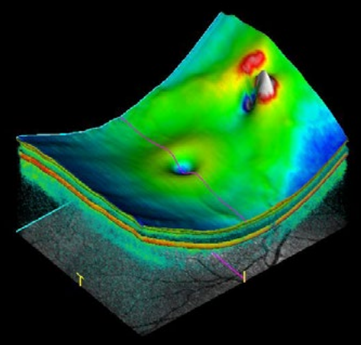
You can capture your retina yourself with a 20d lens and a phone, but those lenses are hard to find and expensive. However, these pictures are often taken at eye doctor's office to check for any deficiencies. That's why I went to an eye doctor to get a picture of my eye. They use a fundus camera, which is a specialized low-power microscope with an attached camera. Its optical design is based on the indirect ophthalmoscope. Fundus cameras are described by the angle of view - the optical angle of acceptance of the lens. An angle of 30°, considered the normal angle of view, creates a film image 2.5 times larger than life (Saine and Tyler, 2002). But this angle can also differ with different machines. For example, the Optus is a camera that can take a wide-angle photo of 200 degrees. In these camera's, light is generated from either viewing lamp or the electronic flash is projected through a set of filters and onto a round mirror. I have used 3 different camera's; the normal fundus camera (see colored and black and white photo and img 7), a fundus camera that can make 3d slices (img 8,9), and a wide angle fundus camera (optus) (see wide colored picture and img 6). After these pictures where taken the doctor explained me how the machines worked and how they used reflected light to make the retina visible and what you could see on the pictures and how the retina works.

The retina is a layer of cells at the back of the eye that is responsible for processing light, this happens through a layer of photoreceptor cells. This light is converted into electrical signals that are sent to the brain via the optic nerve. The retina makes some sort of picture of the focused light and lets the brain process this picture. The retina is made up of two types of cells - cones, and rods these work together and communicates with the brain to produce vision:

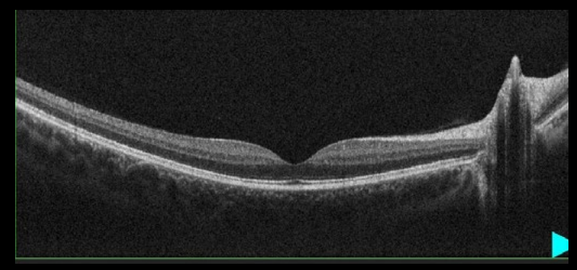
- Cones are located in the central part of the retina, in an area called the macula. These cells enable you to see fine details and colors. The macula is responsible for high-definition vision, which for example allows you to read
- Rods are located more at the outer edges of the retina. These cells are used in peripheral vision and allow you to see in poor lighting

Img 6 Optus camera

Img 7 Fundus camera (left), 3D fundus camera (right)



Img 8 3D scan right retina



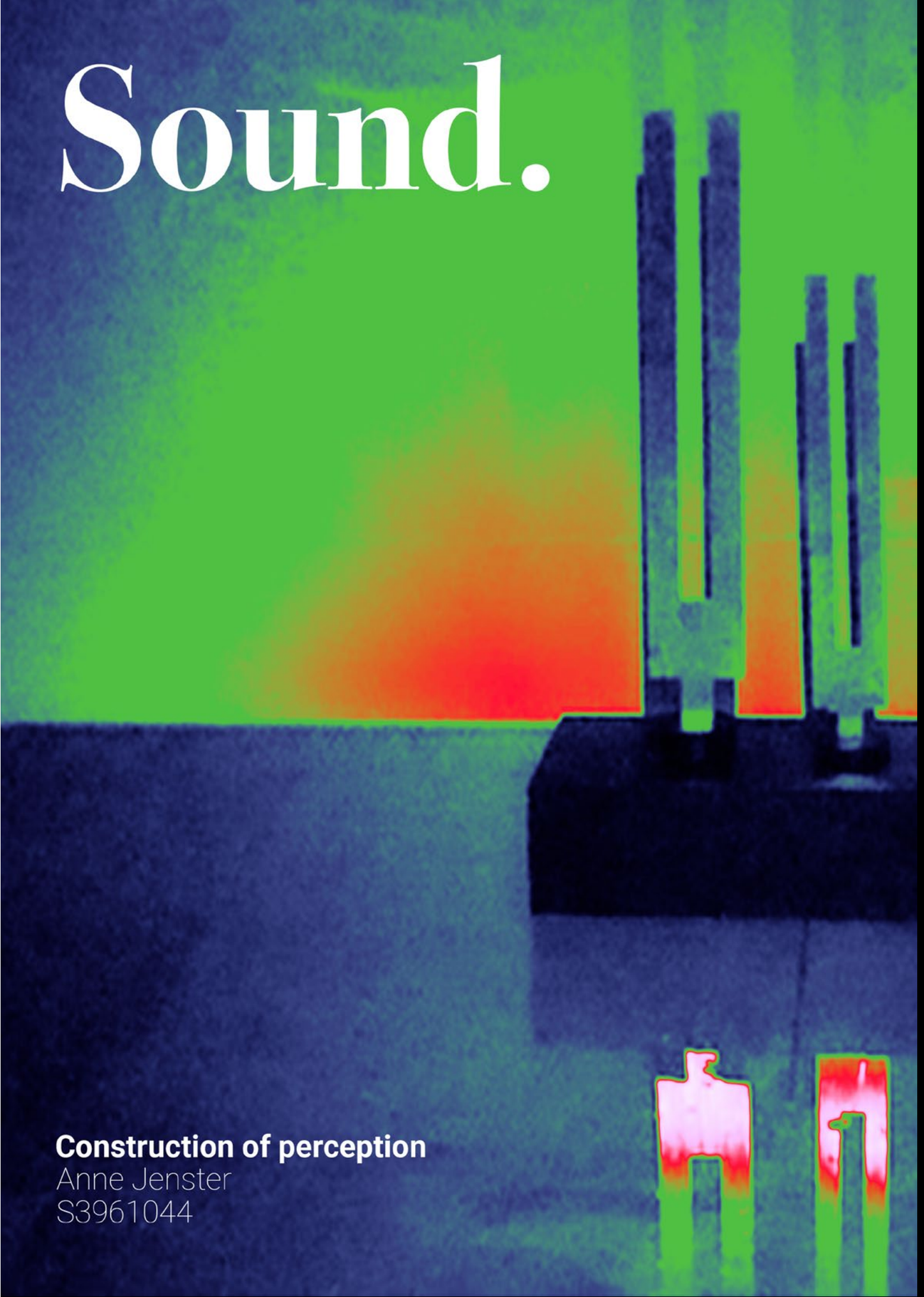
Img 9 3D scan right retina


Jenster, Anne
DOB: Aug 29, 1999
Jul 28, 2022 9:26:22 AM
Image: 1
Collins Street Optometrists, Vic
OPTOS, DAYTONA
Laterality: R
Red: 50%
Green: 50%
Zoom: 3.36
Enhancement: 3.0
Gamma: 1.72
Presentation: Multiple

Reflection.

I believe this project reflects what kind of designer I am, even dough this kind of design is different from my focus back at my home university. I am a designer looking to make an impact on complex societal issues and using making and visualization to simplify these issues. I think this assignment where we needed to explore the field between art and science taught me how art can be a mean to communicate complexity. In this case vision and light, and the way the eye works is complex. Turning this science into art and an aesthetically beautiful image results in simplification. Next to that, when something looks beautiful it grasps curiosity, what can create intrinsic motivation to learn more about it.

The switch I made from creating light effects to capturing the light receiver of our body was a risky choice because I did not know how the photos were going to turn out. Making this discission helped me explore the line between science and art. I had to turn a medical picture into a breathtaking piece of art.



Introduction.

(Vision to hearing)

From the eyes to the ears and from light to resonance.

Resonance can actually be seen brother than just sound, in physics resonance is a phenomenon in which a system is able to absorb more energy when the frequency of its oscillations matches the system's natural frequency of vibration than it does at other frequencies. This increased energy can be used to do work on the system, for example to cause it to vibrate more strongly. The phenomenon of resonance occurs with all types of waves, including sound waves, light waves, and electromagnetic waves. So when we talk about hearing sounds two things can actually resonate, the sound waves and the ear. When a sound wave hits the ear, the ear drum vibrates. This vibration is then passed on to the bones of the middle ear, which amplify the vibrations this happens because of resonance. The vibrations are then passed on to the inner ear, where they are converted into nerve impulses that are sent to the brain. In this report we explore resonance and the resonance space, how can we create and influence it.

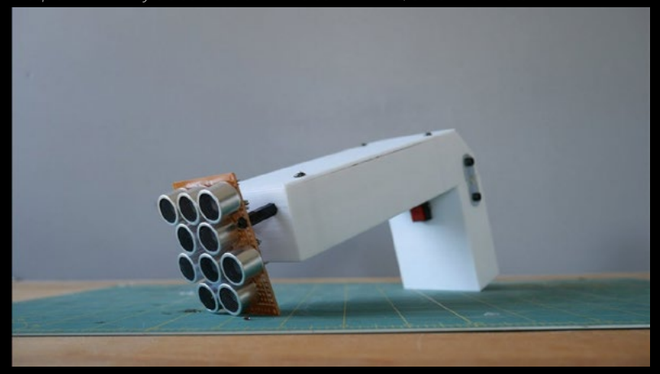
Research.
(By experiencing)

Sounds of the City

To gain inspiration we walked around to find resonance in the city, looking around and paying attention to the sounds. One of the first things we noticed was that the city sounds different from what we are used to, traffic lights, tram sounds, street music, and the birds all sound different from what we are used to back at home. We learned that sound adds to the experience you are having in a city, each has its smells, sounds, and looks. Sometimes we are too focused on only the looks but all the senses that make up the whole experience.

We found some interesting sounds in the city, where spaces resonated and sound piqued our interest, such as a church, a street artist on Flinders Street, and birds underneath a bridge. We also experimented with letting an object resonate in public space; we ringed a fork through metal park benches in different locations. The benches were identical but the location differed each time, so different background noises and the direct surroundings impacted the sound. This learned us what effects resonance, for example, a bench standing to a wall resonated way more than a bench just standing in the middle of the street, the wall made the sound waves bounce off. These benches inspired us to create a resonating object and place it in different spaces. We continued researching visualizing resonance, directional sound, and tuning forks.

https://www.youtube.com/watch?v=TQOabMOMGoE



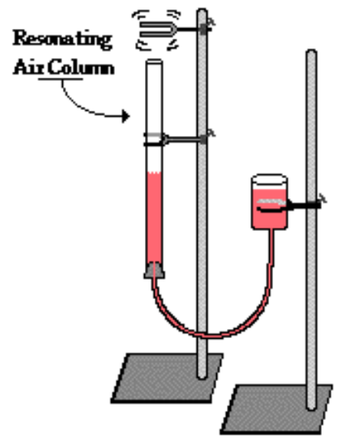
Directional Sound

We got interested in directional sound or also called ultrasonic sound. This can be recreated in a so-called ultrasonic sound gun. Different from the ordinary speaker the ultrasound travels out from a directional speaker in a narrowly focused column, like a flashlight beam. But when it hits something, it turns back into ordinary sound that we are able to hear (Woodford, 2022). We discovered that creating a directional sound panel is quite easy by using Arduino, and with small speakers, only quite basic components are necessary.

Directional Sound

Resonance can also be visualized by forcing the vibrations of a tuning fork into water; a ‘resonance tube’. The vibrations of the tuning fork are forced into the air column. By raising or lowering the amount of water, and thus adjusting the length of the column, the natural frequency of the air in the tube could be matched to the frequency at which the tuning fork vibrates. When the match is achieved, the tuning fork forces the air column inside of the resonance tube to vibrate at its own natural frequency, and resonance is achieved. This way we could experiment with making either a perfect tuning fork or exploring the different tones.

After the orientation phase, we decided to continue with the topic of tuning forks as it fascinated us how such a simple object can emit a pure tone so clearly and long (Physics Tutorial: Resonance, n.d)



Tuning fork forcing air column into resonance

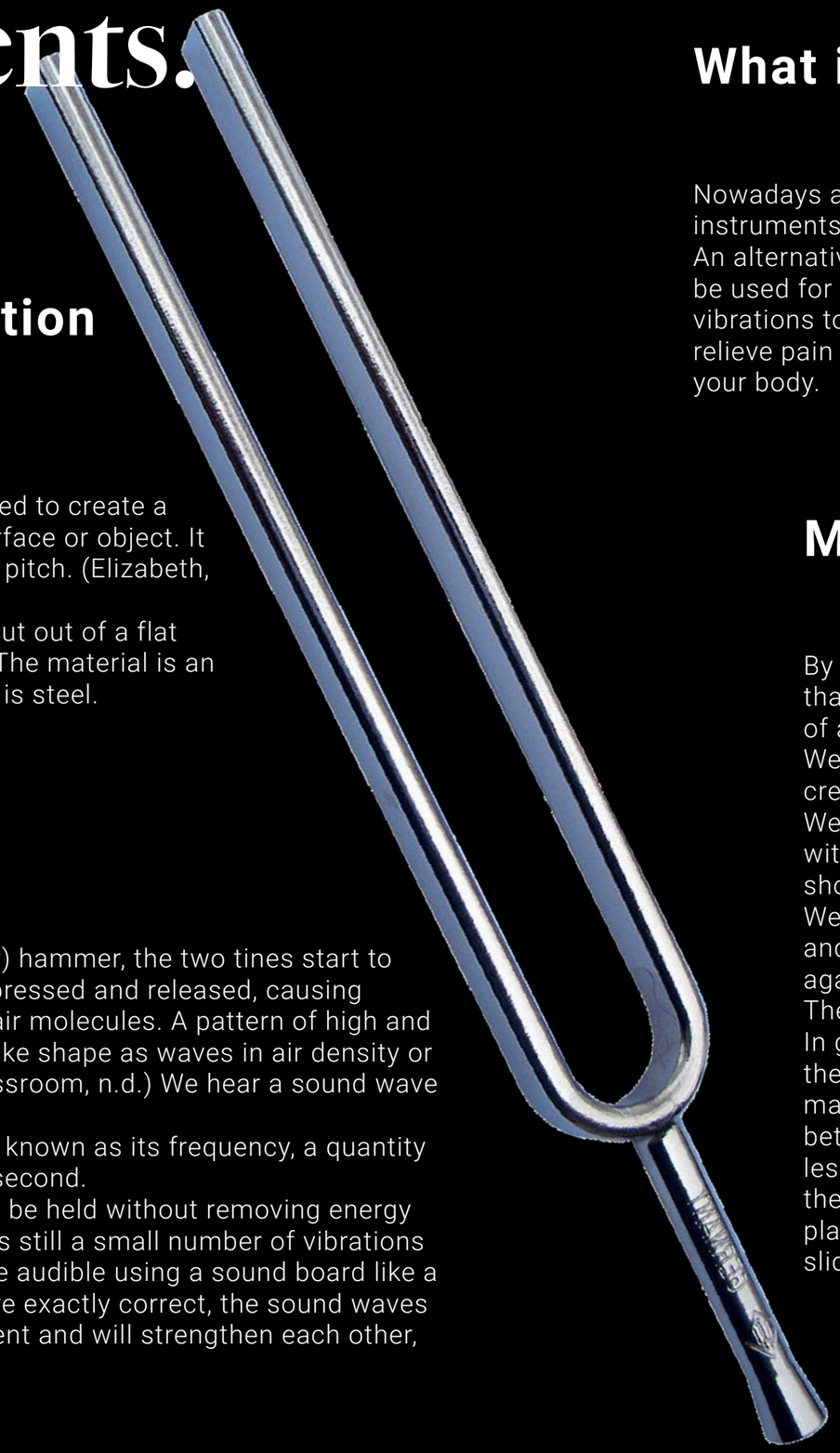
https://www.physicsclassroom.com/class/sound/Lesson-5/Resonance

Experiments.

(With tunining forks)

Background information Tuning Forks

A tuning fork is an acoustic resonator used to create a pure tone when struck against a hard surface or object. It is often used as a reference for accurate pitch. (Elizabeth, 2022)
The shape is a two-pronged fork, either cut out of a flat surface or formed from a U-shaped bar. The material is an elastic metal, its most common material is steel.



How does it work?

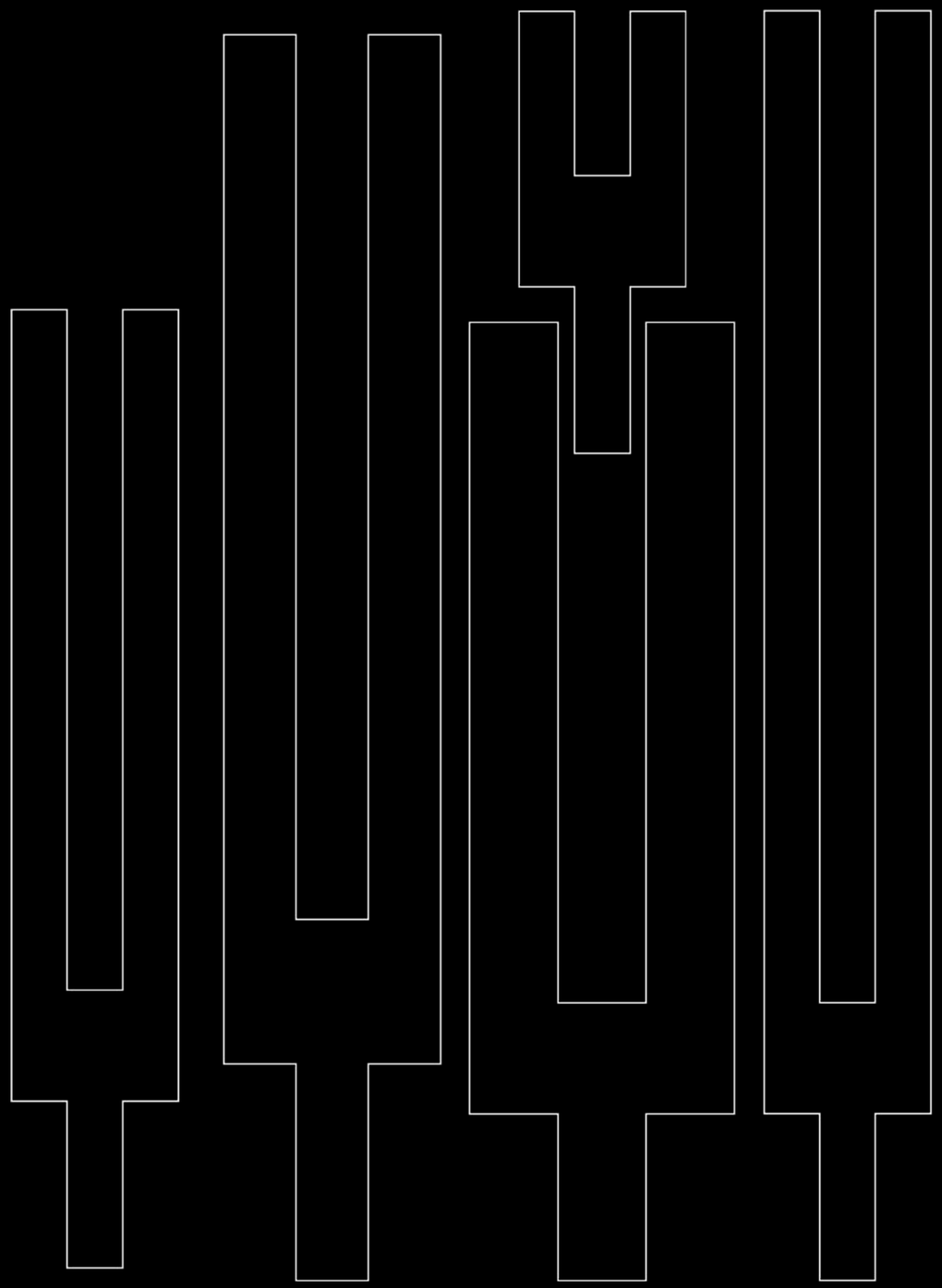
When the tuning fork is hit with a (rubber) hammer, the two tines start to vibrate. The air between the tines is suppressed and released, causing pressure differences in the surrounding air molecules. A pattern of high and low-pressure regions is created, which take shape as waves in air density or so-called sound waves. (the Physics Classroom, n.d.) We hear a sound wave as a perfect tone.
The speed of a tuning fork's vibrations is known as its frequency, a quantity measured in Herz (Hz) or vibrations per second.
On the bottom, there is a handle that can be held without removing energy from the vibrating tines. However, there is still a small number of vibrations that go into the handle. This can be made audible using a sound board like a wooden box. When the measurements are exactly correct, the sound waves bounce off the surface at the right moment and will strengthen each other, making the tone sound much louder.

What is it used for?

Nowadays a tuning fork is generally used to set the pitch for performers or instruments like a piano, though electronic tuners have largely replaced them. An alternative use of the tuning fork is for alternative medical purposes. It can be used for muscle relaxation techniques or meditation. Tuning forks transfer vibrations to the body very easily, so an experienced practitioner can actually relieve pain by placing a vibrating weighted tuning fork on the correct spot of your body.

Making the Tuning Forks

By doing online research on resonance phenomena, we found out that it was rather easy to make a tuning fork ourselves. The shape of a fork is rather simple, a U-shaped piece of steel or aluminium. We found a tutorial online that provided the exact measurements to create the A-tone.
We made a design with multiple variants of the A-tone, to experiment with the effects of the altercations. The prongs (tines) would be shorter or longer, or the entire fork would be enlarged or half the size. We laser-cut and waterjet-cut the design out of a sheet of aluminium and steel. The tuning forks worked very well immediately when struck against a hard material like a tabletop.
The differences in size are notable in the tone that the fork produces. In general, the shorter and more thin forks created a higher pitch, and the longer and wider forks created a lower pitch. The material also made a difference in the tone, in general, the aluminium resonated better than the steel. This was because the steel was heavier and less flexible. We tested the forks in different environments such as the workshop, classroom, and outside. A metal slide in a children's playground transfers the tone really clearly to the other side of the slide.



Measurements tuning forks

Resonant object.

(The result)

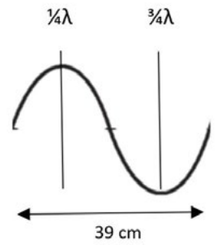
Calculations

To create the perfect resonant object, we created a scenario with the tone-A tuning fork. To amplify the tone the tuning fork should be placed in a resonant wooden box. This way the waves bounce off the wooden sides of the box, and by calculating the wavelength, the exact distance at which the soundwaves amplify each other can be calculated.
The wavelength is given in λ in meters. The frequency of the A-tone is 880 Hz. The speed of sound in normal air is 343 m/s.

$$f = 880\ Hz$$

$$v = 343\ m/s$$

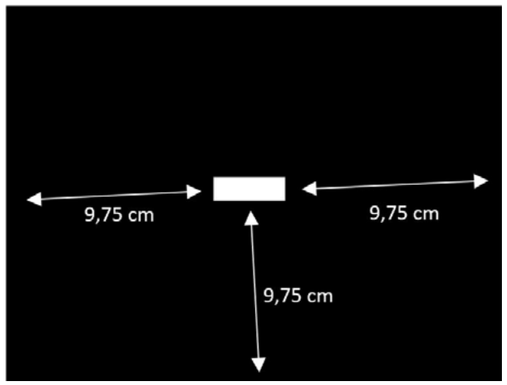
$$\lambda(m) = \frac{v\left(\frac{m}{s}\right)}{F(Hz)} = \frac{343}{880} = 0{,}389\ m \approx 39\ cm$$



The wave can be interrupted in ¼λ or ¾ λ. At these points, the movement is symmetrical. If the wave would be bounced back at ½ λ, the wave would cancel itself out.

$$\frac{1}{4}\lambda = \frac{39}{4} = 9{,}75\ cm$$

This means that the box should be on 9,75 cm distance from the tuning fork. These would be the measurements of the box:

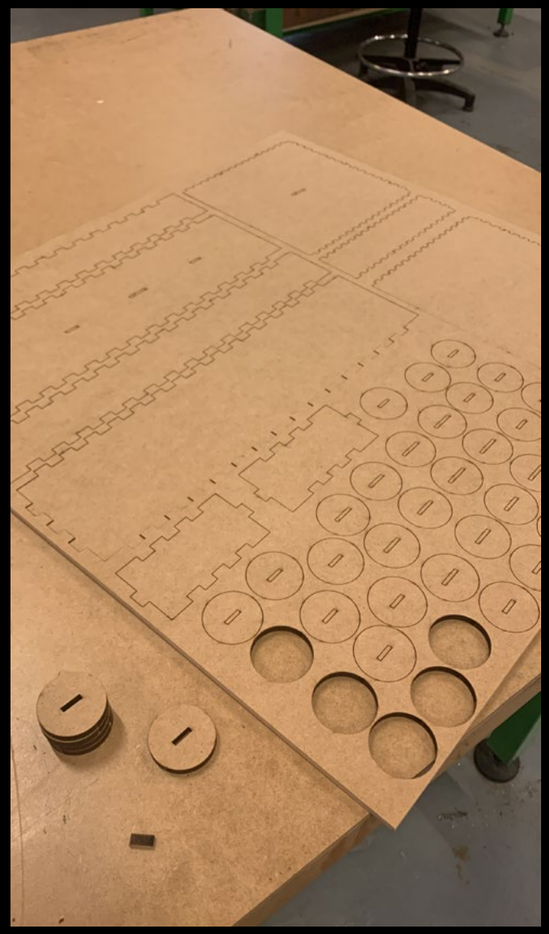


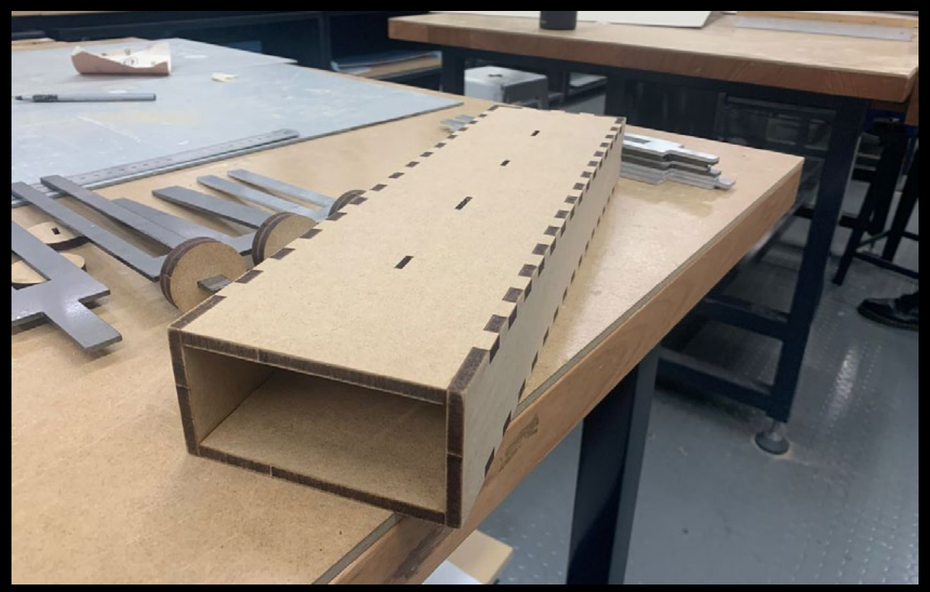
Knowledge on how to make these calculations is retrieved from; University Physics with Modern Physics (Young et al., 2016).

Making process

We wanted to create different sounds with different tuning forks however making multiple resonance boxes was impossible so we choose to put multiple forks in one resonance box. We knew that it was not certain that the tones would be reflected properly, because we did not follow the calculations, but the tuning forks were not pure tones anyway because we had altered the measurements of the tone-A.

The resonance box was made from MDF material, and laser-cut the sides of the box. It was sanded and glued together. To make it look more finished we spray-painted the box black. By continuously spray-painting and sanding, the surface got a shiny and clean finish. The tuning forks were damaged after all the experimentation, but sanding them precisely leveled created a neat finish.





Resonant space.

(The perfect surrounding)

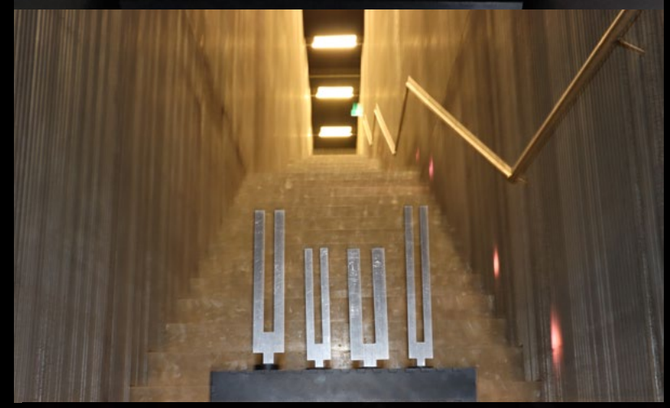
The resonant object was created, now we needed to find our resonant space. Because the sounds that the tuning forks create are quite small we probably needed to find a small space as well. We already tried out our tuning forks individually in some spaces but the use of the resonance box creates a different and more interesting sound. We tried out 4 different spaces, a slide, the stairs in Building 100, a tree trunk and a bathroom.

The slide: We expected the most of this space because it is a small space, with a rounded surface and metal reflective material, we expected that the sound waves would bounce off really well, and next to that the aesthetics would fit the appearance of our object. However, it did not have the desired effect, because slides are usually placed outside and there was too much background noise, recording the effect was really difficult.

Stairs in Building 100: This space is a beautifully resonating space, it has metal on the sides and a high ceiling that creates an echo. However, as expected, our tuning forks create a quite high-pitched small sound which disappears in a big space like this. A space like this more likely resonates better on low tones.

Tree trunk: We were curious what would happen if we would place our object in a space with less reflective material, we found a hollow tree trunk for kids to play in. The space was small and had rounded surfaces which made it resonate more than we expected, but the material did absorb a large part of the sound waves what resulted in the tone not holding on that long.

Bathroom: This room worked the best, it is small and has tiles on the floor and walls which reflect the sound waves well. A toilet can be closed off which eliminates background noise. For the recording, this space fitted best because we could turn off the lights to play with visual effects. We continued with the recordings in this space.



Recording.
(Grasping the effect)

How our object was recorded was a big part of the learning experience, we experimented with the visual effects, lighting and editing in both the sound and image.

Visual Effects

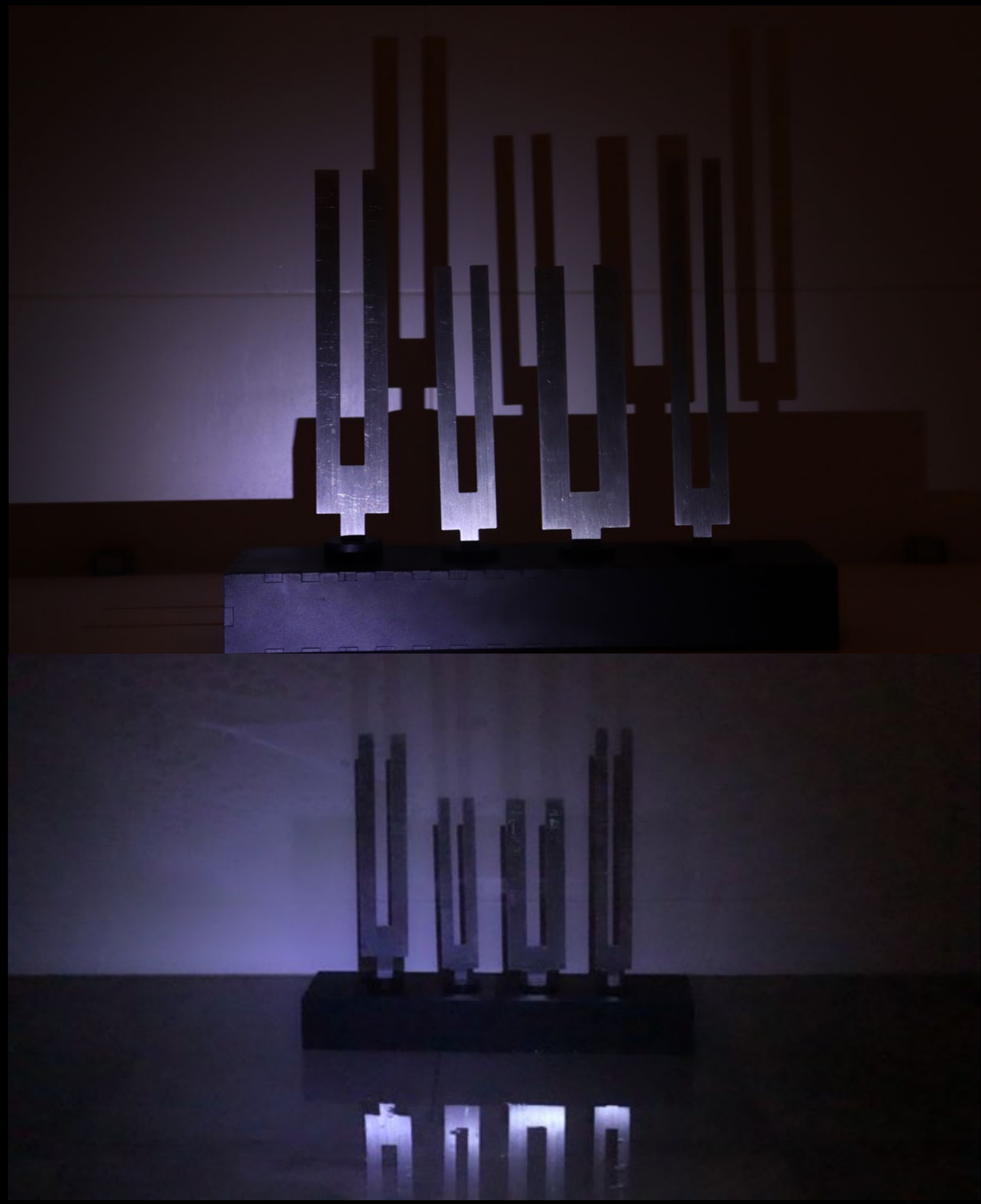
The object we created had a somewhat dark aesthetics, which is why we filmed in the dark with a spotlight on the object. We tried two angles; one against the wall (see image) and one on the ground with a thin layer of water below it (see image). We filmed different types of sounds; ringing only 1 tuning fork or multiple tones creating a rithm. We also experimented with using a flash light in different positions.

Recording Audio

Recording the resonating effect of the tuning forks in the bathroom was quite a challenge, this was because there was a background hum of the fan and the echo was hard to capture. We tried recording with an H2 recorder, but it did not capture the reverb of the bathroom, so we ended up using the sound of the camera.

Recording Video

The material we shot needed quite some editing, because we shot it in the dark there was a lot of noise in the footage so we needed to get rid of this with a lot of editing. For the sound recording, there was a big background hum that was edited out with noise reduction. The noise reduction did get a little bit of the original reverb out of the footage so that was added after editing again.



Reflection.

(And conclusion)

Last report I talked about simplifying complexity with making and visualisation, with light I focused on visualization. With resonance I did this with making, I have some background in physics and actually know a little bit about how to calculate with sound waves however this always stayed very abstract for me. With exploring resonant spaces and creating a resonant object I developed a deeper understanding, next to that it helped me experience spaces further than just the looks it is about the combination of all the senses. Furthermore, this project taught me about materials and making, I have developed new skills and got myself experienced with the workspaces at RMIT. I do think there was some room for improvement regarding the recording of the resonant object and space, I learned how extremely precise it gets when you try to record such delicate tones. I have some skills in video editing, but I needed to learn new functions to edit the footage, for next time I think some more time and experimentation is needed to record it properly.

Patterns.

Construction of perception
Anne Jenster
S3961044

Introduction.

(Nature patterns)

How do we learn and live from and with nature and technology

Patterns in nature can help us understand the world, it makes us realize the wonders and abilities of nature and can make us question our position as humans within this world. This means for us designers that researching these patterns will help us understand the world around us. since the 80s design was mainly focused on human and user-centred design however design is getting more complex, problems like climate change arise and the role of smart technology becomes bigger. some practices in design start thinking about the relationship between humans and non-humans. We might need to start thinking about how we design for algae or chicken, and what kind of frameworks we need. Or how we will live together with a law robot, this viewpoint is called post-humanism (Forlano,2017). For this research assignment, the tree is the objective, there will be to explore how technology (coding) and humans relate to this piece of nature and how they communicate with each other.

Nature Research.

(By experiencing)

To dive into the patterns of nature a park was visited, here the search began for inspiring phenomena. At this point, our interest was in combining coding and geometrical natural patterns. From this point of view the elements in the park were looked at and evaluated. Different structures were identified and photographed.

- Fluid movement, here patterns originate from animals or wind moving the water. It generally creates a water ripple (Img 1-4).

- The folded leaf, here the pattern on the leaf results in the leaf folding, having waves or structure (Img 5-7).

- Rough surfaces, here things a sticking out and creating a 3D pattern creating interesting material properties (Img 8-10).

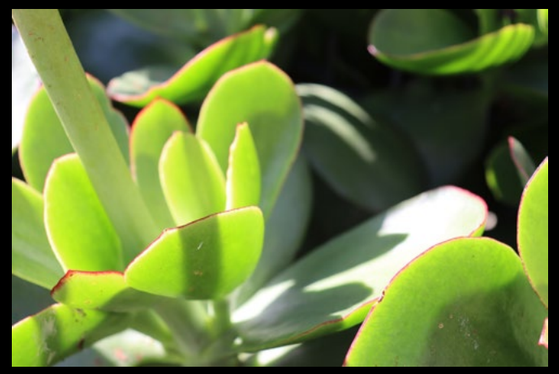
- Smooth surfaces, some trees have a smooth surface, either because its properties (like the gum tree images) or because the bark has come off. Because of this different patterns are created that normal trees, for example, the gum tree bark almost looks like human skin (Img 11-14).

- Centered patterns, a big interest was piqued by especially flowers that have a core and the rest develops around it. One of the flowers was analyzed by drawing it (Img 15-20).

- The growing pattern of fungi was inspiring, the way it creates layers and has a big mass after a while (Img 21-26).

Especially the fungi and the flowers were the most inspiring by the way how it looks and grows from the inside out. this was something that was worth continuing with. These patterns were recognized in a trunk of a tree, this was researched further.

Images 1-4 Fluid movement



Images 5-7 Folded

Images 8-10 Rough surfaces

Images 11-14 smooth surfaces

Images 15-20 Centered paterns

Images 21-26 Fungi patterns

Coding Research.

(And experimentation)

Why coding?

It was soon decided to go in the direction of implementing coding into the design. This was chosen because of the designers' expertise in this area and their program in the Netherlands. Especially the type of coding where something visually interesting is created, the so-called creative coding. Next to that, there was some expertise in making these products interactive and engaging. Since coding is naturally based on mathematical formulas, it fits well with natural phenomena grounded in geometrical rules.

Coding makes a lot possible and experimenting with the interplay between algorithm/technology and nature interested us.

Examples

There are many websites that offer examples to show the possibilities of coding. The start was to scan through those pages and look for codes that show elements of nature to inspire.

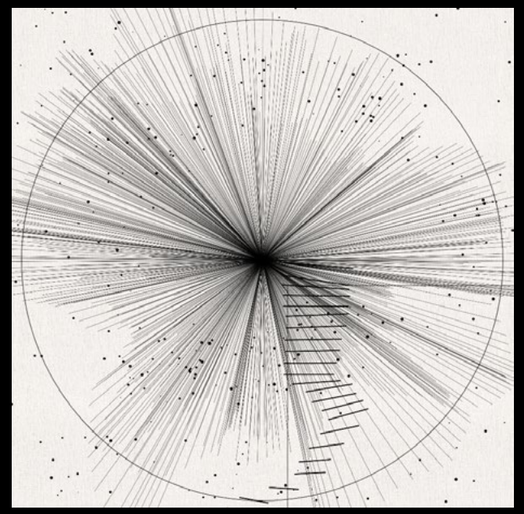
Code 1: 27,28
This code forms a pattern by moving the cursor. Despite it being lines and dots, it looks like you are constructing a flower of some sort. In the second image, the grey areas also seem to have some kind of folds, just like the violets in image 7.

Code 2: 29,30,31
This code generates an image that represents a drop falling into a puddle of water. The circles that form, and how they mix with each other, then disappear again. The code is interactive because you can click where the drops might fall. Very impressive how something can look so realistic.

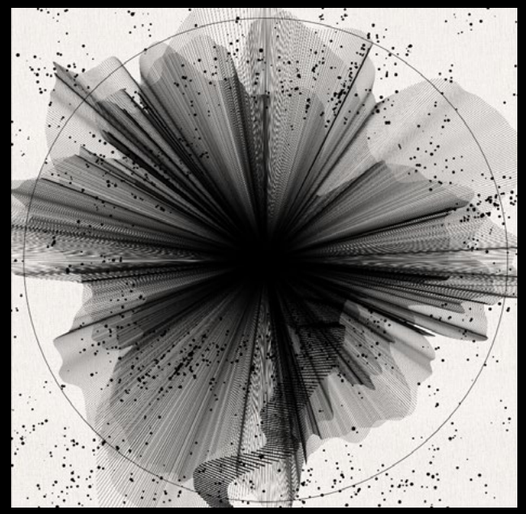
Code 3: 32,33,34
This code shows how certain liquid substances mix together. Think of oil in water, or a lava lamp. You can use the cursor to drive these substances apart or merge them together.

Code 4: 35,36,37
This code represents a cell structure. The circle you see in the second image is the cursor, and you can use it to move the cells apart, just like the third image.

Code 5: 38,39
The last code generates a tree-ring printout with each click. Each new version has a different shape and size.



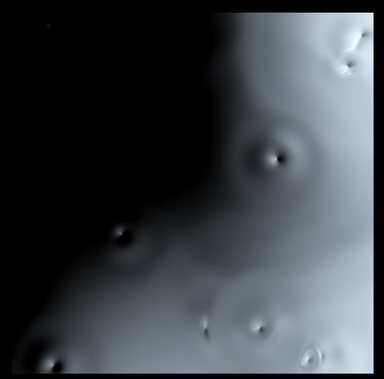
Img 27



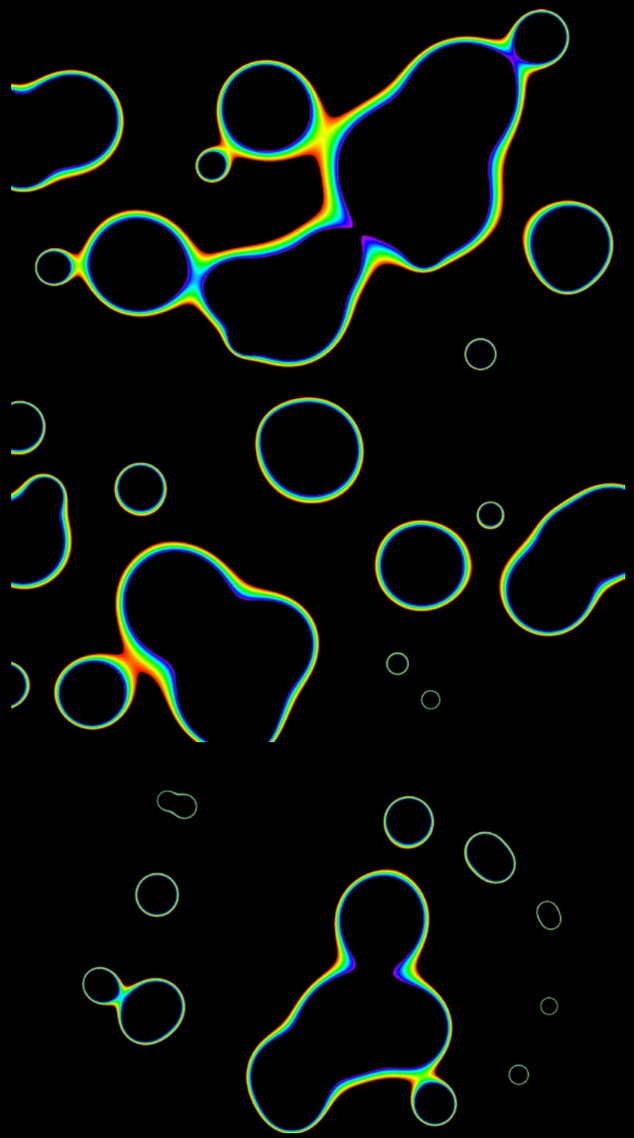
Img 28

Img 29

Img 30



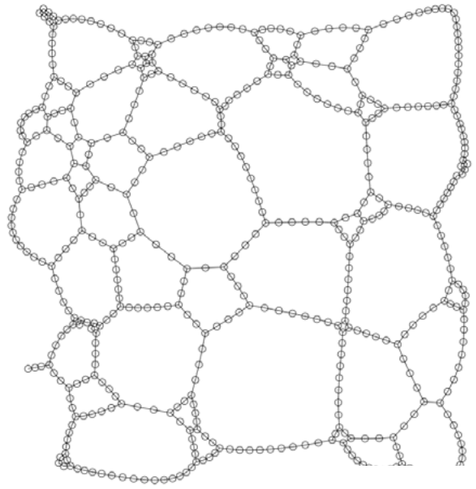
Img 31



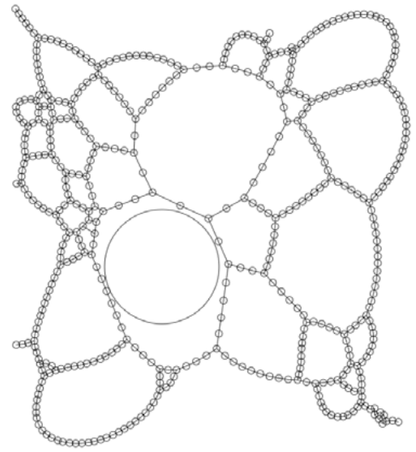
Img 32

Img 33

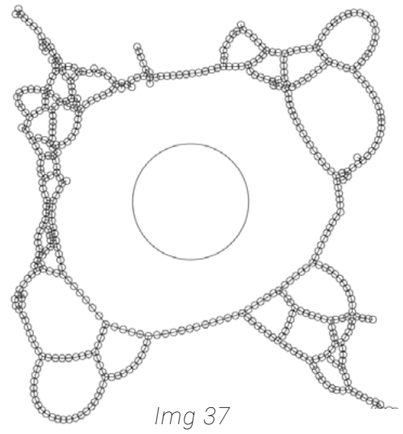
Img 34



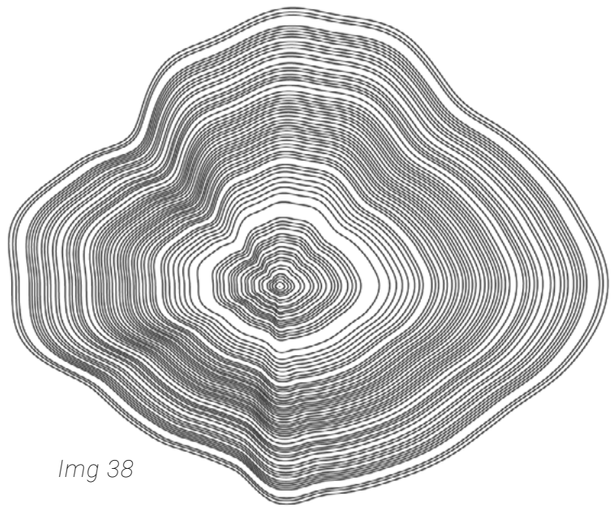
Img 35



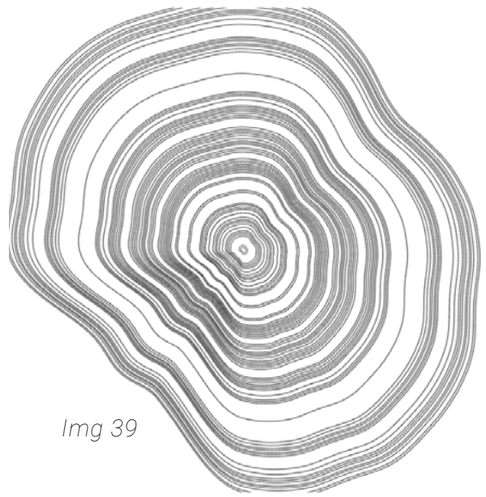
Img 36



Img 37



Img 38



Img 39

Tree Research.

(Understanding the tree)

To understand what the rings of a tree mean and how to read them some research was done. A stump of a tree shows us different patterns and tells interesting stories about the tree and its environment.

How does a tree ring grow?

Each season a tree grows vertically and laterally. The thickening of the tree is caused by this lateral growth and causes the creation of a new ring (Lock, 2021). Each spring and summer, a tree adds new layers of wood to its trunk. The wood formed in spring grows fast and is lighter because it consists of large cells. In summer, growth is slower; the wood has smaller cells and is dark. So when the tree is cut, the layers appear as alternating rings of light and dark wood (The Living Forest at arborday.org, no date).

Tree trunk Anatomy

The tree trunk is made up of the following parts: the pith and heartwood, the sapwood, the vascular cambium, the inner bark, the outer bark, and the medullary rays. The pith and heartwood make up the central part of the tree and give the tree structural strength. The sapwood surrounds the heartwood and is made up of active xylem cells that are responsible for transporting water and nutrients. The vascular cambium is a ring of growth tissue that is responsible for creating new xylem and phloem cells. The inner bark is the part of the tree that contains phloem cells and is responsible for transporting sap around the tree. The cells created in the sapwood lead to distinctive light and dark rings. The ring is light because of rapid sugar-fuelled growth, which occurs in the warmer months. At the end of the growing season, in late summer, the cells are way smaller and form darker rings. The outer bark is the outermost layer of the tree that protects the tree from damage. The medullary rays are the rays that come out from the center of the stump and connect the pith to the outer layers of the tree (Lock, 2021).

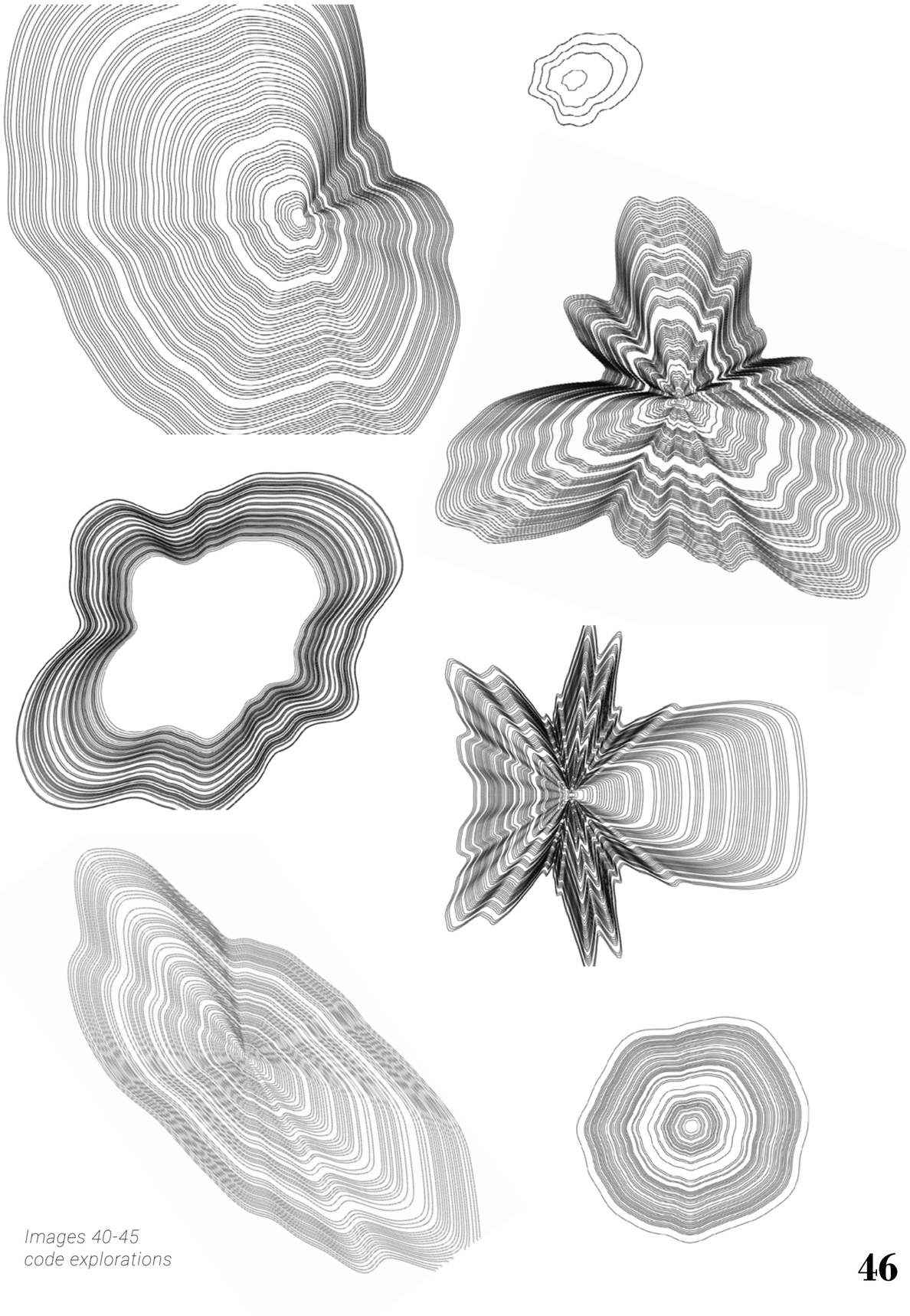
Tree trunk Anatomy

The thickness of a tree's growth rings can vary depending on the conditions the tree was exposed to. If a tree experiences ideal conditions, like plenty of sunlight and nutrients, the tree will grow healthy and the rings will be the expected thickness for the tree's species and age. However, if a tree experiences less than ideal conditions, like a lack of sunlight or nutrients, the tree may not be able to photosynthesize at full capacity and the rings will appear thinner.

Factors that influence the growth of the tree are:

- sunlight
- air
- soil moisture
- nutrients
- temperatures.
- diseases
- animals
- fires

(Lock, 2021)



Images 40-45
code explorations

Code Exploration and Explanation

Alteration of the Code

The code of an example website was taken as fundament. A code often simply consists of pieces written by other coders, so our code is as well.
The initial code would generate prints of a tree trunk. From this, the goniometrical part -which would create folds in the circles- was copied as it was quite complicated. However, the aim was to make it more personal and interactive.
The base code was thoroughly analyzed, and certain elements were made variable instead of constants, so they could be altered. In the following images you can see how we have experimented with the code, and to what visuals this led (see Images 40-45)
These elements were the number of rings and the distance between the rings.
A slider and selection bar was added to the canvas, where the user could give information about themselves.

Explanation of the final code

The function setup, function mySelectEvent, and function mydrawfunc are created to set the canvas and the text, slider and selection bar in the top left corner are created.
Function ppp is what initially creates the tree rings. The code simply creates circles from the centre of the page and goes outwards. Each time a certain distance is added and a new bigger ring is created. The rings are also not completely round, because a random function adds slight alterations to the shape of the circle.
The slider simply defines to the amount of rings. The selection bar is connected to a predefined setting that influences the distance between the rings.

Final design.

(Algorithmic Tree)

The final design is a discussion piece on the relationship between nature, human,s and computing. The piece exists out o two parts; a physical representation of a tree and an algorithm that generates personalized blueprints of a tree. Starting with a generated image of code physicalizing it with laser cutting and analyzing it again with principles of nature, then personalizing the algorithm with the generator. The vision behind this design connects with the viewpoints of post-humanism, where the idea that a change is happening in our understanding of the self and its relation to the natural world, technology and biotechnology is articulated. The human is no longer the centre of the universe and designers should design for every participant in nature and see machines as collaborators (Forlano, 2017). In this design, technology is not seen as a tool but as an outcome of the project and has the same value as the nature and personalisation aspects. An attempt is made to connect nature phenomena to technology by creating the tree generating algorithm and bringing it to the human with personalisation and physicality.

Laser cutting

To embody the algorithm there was chosen to physicalize the algorithm by making a laser cutter tree trunk. MDF was chosen as material because of the aesthetic fit of a tree. When there was a first version of the code an image of a tree trunk was generated, this image was simplified a bit to make it fit for laser cutting. The tree trunk exists out of 24 layers and was stuck together with wood glue.

Explanation screen

To communicate the information about the tree there was chosen to put a layer of acrylic on the prototype explaining the rings and age of the tree. This makes the visitor more aware of certain details and can allow for exploration, if these details can be found back in different locations in the design.

Storytelling

An AI was used to transfer the information that was analysed from the generated tree towards a story, working together with technology to make the information human again:

Each spring and summer, a tree adds new layers of wood to its trunk. The wood formed in spring grows fast and is lighter because it consists of large cells. In summer, growth is slower; the wood has smaller cells and is dark. So when the tree is cut, the layers appear as alternating rings of light and dark wood.

Let's dive into the history of this tree:
The tree was 24 years old, and it had seen some rough years around the years 7 and 8. The bad weather had caused the tree's growth to slow down, and the rings were close together. But then, around year 10, she had some really good years. It got lots of sunshine and rain, and its growth was strong. This can be seen in the rings, which are relatively broad and evenly spaced. However, around year 22, the neighbouring trees began to provide too much shade. Their crowns and root systems took up the lion's share of water and sunshine, and the tree's growth began to slow down again.

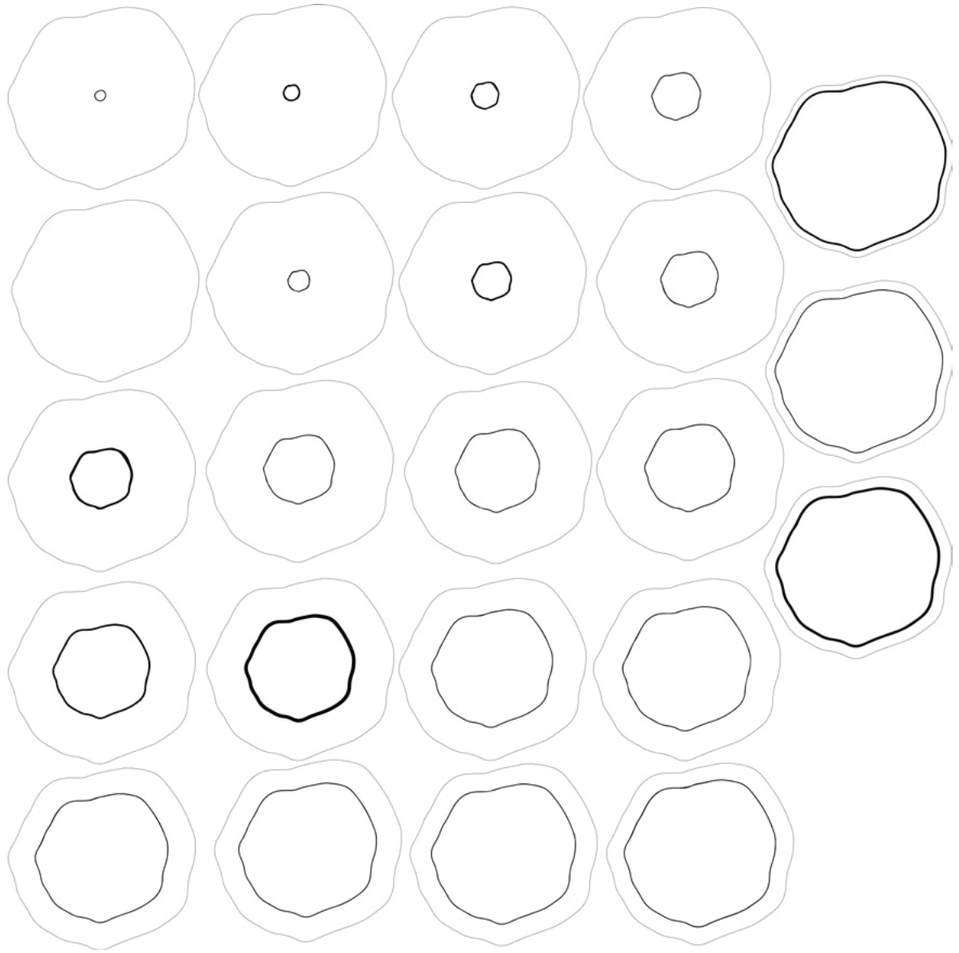
Generator

Whereas the physical representation of the tree is based on computing nature, the generator would do it the other way around, so nature computing. The visitor puts in information about itself, so information as a human. The generator then starts processing this information and creates a personalised visual. There are two variables that can be altered, the age of the person and the play where they live. Based on the climate and the age, a blueprint of a tree trunk is generated.

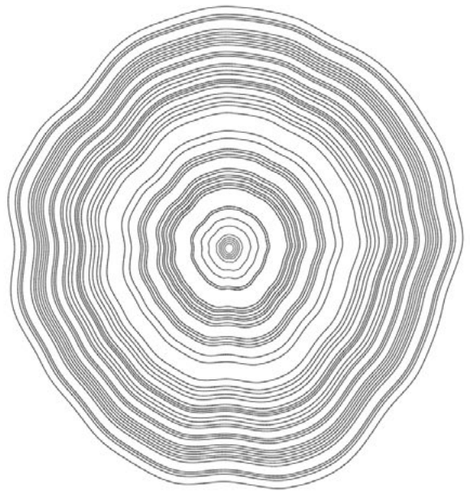
Since it is personal and dependent on details about your life, people feel more engaged. Visitors get to interact with the algorithm. Also, experimentation is possible. What if I were 20 years older, or what if I was born on the other side of the world? How would this affect my personal tree print?

Img 46 final design

Img 47 Explanation screen



Img 48 lasercut file



Img 49 Generator

Reflection.

(And conclusion)

The last two reflections talked about making sense of complexity by making and visualizing, these were two fields more familiar to me. By looking at the patterns of nature I saw that this can help us deal with complexity. This can happen when researching a specific phenomenon (tree) but also when looking around a park. In a way, I became a nature anthropologist, which thought me to pay attention to different things than I am used to doing in field research. The tree tells us a story of the climate of the last couple of years and can teach humans about climate change, to achieve this technological collaboration is needed. Trying to recreate nature with coding taught me to look at different parts of the natural phenomenon than when just looking at the object. Creating formulas to generate this visualisation explored the relationship and similarities between nature and technology. Next to that diving into post-humanism, I started looking at design in a different way which inspired me to explore the relationship between humans and non-humans in other courses as well.
This project is one that I would like to continue in the final assignment, it possesses great complexity and has the ability to learn us how to deal with this complexity and operates in concepts of post-humanism. We can use nature patterns and technology to learn about climate change.

Final work.

Construction of perception
Anne Jenster
S3961044

Introduction.
(Digital Deforestation)

Can a tree explain itself?

One-third of all trees disappeared from the planet. Forests have been cleared throughout history and into the present era to make room for agriculture and animal grazing as well as to obtain wood for fuel, manufacture, and construction. In addition, the effects of climate change, such as wildfires, have an impact on our dwindling forests. Humans are a danger to the world's forests and, thus, their biodiversity (Stanley, no date).
The Post-Humanism approach can be used to reflect on the relationship between humans and trees. We should start designing for and with nature, start seeing them as an important actor in our design processes. How can nature, technology and humans collaborate to regain balance? Can we use nature's data to help humans understand the complexity of deforestation? How can we use technology to help with gaining this understanding? Can the trees explain themselves?

In this chapter you can read about the procces towards the final concept.

Design methods.

(used throughout the project)

Phenomenology

Literally, phenomenology is the study of “phenomena”: appearances of things, or things as they appear in our experience, or the ways we experience things, thus the meanings things have in our experience. Phenomenology studies conscious experience from the subjective or first-person point of view (Wren, no date).

Post-phenomenology

We perceive the world in various dimensions, and this concept means “being in the world” in phenomenology (Hummels, 2021). According to Leung et al, a person’s interaction with the world is individualized (acquired through their own motor and perceptual systems), which means it is made meaningful by previous interactions (Leung et al., 2011).

The documentary Being in the World talks about Heidegger’s philosophy. They used an experienced carpenter as an example of phenomenology. They give the example that this carpenter is so articulated in his profession that the activities go through his body which has a certain know-how.

Speculative Design

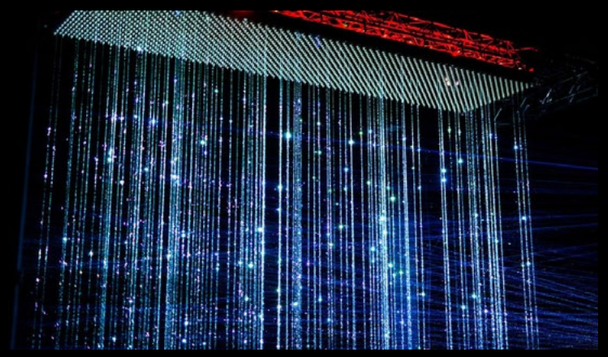
Speculative design uses fiction to present alternative products, systems or worlds, removing the constraint from the physical world surrounding us. Design speculation requires a bridge to exist between the audience’s perception of their world and the fictional element of the concept (Auger, 2013). This kind of design can be used to present futures in which deforestation has continued to progress as it had in the past decades, to show what effect this could have on the world and our daily practices.

Post Humanism

Post Humanism aims to blur the boundaries between the familiar binaries of human and nonhuman, culture and nature, and human and animal. Nonhumans have new kinds of agencies in the world. It reveals new perspectives and raises questions about what, how, and why we engage in the design of the so-called “artificial” world (Forlano, 2017).

Precedents.

(Certain projects were inspiring and offered guidance in making design decisions)



img 1 GLOW

GLOW

an interactive light festival in Eindhoven, The Netherlands. This installation projects light on artificial rain, making it a three-dimensional projection (GLOW, 2022). The room is completely dark and the only thing you can see are the falling raindrops that light up, all around you. The experience was so impressive, the visitor completely emerges into the installation. This notion of wonderous things happening all around you is what we wanted to take with us to our final design.

img. 2 Wither

Wither

by Thijs Biersteker. This is an installation, similar to The Egg, that uses real-time data about deforestation. The installation uses light impulses to indicate each time that 250m2 of rainforest is being deforested (Wither, n.d.). Similarly to The Egg, a big complex theme is tackled in a simple yet effective way that stresses urgency.

Img 3 The EGG

The EGG

by Marco Barotty. This project is currently displayed in the Science Gallery. The sculpture is a large egg that uses live data about births all over the world, each time a new person is born the egg produces a low vibration and pulse. (Barotti, n.d.) The idea of this design is actually really simplistic, but it still makes visitors aware and makes them reflect on a quite important and big theme namely overpopulation. The use of live data brings an urgency, you have to think about it because it is happening right now! This simplicity and urgency were a big inspiration, and is what we wanted to use in our own design as well, and convey to the visitor.

Img 4 Twist

TWIST

by Christophe Guinet. These are sculptures that look like trees, in an odd fluent form (Guinet, 2022). With these sculptures, he tries to push the boundaries of nature to transform it into popular culture. He experiments with nature's ability to transform and adapt. During our exploration phase, there were experiments with wood and the different shapes it can take. These projects inspired us in using data and its visualization or physicalistic, a simple yet effective installation that stresses the urgency of the topic. Also, using some sort of light surrounds the user to create this emergent and almost magical experience.

Experiments/ Process.

Step 1: Tree rings

After the research into nature's patterns, there was decided to continue in this line for our final concept. What we liked about the Tree rings and thus wanted to continue was;

- the issue it was addressing, namely deforestation
- how coding was used
- the personalizable aspect
- the phenomena of tree growth
- the posthuman approach, where it was explored how technology (coding) and humans relate to this piece of nature and how they communicate with each other

To understand trees better and to experience the relationship between human technology and tree there was a need to dive deeper into the science of wood and the history of how humanity has utilized this.

Step 2: Wood Research

Many craftsmen have mastered the skills of woodworking and have a thorough understanding of wood, and appreciate its beauty and fragility. However, the serious human threat of deforestation illustrates how fast consumption leads to a decrease in forests.
In this project, we investigate the relationship between humans and wood. Can we work together with trees to create a product from which we could both benefit? And how can we use the past to speculate about this Post-Human future? The research into trees, wood and the human relationship with it was divided into two parts.

Research into the phenomena and history

In our history, wood has been crucial. It is the only source of continuity in our lengthy evolutionary and cultural history, which began with apes wandering through the forest and continued through farmers using axes and spears, carpenters building roofs, and intellectuals reading papers.

Wood is an all-round structural material, lighter than water, the same stiffness, strength, and toughness as steel, and can withstand being stretched as well as squeezed. It splits easily down the grain and is flexible enough to cut, especially when still green, making it simple to shape. It can be split up into instruments as little as a toothpick and is found in pieces big enough to support houses. Although it can last for centuries if maintained perpetually moist or dry, it can also be burned to provide us with heat, cook our food, and power a variety of industrial activities (Ennos, 2021).

Japanese Carpentry

Context: Chinese architectural influences from the 12th century contributed to the development of Japanese carpentry more than a millennium ago. Without using power tools, nails, screws, glue, or other fasteners, wooden furniture is constructed using joints found in ancient Chinese timber architecture (Japanese carpentry - Wikipedia, no date).

Interaction: Japanese carpenters play with the power of wood, they make use of forces to make the structures strong. They manipulate and cut the wood with a variety of precise tools. They understand different types of wood and make use of their different properties.

Beautiful because: Experienced carpenters can have a post-phenomenal way of working, it is like they work together with the wood. When very articulated in their professional activities can go through their body that has a certain know-how.

https://japanwoodcraftassociation.com/2020/01/27/makers-abroad-hiroshi-sakaguchi/

img 5 Carpenter

Arboreal animals

Context: Animals classified as arboreal live mostly in trees where they eat, sleep, play, and raise their young. Animals that live in trees are usually found in the tree canopy and the emergent layer, which is made up of treetops that may be seen peeking above the forest into the clouds. Geographically, tropical forests are where arboreal creatures are most common, but they can be found in all forest habitats worldwide. The trees are home to a wide variety of wildlife, including insects, arachnids, amphibians, reptiles, birds, and mammals (Reynandez, no date).

Interaction: Animals living in trees face several fascinating obstacles, such as navigating the forest, caring for young, acquiring and storing food, and finding shelter during bad weather. Physical adaptations that have produced some extremely unique and adorable creatures have helped to solve many of these problems. Form fits function is one of the key concepts in biology, and it is beautifully illustrated by the adaptations of animals that live in trees. Organisms' specific anatomy is expertly designed for the task at hand. Such as hanging low centers of gravity, gliding membranes, and prehensile tails (Reynandez, no date).

https://wildlifeinformer.com/examples-of-arboreal-animals/

img 6,7 arboreal animals

Beautiful because: It is interesting how these animals adapted to their environment. It articulates a way of living that we as humans can learn from if moving to post-human living. The way these animals make their home. Humans could live among trees instead of chopping them and building houses.

Insights into the psychological dimension of wood–human interaction

Context: According to the findings, wood elicits more good feelings than plaster, and each person's level of biophilia seems to affect how they perceive the environment through touch, sound, and smell. Additionally, it demonstrates how wood is utilized in actual buildings enhances people's psychological well-being, and emphasizes the significance of taking into account many sensory modalities while examining wood-human interaction (Demattè et al., 2018).

Interaction: Having wooden furniture, being around wood. for example, people in a wooden waiting room tend to have less anxiety. Materials have an impact on humans, and this paper articulates that especially wood has a positive impact. This proves the importance of living together with trees.

Aboriginal use of wood

Context: Indigenous Australians have historically employed a variety of tools and weapons in their daily lives, frequently for gathering and transporting food. The majority of the wooden equipment, tools, and weapons are made from local woods, which vary depending on the instrument or weapon. Fire is another tool used by traditional cultures to bend, straighten, or harden the wood. (David M. Welch, n.d.)

Interaction: The type of wood is selected based on its use. It is carefully worked to enhance the right qualities. The product is used for daily necessities such as hunting and eating.

img 8 aboriginal wood

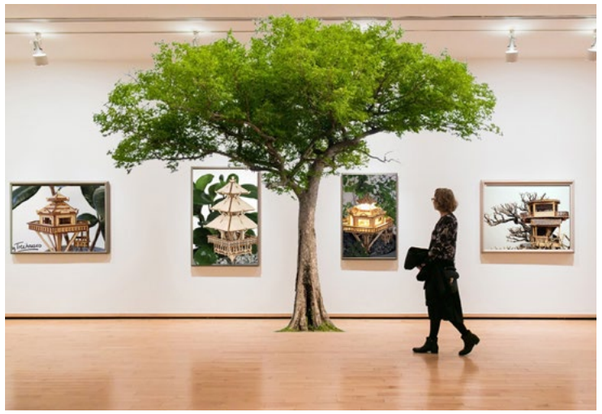
Beautiful because: The tools they make are made from scratch and with their bare hands. They know exactly the right way to edit the wood. It is only one material but it is useful for so many different tasks throughout the day.

Physical research by making

To explore the wood and really understand its behavior some physical exploration was done by walking through the forest and taking apart pieces of wood. With this, we learned about the material properties of different types of wood and learned how to appreciate it. This way of exploring was also an ideation technique to come up with a final concept.

At the end of this phase, a concept was developed about little tree houses in trees. To explain post-humanism living, and how the relationship between humans and trees took shape in history and evolved over the years. Illustrating how we can live with trees in the future instead of from trees. The exhibition would be a gallery of pictures of tiny tree houses in the city and one tree installation in the museum. However this concept missed the showing of phenomena and was made static, so we decided to look more into the data on deforestation.

img 9 wood exploration



img 10 tiny houses in gallery

Step 3: Deforestation visualization

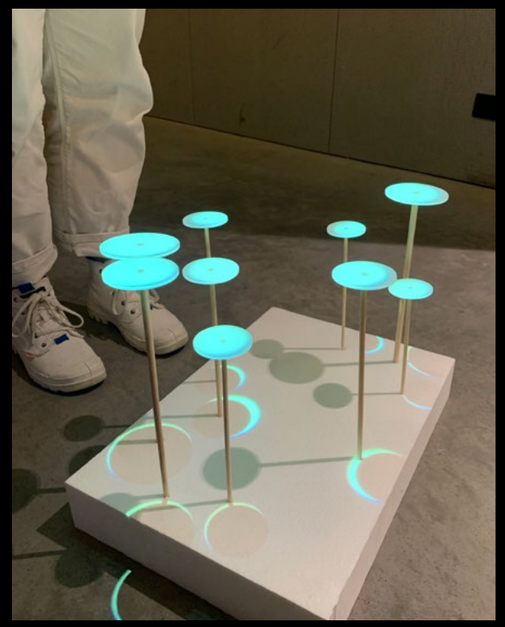
The next phase focussed on how deforestation data can be visualized and made experienceable. How can the message and notion of urgency be conveyed? The research was done into what data would be most effective to show, and into self-visualizing data in nature.

The deliberate clearance of forested terrain is known as deforestation. Forests have been cleared throughout history and into the present era to make room for agriculture and animal grazing as well as to obtain wood for fuel, manufacture, and construction (Stanley, no date).

The need for land for infrastructure development, mining, and agriculture is the main driver of deforestation worldwide. The world has lost one-third of its forests, yet a stop to deforestation is feasible. The degradation of nature and ecosystems by humanity as a result of very recent population increase and rising consumption is what many people think of when they think about environmental concerns. For some issues, like climate change, this is true. However, this is not true of deforestation. For thousands of years, people have been chopping down trees. The per capita footprint of our predecessors would have been considerable even with the most primitive lifestyles in comparison to modern standards. Large areas of land had to be cleared because of low agricultural output and the need for wood for fuel (Ritchie and Roser, 2021) .

As a way to visualize this data, the projection was experimented with, to give the projection a 3D effect acrylic was used that was spray painted white on the bottom to create internal reflection. The first concept existed out of small circles that would represent a forest, and the projection would show the number of trees cut down. This would include live data, and every time trees were cut down the light in the circle would go out. This first concept was realized in a small-scale model where the projection could be tested on. However, this concept abstracted the phenomena of trees and tree growth too much and they looked like mushrooms. A different concept was required.

The next concept was one of the tree roots, the way how the tree roots looked was based on fractile growth based on code.



img 11- 14 concept 1 and acrylic experiment

Final design.

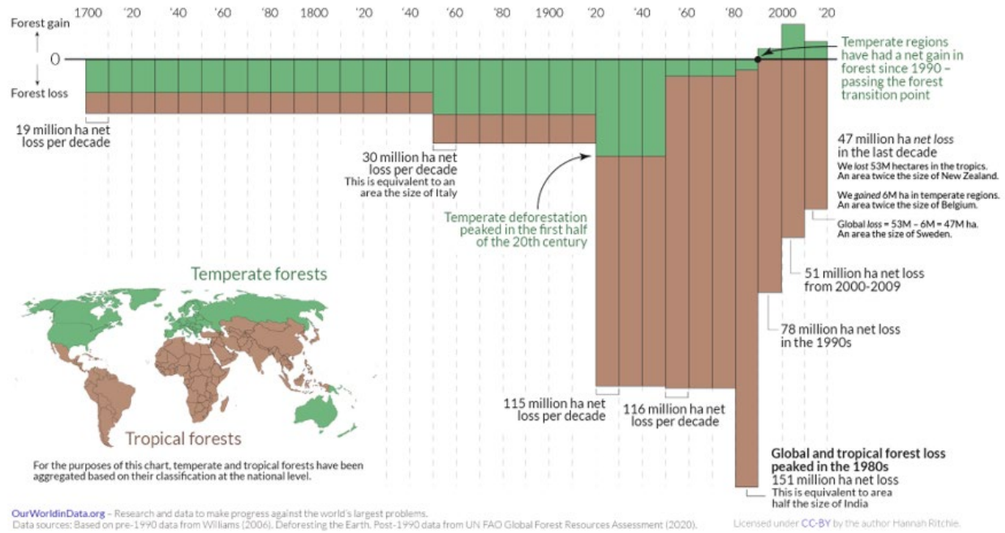
Phenomena

The computer is a medium capable of translating designers' creative thinking into computational logic and thereby automating abstractions. However, this intelligence can be found all around us, not digitally but in our nature. Nature around us is a big data visualization showing us information about its state of growth. The traces that are left behind by objects become the visualization. Tree rings show us how old a tree is, and the color and size of tomatoes tell us information about its ripeness. The passage of time is recorded. This self-visualizing data, or analog intelligence, inspired us to search for a phenomenon in nature.

The phenomenon that we are touching upon is the growth of trees. Tree roots are opportunistic. They will grow where conditions in the soil are the best, and function as a big support mechanism for all its parts above the ground level. Tree roots grow longer and further when they have the opportunity to do so. It shows us how grounded and secure a tree is.

Research in Deforestation Data

In order to understand deforestation, we need to know why and where it is happening. The concept would display the following data:



img 15 deforestation since 1700

	Logging	Shifting Agriculture	Forestry Products	Wildfires
South-America	3.4 Mha	1.4 Mha	0.5 Mha	0.1 Mha
Asia	1.6 Mha	0.6 Mha	0.4 Mha	0.1 Mha
Africa	0.1 Mha	2.4 Mha	0.15 Mha	0 Mha
North-America	0.2 Mha	0.1 Mha	2.3 Mha	2.3 Mha
Antarctica	0.1 Mha	0.1 Mha	1.6 Mha	2.6 Mha
Europe	0 Mha	0 Mha	0.9 Mha	0.1 Mha
Oceania	0.1 Mha	0.1 Mha	0.2 Mha	0.4 Mha
World	5.8 Mha	5 Mha	5.4 Mha	4.8 Mha

img 16 total deforestation per category

Final Concept

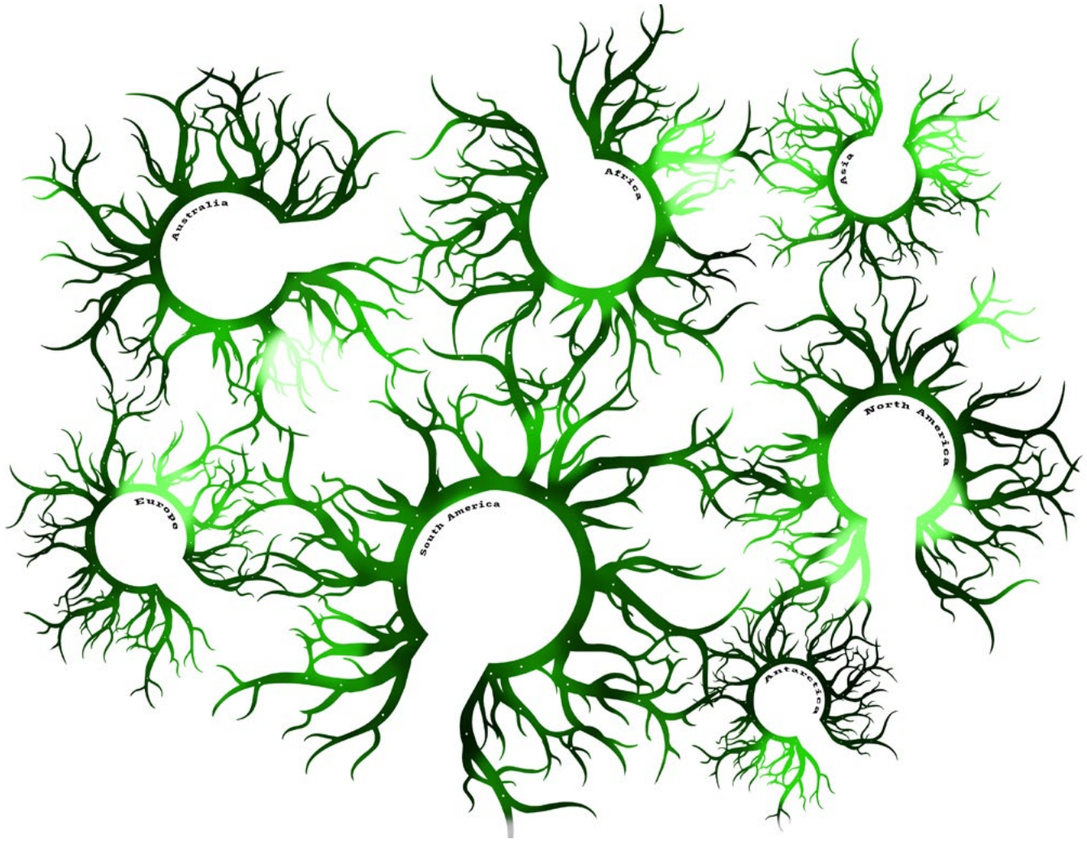
The final concept is an interactive light installation that shows deforestation data, aiming to inform the visitor about the topic and stress its concern and urgency.

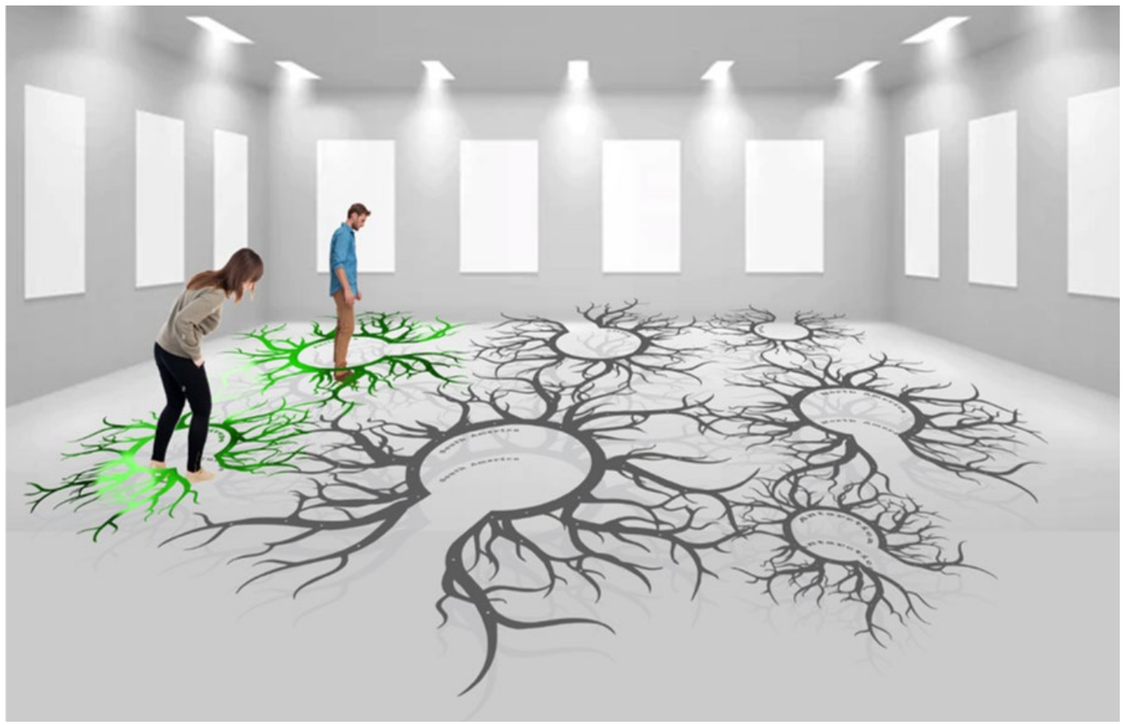
In order to be aware of the geographical aspect of deforestation, we included the seven continents. The installation consists out of seven different acrylic shapes that represent a top view of tree roots, one for every continent. The size of the acrylic piece indicates the surface size of the continent.
A projector projects on the acrylic from above. The projection shows an animation, revealing data about deforestation. First, the development of temporal and tropical forest are shown, approximately between 1700 and now. The projected surface of the continent starts to shrink, indicating the loss of forest. The data is not shown in numbers, solely in relative surface decline. The second data output is how the forest is being used, be it for forestry products, logging, agriculture, or by means of wildfires. Each has its own color, and the added text is clarifying the categories.

A timeline indicates the period in which this in- or decrease took place. Because the projection can be placed on the floor or on the layer of acrylic, there are multiple levels of information.

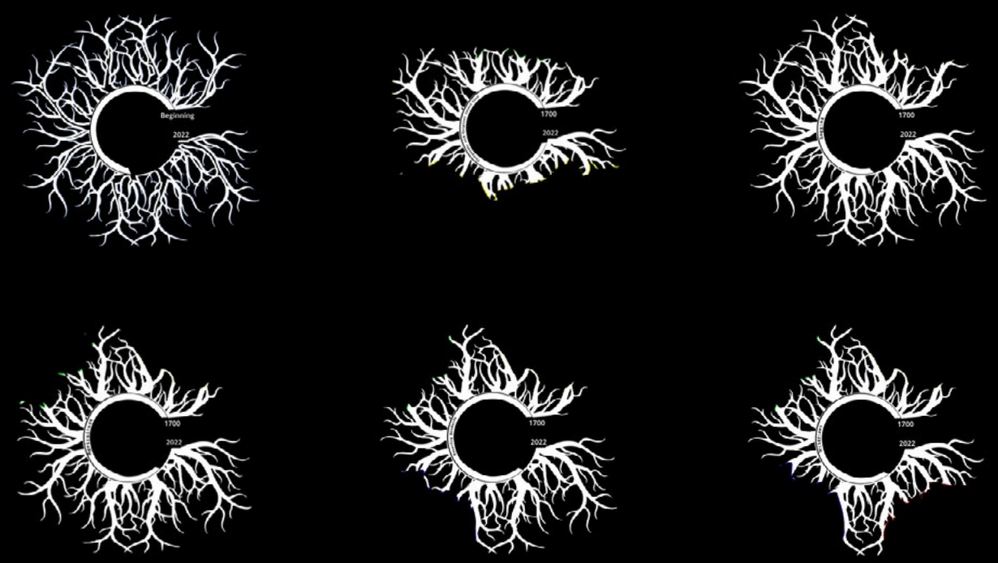
The installation has an auditory experience as well. A soundscape accompanies the categories by adding corresponding sounds.

The installation is interactive. The acrylic shapes each have an opening, inviting visitors to go and stand in it. The roots only reveal their data when a person takes place in the middle of a tree. If multiple people take positions in the continents, the data also starts to communicate amongst each other. There are continents that do very well in their own deforestation but take wood from other continents, and this exchange in wood will reveal itself once multiple people activate the roots.





img 17-18 acrylic



img 19 animations

Prototype

The prototype that was built for the presentation is different from the final design. As making seven large different pieces of acrylic would be complicated, the prototype focussed on data representing the whole world. Also, the final design should be significantly bigger, making it comfortable and inviting to go stand in the middle.
The animation first shows the decline and growth in temporal and tropical forests. After that, it shows how many hectares of forest were lost due to agriculture, forestry products, logging, or wildfires.

Lasercut

A silhouette design of tree roots was made and adjusted to the preferred size with a circle in the middle for a person to stand in. Certain branches were taken out of the design, meaning that they were not included in the acrylic piece, but only projected on the floor. This design was divided into six parts and lasercutted individually.

The bottom was spray painted and all the sides were carefully cleaned of spraypaint. After that, small wooden sticks were prepared by cutting them to one size. They were glued to the acrylic pieces, functioning as legs. Some acrylic pieces were glued together, making the final piece only exist out of four parts for easy assembly.

Animation

The animation was made in Davinci resolve and adobe after effects. it was based on real-time data (see page 69) and It has the following stages:
Growth from the “begining of the earth” to now

1. The decline of trees 1700-2022 temporal forests and tropical forests
2. The decline of trees 1700-2022 caused by logging
3. The decline of trees 1700-2022 caused by agriculture
4. The decline of trees 1700-2022 caused by forestry products
5. The decline of trees 1700-2022 caused by wildfires

Science Gallery.

For a project to be presented in the science gallery, the design needs to be made gallery-ready. This means that the design needs to be built and manufactured professionally. The science gallery has a budget available for each chosen project to manufacture it.

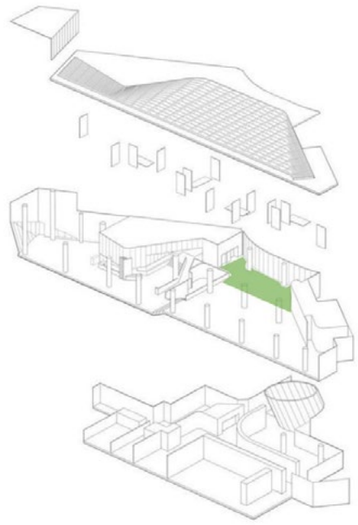
Realize

Since the design uses total internal reflection, it needs acrylic. Seven continents are involved in the design, so seven big tree-root-structure pieces need to be laser cutted out of the acrylic. Also, the acrylic needs to be slightly above the ground, hence it needs legs to stand on. They are made out of wood and just positioned on the floor, but it is recommended to make it more sturdy by attaching them to the ground. Multiple big projectors that can be attached to the ceiling are necessary. As the installation is interactive, sensors have to be installed that can sense the presence of a person, to which the animation can respond. Also, the soundscape needs to be recreated professionally, perhaps making the sound respond directionally to the animation.

Lastly, the data and the animation. For the design that was presented, data was used that was available on the internet. However, speaking to an expert in the field will give more elaborate insights on the topic, and possibly get real-life data. The animation of the projection is the most important, this needs to be created by a designer that transfers the data into a visual, and by an animator that can make this visual moving.

Placement in the gallery

For the placement in the gallery, we have chosen a location that is big, yet is placed somewhere close to a corner where there is not too much light. Depending on the visibility of the projection, perhaps some curtains might be necessary to block the light of the rest of the exhibition. On the other hand, if projectors are powerful enough, that might not be necessary.



img 20 location in science gallery

Future work

There were a few ideas that could be considered if the concept is being further developed.

- The animation lacked clarity about what was actually the meaning of each motion happening. There was text in the design that described each motion, however, this still proved to be unclear. We could enhance this understanding by using images in the animation, such as fire and construction or animals, or just brighter colors. The circle timeline was also not clear as it looked like a clock that would indicate hours instead of years.

- There needs to be additional information about deforestation, for example with a clear didactic panel to explain exactly what each animation and term means. We mentioned temporal and tropical forests, but it might not be clear what their definition and effects are. In order to understand deforestation, visitors need to be aware of some background information.

- The installation could be made more elaborate by using multiple layers of acrylic on top of each other. This means that the installation is higher, and therefore the visitor is more surrounded by the tree roots. Also, more data could be projected on these multiple layers.

- The installation can be made more interactive. Allowing the visitors to choose what data they want to see, or letting them zoom in on certain parts that spark interest.

- A speculative future element could be added. How do visitors see the future of deforestation? Maybe they can adjust the projection to their preferred future. Or the installation could show examples of futures, like humanity collaborating with trees, or what would a world without trees look like?

Reflection.

Before I started my exchange I set some goals for myself as a designer. Back home at my home University I am already quite developed in a certain area where I am also already working in, namely designing for transformation (social design) where am exploring the field of design and politics. However this direction is quite theoretical I see myself as a maker, I use making as a way to make sense of complexity, and this was also one of my goals when coming to RMIT. Learning how to make, visualize and sense. If I look at my three projects and the end work this was also the overarching theme.

With light, I learned how to use beauty to grasp curiosity and intrinsic motivation to learn more. With sound, I learned how to create and make an experience, and how every sense is important. Next to that it also learned me how making can also make things clear for the designer itself. With the patterns project, I realised that the things around us can already explain so much complexity, I learned how to sense and how to use natures ways of communicating. This was something very valuable for me. These projects gave me tools to understand and explain complexity, this made me stronger as a social designer as the societal issues we have to deal with are getting more and more complex.

With designing the end concept I learned a whole new design process, as we were designing for a gallery the end work was more important than the way to it. This way of working did not come naturally to me and it made us stay conceptual for a little bit too long. Designing for a purpose like this was really interesting to me because you create for the people who are going in to see it and every detail counts. This eye for detail is something I am taking home with me. This project also made me think about what I want to do after my master, I am still most likely going to work at a social design consultancy or do a PhD in that area but on the side, I would love to also get my message through, through art installations like these in galleries. This way I can keep making these objects but also work on meaningful changes in society.

Overall I am really happy with the development me and my team had in this project, even though we had some struggles choosing a concept in the end. But we overcame this by articulating what we wanted to say and what was going to be the best mean for this message. Our teamwork went very well but this is also because me and Renate are already used to working together, and really adding to each other's strengths and weaknesses.

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