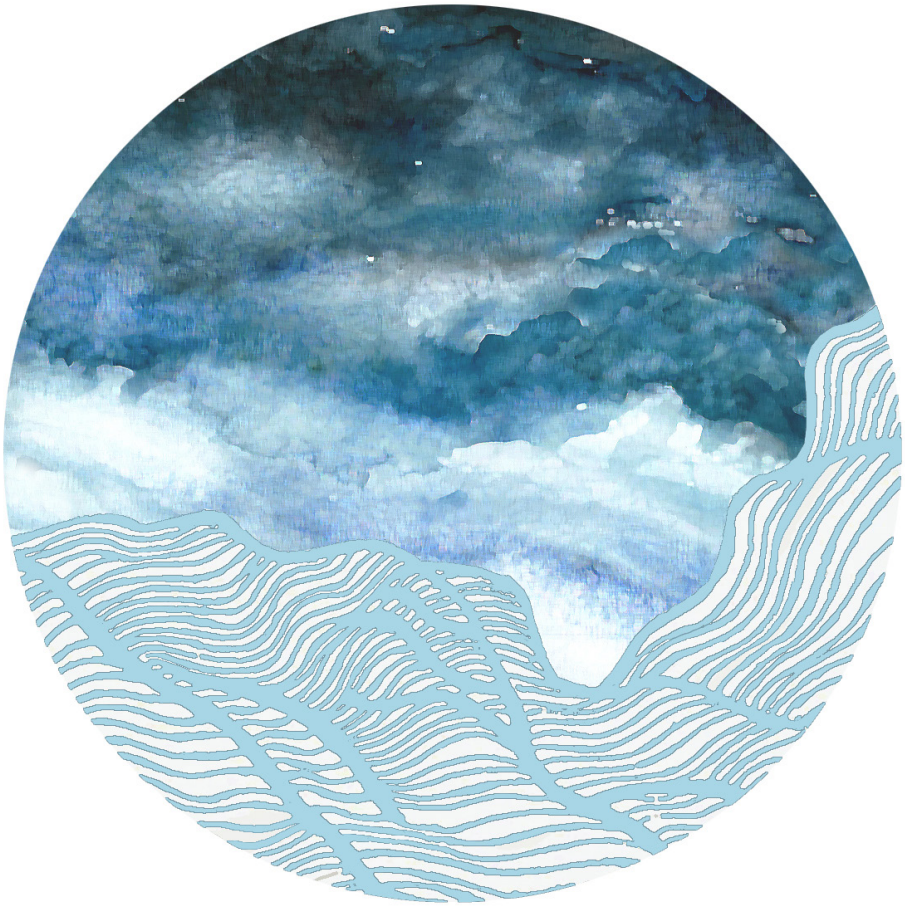

Sounds of Rain

How to create soundart in parks using rain

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Abstract

This project is about creating a sonic experience using rain as a sound component in park environments in Gothenburg. I wanted to take advantage of the rain since a third part of the year in Gothenburg consists of rainy days. For many in the Western world, where rain is not scarce, the cold and wet rain is viewed as a negative thing. And when it comes to the qualities of rainy days, the contrasts are often mentioned [1] , like when you're sitting indoors with a cup of tea, hearing the rain tapping outdoors on the roof or window. But when you're actually outside during the rainy days, how can you then make it a more pleasant experience?

During this project, I've been examined different techniques of water and rain sound installations, with a focus on Eastasian gardens, where most of the water sound installations have its origin. I've also been looking into different percussion music instruments that can be activated by the rain, in order to create a *musical experience* from the rain.

From these investigations, I've developed a design proposal for a small scale rain pavilion where people can have a pause outdoors, protected from the rain and listening how the raindrops are meeting different surfaces and creating different compositions according to the amount of rainfall. I've been using video as a documentation tool to catch soundscapes and reactions to the sound tests and a full-scale mock-up of the rain pavilion that I've been exhibiting in Vasaparken in Gothenburg.

My findings have been the relation of the acoustics of different shapes and materials in relation to falling waterdrops. My aim is that this rain pavilion will be non-site specific, so it can be produced and placed in more parks or other public spaces where you can enhance a rain shelter experience, like bus stops or attached to streetlights for example.

[1] Thoms Ivarsson, J. Creative director, Cyclops and Water, Meeting (08-03-2019)

Table of Content

Method Description

- Testing materials and shapes to produce interesting soundscapes of falling water drops.

Introduction:

I came into the sound/acoustic field because I have a background as an architect and music teacher and I felt an urge to combine these fields in my master thesis. During my architecture studies, I came across research that the so-called "invisible architecture" often is less prioritized. *Architects are visual by old habit, maybe with a drawn for the tactile in the qualities of the material but rarely with an active ear to the form giving* [3]. With these different parts in mind; *rain, sound, acoustics, architecture* I developed my master thesis question;

- How can we improve rainy days and public soundscapes, in order to enhance well-being and raise the value of acoustics in architecture?

Key method:

My key method has been to experiment on how to create sounds using waterdrops that are falling onto different materials and shapes in order to find pleasant soundscapes. I've been testing this in the shower, in order to save time waiting for the rain and the right amount of rainfall for the different mock-ups. Since my goal has been to found well-being sounds in order to design the rain pavilion I think this method has been adequate to quickly try out material, shapes and durability for the development of the project. The materials I've been experimenting with are paper, clay, plastic, bamboo, birch, copper, steel and brass.

Disadvantages with the Method:

An important aspect to consider with this method is that I've been working in another space than the selected site of a park environment, and in that case, it's been harder to analyze how the soundscape will actually work in its real context. Another thing is the creation of the water drops, where I had the opportunity to direct the flow, power and direction of the waterdrops. Another disadvantage that I found out later on, was that a more realistic way to create rain would be to hold the water hose upside down because in that case, you can create a more realistic scenario with the gravity of the waterdrops.[4]

Below I will explain in detail the five different design elements that I've been examined during my shower sessions.

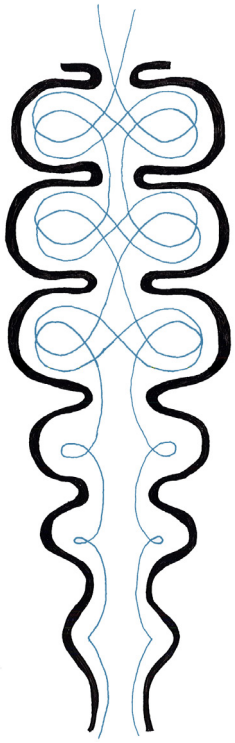
[3] Dyrssén, C, Hultqvist, A, Mossenmark, S, Sjösten P ; Sound and Other Spaces (Ljud och andra rum) (2014), p. 38

[4] https://www.instructables.com/id/How-to-Make-a-Rain-Machine/

1. Flow Forms

The concept of flow forms was developed by John Wilkes in the 1970s inspired by mountain streams [5]. Flow forms today have several purposes, like increasing the humidity indoors, masking unwanted noises in public spaces, or oxygenate water in sewage systems, to improve the purification [6].

I tried the technique of letting the waterfall from one shape to another like a water stair. I used a thicker metallic paper which created a very soft sound, reminding me of rain falling on a fabric roof. I also tried the more classical flow form material in clay that I burnt before the use. I made two different shapes that I named *the spiral and the heart*. According to a flow form company, they're referring to that you can produce water spirals at a specific pitch when arranging several flow forms in a certain angle [7]. Another sonic factor about flow forms I found in the book *The gardens of Japan* [8], where they state that with a shallow bottom design, the water will run faster which creates more opportunities for sounds and visual effects.



Flow form diagramme of the water's movement. [9]

Since my aim was to try a lot of different materials and techniques during the material investigation, I only made these flow forms shown below and couldn't really compare the result of several flow forms in a row, but the most sound was created when I poured the water on the top of the spiral and the narrow space created a rippling sound.
Otherwise, the sound from the shower and the drain drowned the sounds from the flowing water itself when it came to the clay model, representing a sustainable 1:1 model compared to the paper sketch model.

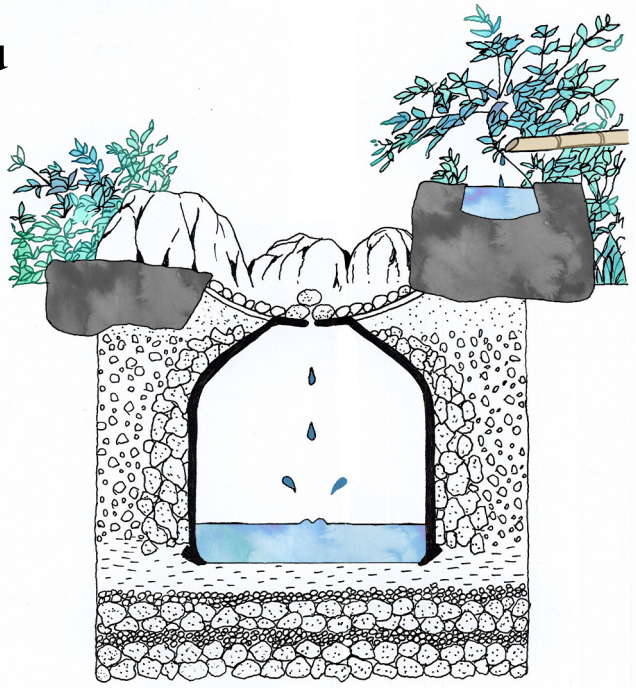
Paper flow forms.

Clay flow forms, the heart at the top and the spiral at the bottom.

[5] http://www.bohemianstoneworks.com/portfolio-item/flowforms/
[6] Jonson, E. Andersson, E ; 404 Experiments, Tom Tits Experiment, (2003)
[7] http://bohemianstoneworks.com/portfolio-item/flowforms/
[8] Itō, T ; The Gardens of Japan (1998) p. 43.
[9] http://www.paul-van-dijk.com/nieuws/application-of-flowform-technology-in-the-sewage-water-treatment-plant-soerendonk-nl (Modified drawing)

2. Suikinkutsu

To clean one's soul before entering a tea house the hands were washed in a low and shallow sink, a so-called Tsukubai. A gardener once tested to use a pot instead of digging a hole under the rocks that worked as drainage to the water from the sink. In the bottom of the pot, there was little water and when someone washed their hands before a tea ceremony the wash water dropped down slowly in the pot and gave a reinforced sound. The people started to appreciate the new sound when it was saying having a calming effect. Since the dropping didn't occur at once people stopped and started listening for it to begin. This resulted that you started to lose the feeling for time and space and instead started to "hear" the garden. [10]



Section Drawing of a Suikinkutsu. [11]

The usage of pots as an acoustic phenomenon isn't unique for the Sukinkutsu. Another example is used in churches, where you can see small holes in the ceiling and walls, pots are walled behind in order to take away echoes and then improve the acoustics [12].

When I tried the Suikinkutsu technique myself I first used ready-made pots in clay and plastic.
I also made two clay-pots to try other shapes than the traditional pots. I made one in the shape of an ellipse since that shape is efficient giving a lot of sound reflections and is for example used in *whispering chambers.* [13] Then I made one pentagon shaped pot to examine the differences. But the main difference I heard was that the pentagon gave a richer sound since it became bigger. This was another disadvantage since I don't have the craftsman skills in ceramics to make precise models.

Test of the ellipse pot + funnel.

Although I really enjoyed how the water drops created different "melodies" when falling into the different pots. When it came to the pitch, I found out that the smaller the pot the higher the pitch and the bigger the pot the lower and deeper sound. When I compared the clay and plastic pots, the clay gave a richer sound, probably due to the density of the material. I also tried to put a funnel standing on the pot leading the water into it. The same melodic effect didn't occur since all the water came down at once, but I felt a reinforcement of the sound from the funnel that now acted like an exponential horn, making the vessel sounding deeper, like a well.

Test with redymade pots of clay and plastic.

[10] Alvaker, K ; Acoustical garden art (Akustisk trädgårdskonst) SLU (2008) p. 23
[11] https://www.pinterest.com/pin/697002479800266070/ (Modified drawing)
[12] Dyrssén, C. Professor at Chalmers in Architecture. Meeting (06-02-2019)
[13] Elizabeth, S; Conics: Ellipses: Word Problems. Purplemath (29-05-2019)

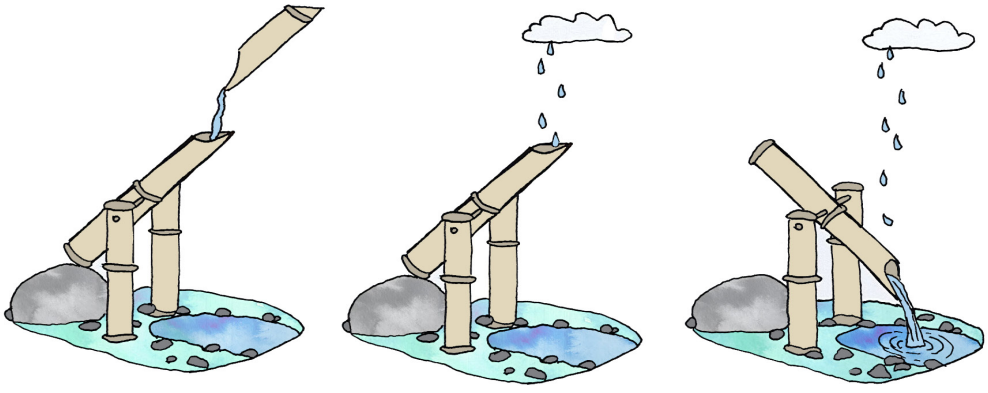
3. Shishi Odoshi

Bamboo shishi Odoshi + Stainless-steel

In Japan, the farmers had problems with animals eating the crops. Therefore they developed a tool for scaring them away using sounds from a *Shishi Odoshi,* (also known as a lion/deer/ghost-scarer). It consists of a thick bamboo pipe put on a stand which it rotates from when it gets filled with water. When the stick gets heavy forward, the water falls out and the stick moves back and the end hits a rock placed underneath which create a *klonk* sound. The sudden sound often scared the animals so they disappeared from the fields. Eventually, the animal scarer got popular in fine gardens. The sound that the animal's thought was unpleasant the humans learnt to appreciate. The recurrent flap became a reminder of time passing by and the constant change in life [14].

The Shishi Odoshi could also be heard in the entire garden and therefore create a reference point both in time and space. Tensions arise both in the void between the thump and in the imaginary connecting lines between the place where you are and the invisible centre of the Shishi Odoshi. [15]

I've built two Shishi Odoshis in bamboo, one bigger and one smaller since I thought the smaller one would move more easily getting filled with water quicker. When I've been trying out the object's I switched the rock to a birch wooden piece/stainless steel, in order to test other sounds and not copy the installation fully. The bamboo meeting wood created a very alert sound, like the music instrument claves, and bamboo too steel created a very ringing sound that had long reverberation, which I felt was a bit unpleasant cause it got dissonant overtones. I had problems making the sticks to return to their original position thou, and in order to create an alert sound, the hit of the stick needs to be quick on the bar, according to the acoustician Jens Forssén from Chalmers [16]. I think the reason that my Shishi Odoshi didn't get back to its original position was that it had to be a little bit back-loaded in the beginning and mines were more centred in the middle.



The Shishi Odoshi cycle, created by a water pump/rain. [17]

[14] Alvaker, K; Acoustical garden art (Akustisk trädgårdskonst) SLU (2008) p. 24

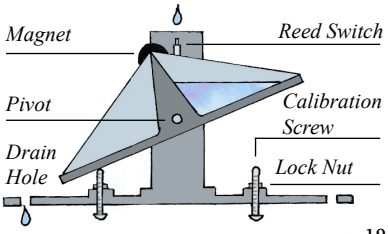
[15] Dyrssén, C, Hultqvist, A, Mossenmark, S, Sjösten, P ; Sound and Other Spaces (Ljud och andra rum) (2014)

[16] Forssén, J. Professor at the Technical acoustic department, Chalmers. Meeting (26-03-2019)

[17] https://www.frontiersin.org/articles/10.3389/fnins.2011.00019/full10. picture reference: http://soundartsresearch.blog (modified drawing)

Rain Gauge

Sketch model of a rain gague to try out the tipping function.



Tippet bucket section. [19]

The rain gauge has a similar technique as the Shishi Odoshi, but with a different use. *The rain gauge is an instrument used by meteorologists and hydrologists to gather and measure the amount of liquid precipitation over a set period of time* [18]. This tippet bucket shown in the picture is placed in the interior of a rain gauge. The reason that I copied this function, was to try out if it would move easier than the Shishi Odoshi, since its more open, will be filled quicker and therefore tip over faster, which it also did according to my experiment. The rain gauge was more a form test than a sound test, so I made a quick prototype in cardboard just to try out the function.

I got the idea during my process to let the Rain gauge/Shishi Odoshi play a percussion instrument. But then the Shishi Odoshi would be more suitable since the rain gauge will lay down resting longer and I need a quick thump on the surface in order to get a clear and louder sound.

4. Shapes of metal

In the next material investigation, I tried different shapes of metal. Brass, (pure and nickel-plated), copper, steel (pure and stainless). I used different ready-made vessels in order to quickly test different prototypes. Since they all have different shapes and thickness I couldn't really make a proper sound-analysis of them, because Forssén let me know that in this case shapes and thickness has more impact on the sound than the different metals itself [20].

The first shape I tried was a dome shape in brass with a handle on the top which created a quite soft, pleasant and even sound with a high note accentuating in the background, (probably the drops falling on the handle). The second shape was an upside-down pot in copper with a flat bottom. The sound got quite alarming and unpleasant to me. It could be due to the shape or/and that I accidentally placed the vessel over the shower drain. Next, I tried nickel-plated brass shapes. I named them the *Tealight,* the *Snail-plate* and the *Bell* according to their design. The Tealight and the Bell had similarities in the way that their outer edges are folded up, and the sound became loudest at the edges. The bell got a more ringing sound though due to its flowing shape, while the tealight has joints that probably created less sounds, according to the sound journalist Olle Niklasson [21]. When it came to the Snail plate different tones occurred on the little hills compared to the flat surrounding surface, It which created a meditative feeling for me.



The Tealight, the snailplate and the Bell.

[18] https://en.wikipedia.org/wiki/Rain_gauge (24-05-2019)

[19] https://www.weathershack.com/static/ed-tipping-bucket-rain-gauge.html (Modified drawing)

[20] Forssén, J. Professor at the Technical acoustic department, Chalmers. Meeting (26-03-2019)

[21] Niklasson, O. music technical journalist, musician, composer, producer. Meeting (03-12-2019)

5. The vibraphone

I got the idea that people probably most will recognize the sounds of rain if I really could create a musical experience out of it. I started to think of different percussion music instruments that could be played by the rain where a vibraphone was one of them. I constructed a test vibraphone with bars of stainless-steel laying on a wooden frame that works as a resonator chamber. I also put rubber bands that the bars are resting on so they can vibrate more in order to create more sounds. The less friction the more resonance, so the best case would actually be if they could be levitated, according to the music instrument maker Hans Lindström. I tried the mock-up in the shower and it worked surprisingly well to produce sounds, except that the tones from the bars became quite false. According to Lindström I had the wrong distance of the nodes which needs to be at 22.2 % distance measured from the ends of the bar [22]. Although the false sound of the bars wasn't so obvious when the water was masking some noise.

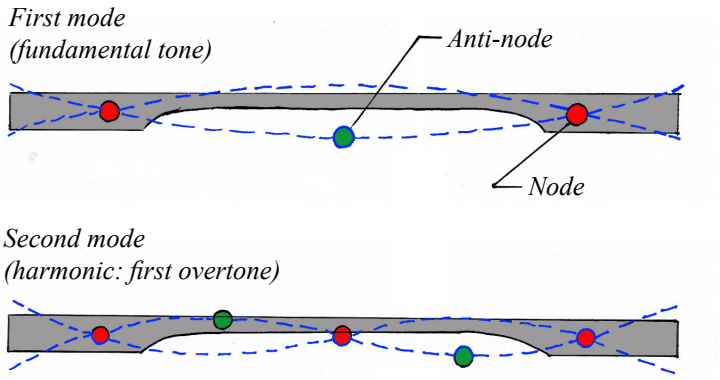


Diagramme of vibraphone oscillations. [23]

I also tested the vibraphone out in the public space of Kronhusgatan, since it didn't work out on my first selected site of Kronhusparken, because I found out that the raindrops need to be heavy like when they're collected and falling from a roof. It worked out in Kronhusgatan because the raindrops were falling from a construction roof and in Kronhusparken the roofs were already "occupied" by downpipes. Although the sounds in Kronhusgatan didn't get so loud so people passing by the vibraphone didn't put any notice. Except for the low sounds, the position of the vibraphone on the ground probably also made it invisible.

- *Without the eye, the ear gets helpless*, as Niklasson said to me. [24]

Conclusion of Method description

In line with Niklasson's quote, I developed a qualitative survey that I sent out to six people where the participants could listen to selected works from the five sound categories;
(1. Paper flow forms, 2. Suikinkutsu, 3. Shishi Odoshi + birch wood, 4. Brass dome, 5. vibraphone)
but without seeing how the sounds were made. I asked them to rank each and every one of the five sounds in a scale from 1-5 in terms of how strong they experienced the sound and how delightful and variated each sound was. Then I also asked them to guess what the material was that the water was dripping on and at last attach an emoji/describe the feeling the sound created for them.

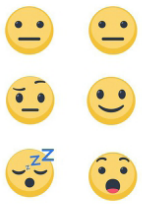
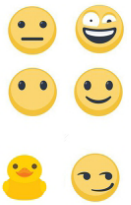
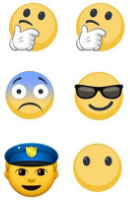
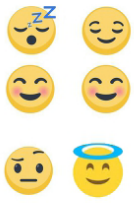
[22] Lindström, H. Civil engineer, hobby music instrument maker. Meeting (27-03-2019)

[23] https://www.yamaha.com/en/musical_instrument_guide/marimba/mechanism/mechanism003.html

[24] Niklasson, O. music technical journalist, musician, composer, producer. Meeting (03-12-2019)

SOUND SURVEY

RAINDROPS MEETING DIFFERENT MATERIALS

	# 1	# 2	# 3	# 4	# 5
MATERIAL VOLUME: Volyme of when the rain drops are meeting the material in a scale from 1-5 where 1 is low and 5 is strong.	16	16	18	20	16
DELIGHTFUL: How pleasant does the sound make you feel in a 1-5 scale? 1 unpleasant. 5 very pleasant.	17	16	15	23	23
VARIATION: 1= little variation 5=much variation	14	20	14	18	21
SURFACE MATERIAL: Guess the material that the raindrops are falling onto:	**plastic** plastic plastic wood wood paper	**metal** metal metal water water ceramics	**ceramics** ceramics stone wood ground ?	**metal** metal metal copper brass brass	**metal** metal metal steel steel fabric
FEELING: Draw an emoji or describe in words how the sound affects you					

To summarize, it was not a big difference between the scores, tastes are very different, but the metal objects got the highest score when it came to both *volume*, *delightful* and *variation*, meanwhile the Shishi Odoshi got the lowest one in each category. When it came to the guessing material part I felt that Niklasson had a good point that we often need the eye to support what we hear. An interesting fact was that the participants had easiest to guess right on the metal shapes, and the Shishi Odoshi was hardest to guess, so maybe that effects that we don't always like what we aren't familiar with? The hardest part to summarize was the emoji answers. Although the metal ones got most positive feelings as well, where the vibraphone got a more peaceful result, which could be nice in a park environment I think, that's also a reason why I wanted to develop that.

Literature review

In this literature review I have been chosen 3 books;

- *Constructing Urban space with sounds and music*, by Ricciarda Belgiojoso (2014).
- *Spaces speak, are you listening: Experiencing aural architecture,* by Barry Blesser and Linda-Ruth Salter (2006)
- *The eyes of the skin*, by Juhani Pallasmaa (1996)

One thing behind the selection of my books is that they're giving me a time range of around 1 decade between each of them, which I think can be useful in trying to understand the development of sound in relation to space. I have altered my research question to my previous broader research question and changed *rainy days* to *everyday life*, and *public* to *surrounding* since this review has been made at the beginning of the research semester.

-How can we improve everyday life and surrounding soundscapes, in order to enhance well-being and raise the value of acoustics in architecture?

In *The eyes of the skin*, Pallasmaa talks about how the acoustic conditions make us feel in different spaces. He mentions tranquillity as a well-being effect in buildings that excludes exterior sounds and gives us time for self-reflection; *Architecture emancipates us from the embrace of the present and allows us to experience the slow healing flow of time* (p. 52.) Pallasmaa also criticizes the phenomenon of making spaces too quiet that isn't that naturally. He brings an example of how the citie's echoes have disappeared and how the interior space sounds are absorbed and censored. *Our ears have become deaf*, Pallasmaa states.

In *Constructing Urban space with sounds and music*, Ricciarda Belgiojoso is giving an explanation of why the echoes have been decreasing from the cities. He explains that we in modern time live in "the age of noise" with a lot of electronic sounds around us and that creates a need to absorb and censure the sounds. According to the well-being aspect, Belgiosso brings up examples of how sounds in different rooms affect our behaviour. We react in a certain way in a cosy well-furnished apartment indifference to a public railway station that is extremely resonant due to the marble floor and the high ceiling. And in order to create spaces for well-being, different rooms require wanted and unwanted sounds, as Blesser and Ruth-Salter are mentioning in *Spaces speak are you listening?* They exemplify that in a concert hall, you want much reverb, but in a room for meetings and discussion, you want the opposite.

To understand the qualities of sound and hearing as a sense, Pallasmaa, Blesser and Ruth-Salter Are comparing hearing with vision in their books. Pallasmaa means that sound has a more introvert but at the same time uniting quality, while vision is more extrovert and solitude. Blesser and Ruth-Salter also mean that sound is constant while vision is not, like for example when you're turning the light off in a room and the sight goes off, compared to sound which is always there even after the lights go out. Another distinctive definition Blesser and Ruth-Salter are mentioning is the term *soundscape* which comes from sound + landscape. But the difference is that soundscape is always dynamic in relation to a landscape that can be very static.

In order to understand what categorize *sounds*, *silence* and *music* and where the lines dissolve, Belgiojoso is mentioning different sound art examples. One is John Cage's composition *4'33* where an orchestra is performing a piece in total silence. But during the performance, the sounds within the room is recorded and instead, the focus is put on the audience which makes sounds instead in the awkward silence. This performance shows that there is no such thing as absolute silence, even when you are in a totally soundproof room you will still hear your heartbeat and the blood running through your veins [25]. (This I also experienced myself when I visited the *Soundproof Chamber* at Chalmers.) Alike the Simon & Garfunkel song: *The sound of silence* also adds another definition to my categorization of sound in relation to space.

At last Belgiojoso is also mentioning the research field within sound and that it exists a lot of research in relation to concert halls and theatres, but that it started to come broader literature. I think this is interesting to know because my research field is situated outside those buildings, and is dealing with the complex entity of adding sounds in an already sounding environment, changing an already existing soundscape within the landscape.

Project Intentions, WHY/Purpose:

When it comes to the discussion about sounds and city scaping, traffic noise is often on the agenda for how cities should be built, but its more seldom to discuss the positive sound qualities within the city [26]. This is one reason why I wanted to work with how we can create a better soundscape within the city by looking at sound installations that are adding sound to the environment in order to improve the surroundings.

I started this project with researching and visiting the existing sound installations around the city centre of Gothenburg that I will describe more in details during the next chapter. One way for me to find the installations was to contact the Transport administration that told me that the ones they knew about are installed in tunnels. The problems according to the Transport administration were that not all of the sound installations were working due to vandalization or problems with the electronics (lack of maintenance).

One reason for this vandalization or temporary use of the sound installation can be due to that the soundscape from an electronic sound installation is a quite static phenomenon in the long run and in order to make it work as good as possible the sounds must be of a variated character [27]. The sound artist Åsa Stjerna is exemplifying this by talking about the constant change of places: *Simplified, one can understand a place as an organism that is constantly changing. It is generated by an infinite number of components, human, non-human, material, non-material, which establish transverse relationships with one another - relationships that possess specific capabilities to influence, that is, affect* [28].
This insight made me realize that I wanted to work with a dynamic non-electronic phenomenon that should activate the installation, and I started thinking about the ones that are being activated by the weather. And since Gothenburg is famous as a rain town, I started to think about rain sound installations and got curious, I didn't even know if this was an existing phenomenon.

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[25] Forssén, J. Professor at the Technical acoustic department, Chalmers. Meeting (26-03-2019)

[26] Dyrssén, C, Hultqvist,A, Mossenmark, S, Sjösten, P ; Sound and Other Spaces, Ljud och andra rum (2014), page. 38

[27] Erlandsson, T ; *Sound installation*s *in the outdoor environments of Sweden, (Ljudinstallationer i Sveriges utemiljö)* SLU (2010) page 87.

[28] Stjerna, Å, Cox, C ; *Sound, Affect and Public space- A conversation between Åsa Stjerna and Christopher Cox, in Dirty Ear Report #1, Errant bodies press, (Ljud i Offentliga Rummet)* (Fall 2016)

And according to the landscape architect student Thomas Erlandsson, that has mapped out 51 sound installations in Sweden, none of them is working with weather forces like wind, rushing water or rain [29].

After doing some research about rain installations, mentioned in the method description I also got the tip to meet a former Academy of Design and Craft-student Jens Thoms Ivarsson, the creator and project leader behind the project *Rain GBG*. The project is a part of *Gothenburg's City Jubilee investment* in the department of *Cycle and Water*. The vision of Rain GBG is that Gothenburg should be "The world's greatest city when it rains". Ivarsson told me that the rain installations that exist in Gothenburg are by far (around 98%) created by engineers and very few created by designers/artists. Another problem today in Gothenburg is the stormwater management since it's getting into the ground too quickly and flooding can easily appear. With a rain installation, it can delay the rain a little bit which is good for the environment [30].

Another installation dealing with water and sound design in public spaces are fountains. And fountains aren't only used for creating harmonic sounds by itself, they also produce white noise, which masks other sounds, like traffic noise. Although the white noise will also mask high frequency sounds which also makes it hard to have conversations if you're positioned close to a fountain [31] .

Noise does have a very negative impact on our well-being if were exposed to high noise levels for a longer period of time, which can lead to insomnia and heart diseases [32]. But another good aspect with the white noise, also produced by rain is that I found that it's the most common search term for sleep aids, where the white noise from the rain can help our brain to wander freely but also focus on just the sounds of rain when it's masking the other unpleasant sounds in the city. [32] Another factor is that noisy parks and green areas also can lead to people rather stay indoors than outdoors, which in the long term constitutes a risk to public health. [33]

WHAT/Project Question:

- How can we improve rainy days and public soundscapes, in order to enhance well-being and raise the value of acoustics in architecture?

I first selected to work with the park *Kronhusparken*, situated next to *Kronhusbodarna*, after a discussion with Niklasson and Ivarsson. One area that Rain GBG is developing is the area West of Nordstan since it's a kind of a neglected area, although a very central site of the city. And within that area I thought about Kronhusparken since the sound level is quite low that will be needed since a rain installation will not sound very high, considering if I don't want to integrate electronics into the construction.

[29] Erlandsson,T; Sound installations in Swedish outdoor environments, Ljudinstallationer i Sveriges utemiljö, Master degree project in Landscape architecture, SLU (2010) p. 56.

[30] Thoms Ivarsson, J. Creative Director, Cyclops and water, Göteborgs Stad. Meeting (15-02-2019)

[31] Niklasson, O; music technical journalist, musician, composer, producer. Meeting (03-12-2019)

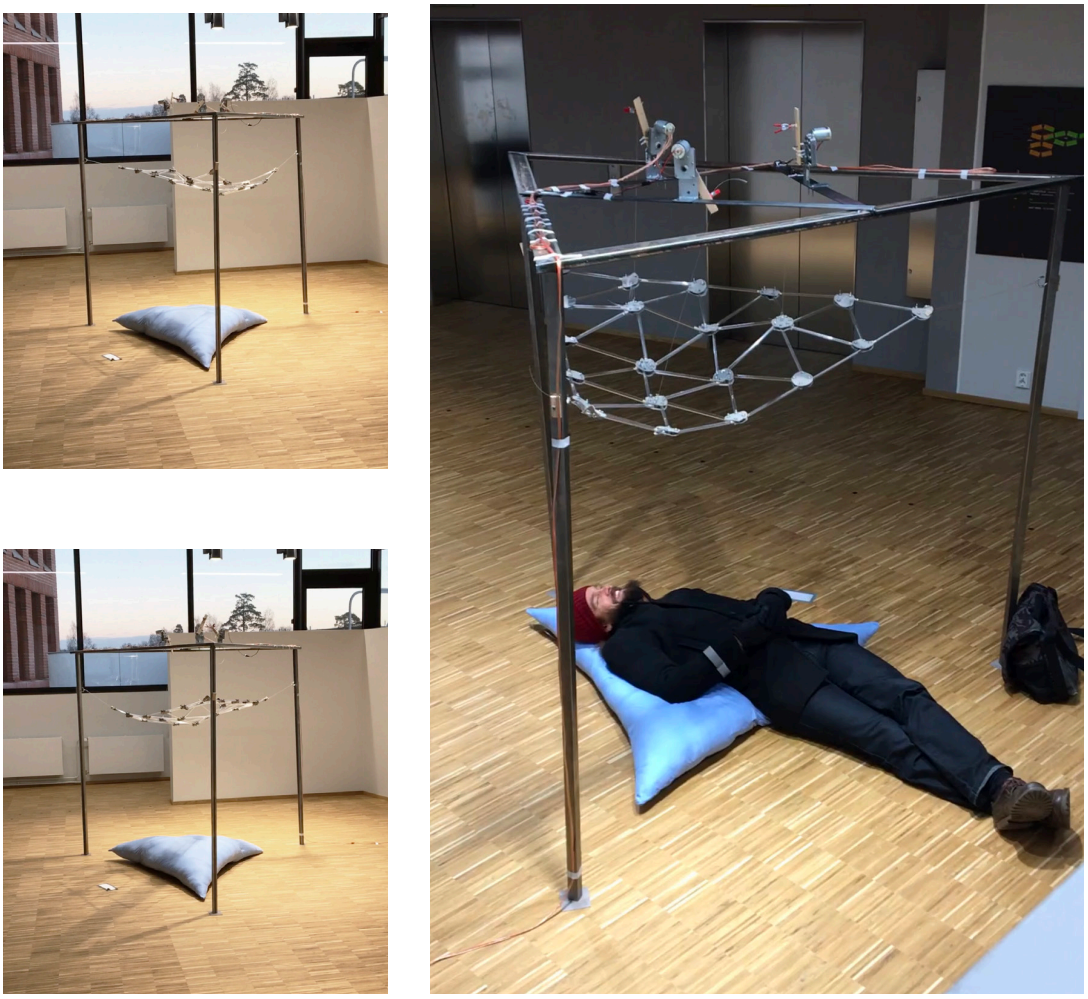
[32] McMillan, A; *How Loud Noise Exposure Is Linked to Heart Disease.* TIME (06-02-2018)

[33] https://blog.ambient-mixer.com/sound/rain-sounds/why-are-rain-sounds-relaxing/

[34] Erlandsson, T; Sound installations in the outdoor environments of Sweden, Ljudinstallationer i Sveriges utemiljö, Master degree project in Landscape architecture, SLU (2010) p. 25 .

Niklasson has also been writing about the history of soundscaping Nature; *In all times, one has tried to enhance the experience of the garden, usually with lighting, but there is also a long but less familiar tradition of soundscaping gardens. For most people a detail that takes care of itself with the help of bird song, rustling leaves, buzzing insects or a rippling brook, but if we go back to the times where a garden was an exclusivity and a way to show off one's prosperity, artificial trees of gold and silver with singing mechanical birds in the branches was the ultimate demonstration of both wealth and power.* [35]

During my first semester of the Master thesis project I did an exchange semester in Interior architecture at *Aalto University*, in Espoo, Finland, in order to enhance my design specialization and start my thesis project there. In one of the courses I made a *sonic sculpture*, that was imitating ocean waves, because I found research that Playing "Natural sounds" affects the bodily systems that control the flight-or-fright and rest-digest autonomic nervous systems, with associated effects in the resting activity of the brain [36]. So in line with my autumn semester I wanted to continue in the sonic sculpture/installation field, but instead of **imitating** the water sounds, the installation would now be **activated** by rain water. Another difference is that my sonic sculpture was situated in an exhibition **indoors** and were driven by **technology**, and my new sculpture/installation will be situated **outdoors** and driven by **weather** and **mechanics**.



My Sonic Sculpture; Breathing ocean, exhibited at Aalto University, 16-30/11-2019, Väre building.

[35] Niklasson, O; *Designed sound in the garden (Designat ljud i trädgården)* Allt om Trädgård (2019)

[36] University of Sussex; *It's true: The sound of nature helps us relax.* Science Daily (30-03-2017)

Outdoor public sound/rain installations

Alike Erlandsson I have also categorized the sound installations I found in Gothenburg. Some of the purposes he is mentioning are:
art pieces, play, help for visually impaired people, reducing/masking unwanted noise, recurrent (like sound installations that are being used at a festival or day that's being celebrated annually) or other. In Gothenburg I found 7 installations in total, considering both existing and former installations. (I've also mapped a rain playground which has sound elements.) Then I have categorized them according to the purpose and permanent/temporary character in order to investigate if I can find some conclusions. To start with locations, I found out that pedestrian tunnels and parks are the most common placements.

Pedestrian Tunnel of Röda Sten

Two of the installations are positioned in pedestrian tunnels. One is placed in the tunnel leading to *Röda Stens Konsthall*. The installation, named *Tunnel Tales* was consecrated in September 2013 and invented by Roberto Paci Dalò. In the link on the footnote, you can listen to the different pieces that have been exhibited. [37]

This installation falls under the category art piece I would say in connection to the art museum of Röda Sten. Other criteria an art sound installation would create is that it can contribute to reflection, according to Erlandsson.

The other tunnel installation is installed in *Fjällgatan* (close to *Oskar Fredrikskyrkan*) Unfortunately the Traffic Office Department also told me that this sound installation is vandalized and doesn't work either. I haven't visited this installation myself, but when I did some research I found out that the purpose, of the installation in Fjällgatan is to create a feeling of a safer environment. [38]

Another former sound installation named *Milleniummonumentet* was placed at The Big Theatre's facilities next to Kungsportsavenyen. I haven't found out exactly when they exhibited this piece, but as the name suggested it sounds like it was exhibited close to the new millennium 2000. The installation consisted of two pyramid-shaped objects where harmonic sounds were mixed with sounds from chimes. The sounds were recorded and played by speakers. It was played regularly and could be moved between the two objects. [39] I also categorize this as an art piece but with playful elements when you can interact and move the soundscape

[37] http://rodasten.com/index.php/sv/utstaellningar/tunnel-tales

[38] Johansson Sjöwall, C ; *Fjällgatans gångtunnel tryggas med ljus och ljud.* Göteborg Direkt. (17-10-2014)

[39] Erlandsson, T ; *Sound installations in the outdoor environments of Sweden, (Ljudinstallationer i Sveriges utemiljö)* SLU (2010) page 42.

When it comes to the park installations; *Plikta*, in *Slottsskogen* is one that has the form of a satellite reflector, consisting of two upstanding round spheres that are reflecting the sounds so you can stand and talk to each other, at a longer distance. One criterium for a play installation that Erlandsson is mentioning is that it has to be activated, which this installation do since you need to be 2 persons to experience it working.

An installation with a very similar purpose is placed in *Vasaparken*. The difference between the Plikta installation is that this one has a pipe connecting the two sculptures underground so you can talk to each other. Both these installations are playful and permanent.

I also found a previous sound exhibition in The Botanic Garden, called Botanic Sounds, exhibited in June 2009 [40], which would be another artistic temporary installation.

The last installation I've found is an installation placed in Världens Park, in Hisings backa where whale sounds are being played once you're crossing a path in the park [41]. I'm not sure if it's still in use today, but I would also categorize this as a playful installation since it also needs to be activated.

Satallite reflector, Plikta, Slottsskogen

Sound pipes, Vasaparken

[40] Rånlund, S ; *Ljud som vidgar världen.* Göteborgsposten (10-06-2009)

[41] Risberg, U ; *Speaker park, about sound scaping of outdoor environments.* SLU (2008) (p. 31)

Flow form water lilies by Rain GBG.

Continuing to the other category of a rain playground, the first one has been designed by *Rain GBG* and placed at *Näckrosdammen* in *Näckrosparken.* The park opened in December 2018 [42]. The form language of the shelters comes from the waterlilies that are floating in the adjacent pond. The shelters also have the function to lead down water to the kids, like flow forms, which will create some sounds during the rainy days.

To summarize the 7 sound installations (Näckrosparken not included) I found out there was most artistic and playful installations (3 each), and one used to increase safety. Both of the play installations, probably all three were also permanent while all the art installations has been temporary.

When it comes to placement, the playful ones are mostly placed in parks (except the exhibition in the Botanical Garden). I can't really draw a conclusion with so few examples, but it's interesting to see that overall the electronic artistic installations became temporary, while the mechanical playful are more dynamic and also permanent. In relation to my own installation, it will fall mainly under the playful category since it has to be activated by rain or someone playing at the vibraphones when it's not raining.

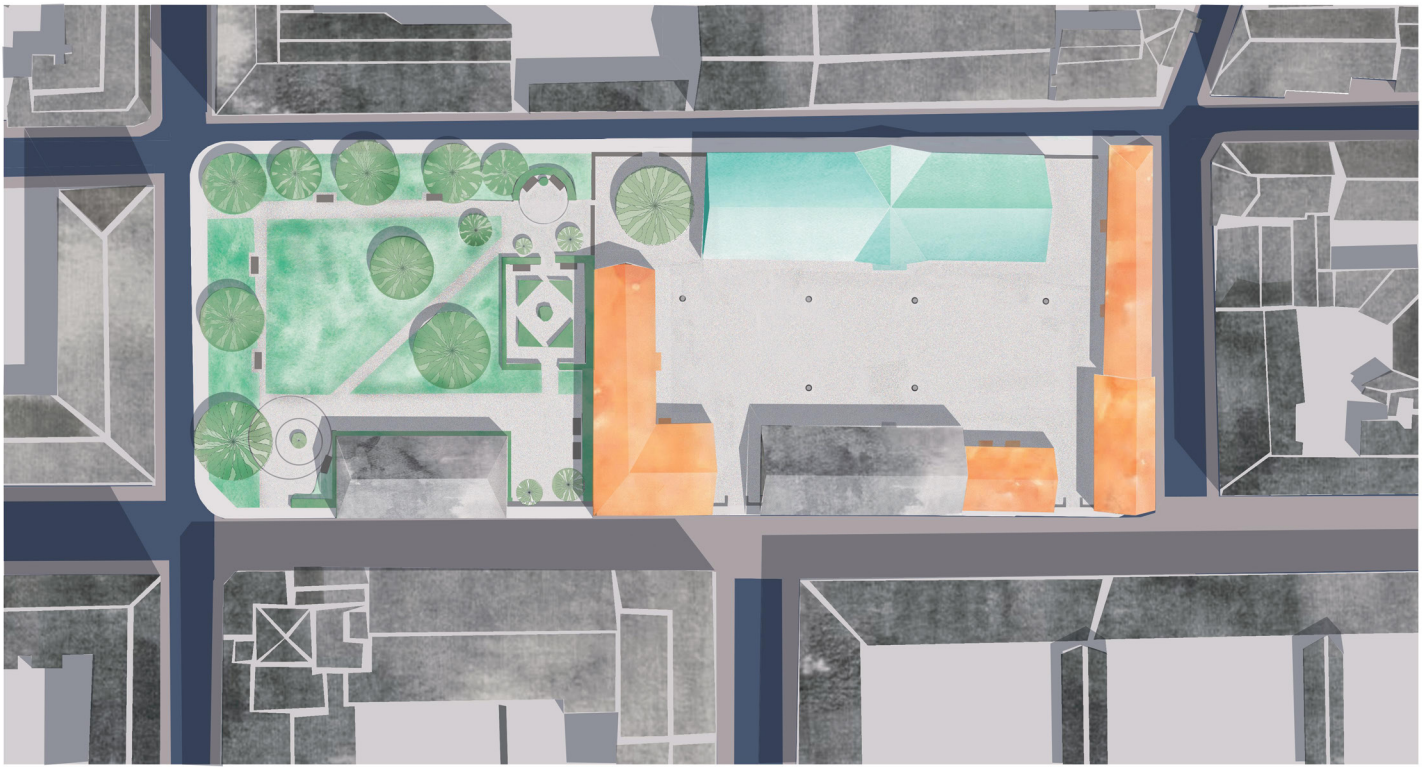
HOW/Framework

The framework that I got from Ivarsson in the Rain Gbg collaboration was to first pick a site in Gothenburg, although the installation didn't have to be site-specific (only related to that site).
The second thing was that there should be some kind of rain shelter where you can stand dry and experience the installation and the third thing was to have in mind what the purpose would be of the installation when it's not raining.

For me, the chosen place hasn't been of main importance either, because my main focus has been to make the acoustics to work in my design decisions, which has been of a quite complex character. Although it has been a good ground to map out and analyze a given place in order to relate the project to a real context which I felt have facilitated the idea generating when there are some constraints to work with. Unfortunately, I got a problem with my first selected site of Kronhusparken that made me unable to exhibit my installation prototype in the park due to a construction work that unluckily was being hold during the month when I could exhibit there. As a solution, I meanwhile changed the location to Vasaparken, situated close to my University which facilitated transportation and documentation for the real scale prototyping. Vasaparken is also a relatively calm park area, with a difference that the park is bigger scaled than Kronhusparken. Although I will still describe my site analysis and site visits in Kronhusparken, that laid ground for my design intentions.

[42] https://www.goteborg.com/regnlekplatsen/

Site Analysis



Map of Kronhusbodarna and Kronhusparken

Shortcuts being made on the diagonal path

In this analysis I've been considering soundscapes, flows of movement, light and shadow, history and stakeholders. I will mention the most important aspects and conclusions during my observations.

Soundscapes:

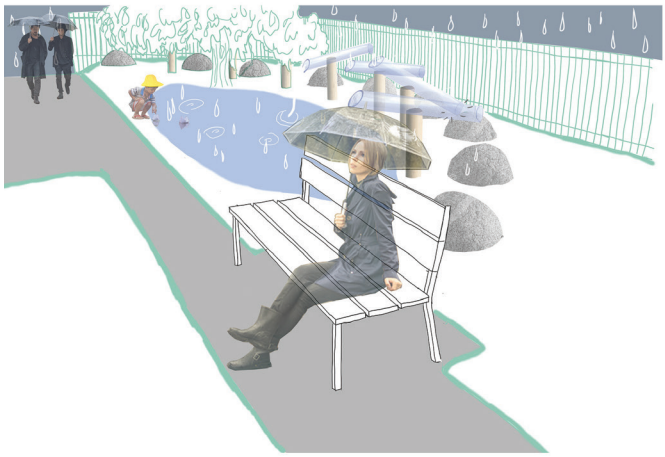
The birds are twittering, the leaves are rustling. During rainfall, the downpipes ripples and my boots cleat from the clayey ground.
But one important sound source to consider that I don't even hear are the low frequency sounds from the nearby harbour. This results that I will need to create a higher frequency sound installation, according to Forssén [43] .

Movement:

I found out that people are mostly moving through the paved diagonal path, using the park as a shortcut. This made me want to place the rain installation in connection to the path, so a pause could be created. There are four entrances to the park, and the ones attached to the diagonal becomes the most used ones. There are also preschool kids using the park during the days. Especially a movement of play around the biggest tree on the site is popular.

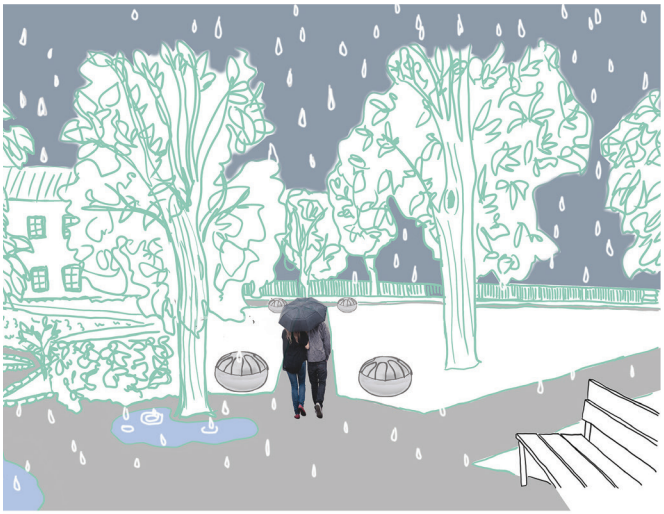
[43] Forssén, J. Professor at the Technical acoustic department, Chalmers. Meeting (26-03-2019)

First draft of different design desiscions, in connection to the different entrances of Kronhusparken.



Shishi Odoshi- Soutwest Entrance

Flow Forms- Souteast Entrance



Hank Drum- Northeast Entrance

Suikinkutsu- Northeast Entrance

Light & shadow:
I found out that the quietest entrance area of the park also has the most shadow in the southeast corner. It's quietest since its connected to a street for pedestrians, while the two others are connected to the car roads and the third one is connected to Kronhuset, but close to the car driven road.

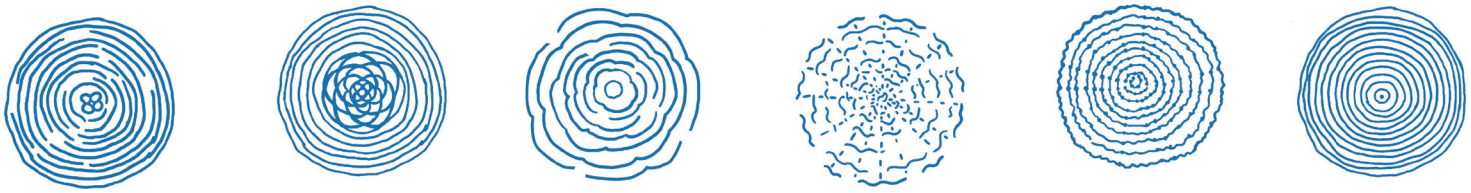
History:
I also visited the library Faktarummet of Gothenburg City Museum to do some research about the history of Kronhusparken. One of the facts that I used in the design process was that Kronhusparken used to have a popular herbal garden with different herbs and plants that could stand the Westcoast climate. [44]

In the pictures you see the first drafts of possible developments of the investigated methods. But after the meeting with Rain GBG, I was reminded that many of the suggestions lack shelters, and therefore I went back to my former sketch models, that I will present more in detail during the next chapter.

[44] Roos, J ; *Kronhuskvarteret; Vård och Underhållsplan Del 1-Värdebeskrivning och historik.* Antiquum AB (2017) p.21

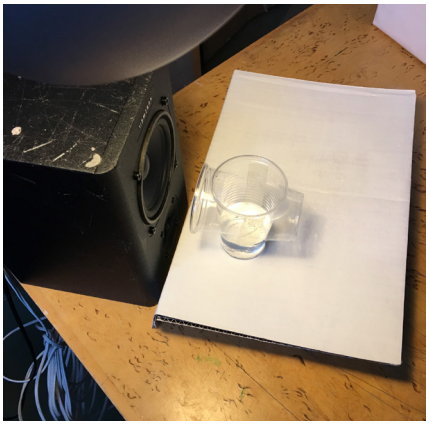
Process:

Movement of water:



Cymatics:

Before I decided to work without electronics during the second semester, I tried out the so-called *Cymatics* method, making water move by playing different frequencies from a speaker. I also examined how light can shift according to the water's movement. Later on, I sketched how the water pattern changed accordingly to the different frequencies. I tried it with a span from around 100 Hz to 400 Hz, and the higher the frequency got, the more rings were created on the surface. Related to the flow forms, you can also trace the water's movement of traditionally shaped flow forms by letting something flow on the water, that will show you whirling formations. [45]

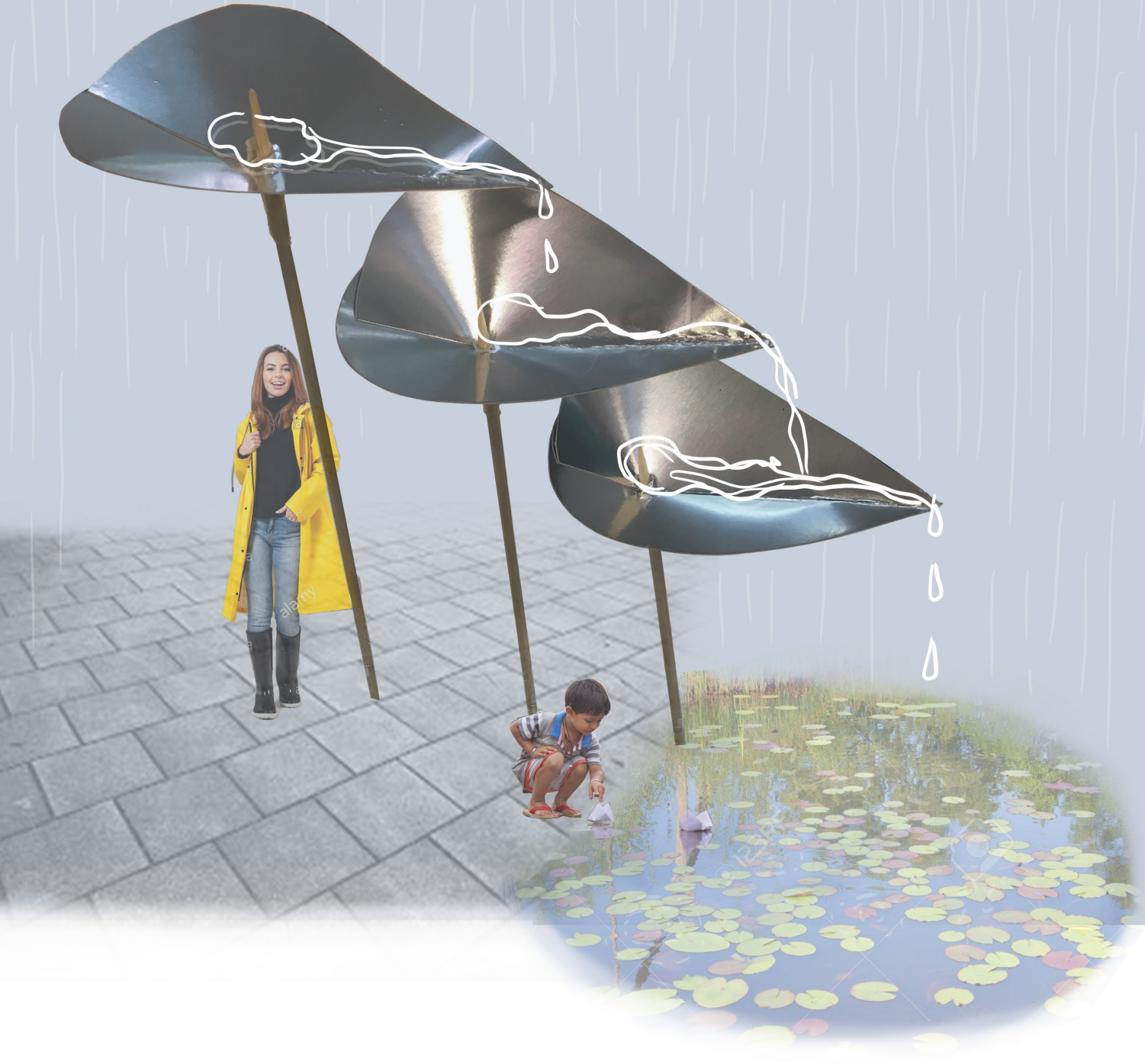



Sketch models, rain pavilion and development

When I first got into the idea of a rain installation, I started brainstorming how rain or the force of rain could create sounds. The first association, which I think is the most commonly spread among people is raindrops falling on a metal or plastic roof. Another association I got was from Disney's movie Bambi with the song *Little April shower*, when the raindrops are creating music at the beginning of the song when falling onto the leaves.

[45] http://www.paul-van-dijk.com/nieuws/application-of-flowform-technology-in-the-sewage-water-treatment-plant-soerendonk-nl

Rain pavilion 1



Inspired by the Disney song I started to investigate in the leave shape with the thought of it getting filled with water and eventually tipping over at one side, creating sound by the tipping force. At this stage, I had flow forms unconsciously in my mind and this was also before I knew about the Shishi Odoshi's existence. This led me to my first sketch model, where I made bowl-shaped leaves out of a thicker metallic paper just to try out the physics of a water stair. The intention was that later they would create a jingling sound when tipping over, meeting the next one. I made this sketch model before visiting the rain playground, but after I did that I realized that they were surprisingly similar both to the aesthetics and function. The main difference was that my sketch model didn't have flat leaves and the thought of creating sounds by the tipping point.

Rain pavilion 2

the shape of a gramophone to create a clear connotation to the sounds. But after I had the meeting with Niklasson, he explained how these forms would work in reality. The first sketch model were more resonant, (creating more sounds) because they're having a continuous shape, (the bowl reinforces the sound) while the gramophone bowls will have no resonance due to the joints/folds. Another factor is that the shapes will sound less when they get filled with water. So Niklasson explained it would be better to have the shapes upside down instead. [46]

[46] Niklasson, O; music technical journalist, musician, composer, producer. Meeting (03-12-2019)

Rain pavilion 3

I developed my third sketch model inspired by the Shishi Odoshi. I thought it could be a fun roof idea with several Shishi Odoshis placed upon it in order to create a surprising waterplay. Although when I tried my modeled real scale Shishi Odoshi in Kronhusparken during light rainfall they didn't move at all, so I'm thinking that cloudburst rain would be needed to make them move, or collecting all the rainwater from the roof, using the force like from a downspout since its usually a water pump filling up the Shishi Odoshi that make it moves. So, in that case, it would only work to have a few of them that would move, for example, one attached to every gable of the building.

Another problem I faced during the 1:1 scale making was that the bamboo material cracked easily when I was drilling the holes, and several of the bigger bamboo sticks in the store was already cracked. This can depend on that bamboo is not suitable for a colder Swedish climate, when the material gets brittle and cracks.

Rain pavilion 4

After the method description and the qualitative sound survey, I draw the conclusions to focus and develop the vibraphone method more. For me it had the most well-being sound, reminding of the sounds from wind chimes. Traditionally wind chimes have had several usages where one has been used in temples [47], and the effect I wanted with this installation is to create a meditative environment, like a temple.

After I tried the vibraphone out in the rain and realized that I need to create some kind of roof structure to create heavier drops, I came up with to different construction suggestions. In the first one, I'd let the vibraphone bars become the roof and a funnel would concentrate the downfall on the keys. But since it would require a quite high fall of around 1.40 meters according to my tests, it would be kind of a tricky solution. Another factor is also that it would be more fun to also see the rain play standing inside the pavilion, than having it hidden upon the roof.

[47] http://www.windchimesaustralia.com.au/history-of-wind-chimes.php

Rain pavilion 5

In my second proposal, I made the sketch model with visible bars where the raindrops will be guided from the roof and fall on the middle of the bar, meanwhile, you will stand protected from the rain. A problem might be that the rain can fall into the construction when the bars are straight, so a solution would be to let them be slightly tilted. After meeting Lindström, he also made me realize that the shape of the vibraphone would be better with straight lines instead of curved in this model, in order to follow the nodes of the vibraphone [48], so that the circle could be transformed into a hexagon for example. Other tips I got from the acoustician Forssén. He said that the roof shouldn't lean or slope too much to mask the vibraphone sound [49].

[48] Lindström, H. Civil engineer, hobby music instrument maker. Meeting (27-03-2019)

[49] Forssén, J. Professor at the Technical acoustic department, Chalmers. Meeting (26-03-2019)

There is a Japanese concept called *Shibui*, referred to as; *beauty with inner implications. It is not a beauty displayed before the viewer by its creator, but rather making a piece that will lead the viewer to draw beauty out of it for himself. This intimated, almost hidden beauty requires active participation of the spectator. An invisible dimension of subjective beauty experience and thus also something incomplete that the viewer himself may fill out.* [46]

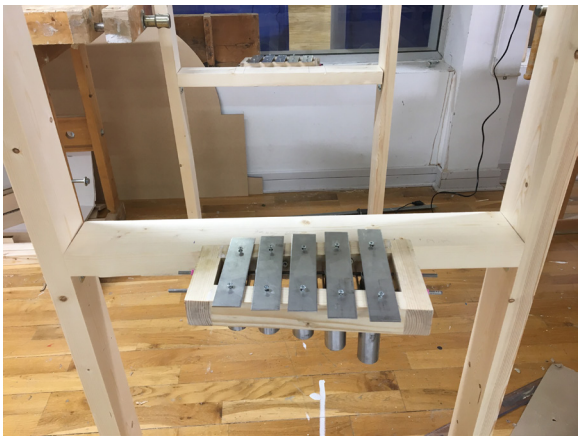
I'm considering my installation having a reference to the Shubui, meaning that it has the hidden potential that will only be shown during rainfall, and when people will truly **listen**, not only **hearing** the park.

Prototype making 1:1

VIBRAPHONE DEVELOPMENT

After the meeting with Lindström, I started to develop the vibraphones. [50] The development got quite mathematic. There's a formula to calculate where the nodes are on the bar, by having them 22.4 % of the length from the outer edges of the bar. And to calculate how long the resonance pipes are (that are placed under the bars in order to enhance the ground tone). Lindström told me the formula by starting with the speed of sound in air which is 320 meters/second. Then you divide it by 4 multiplied by the frequency of the bar (320/4+frequency). So, when I wanted a C#2 for example with a bar that is 18.66 cm and with a frequency of 554.365, the formula becomes 320/4x554.365 = 0.144 = 14.4 cm pipe. [51]

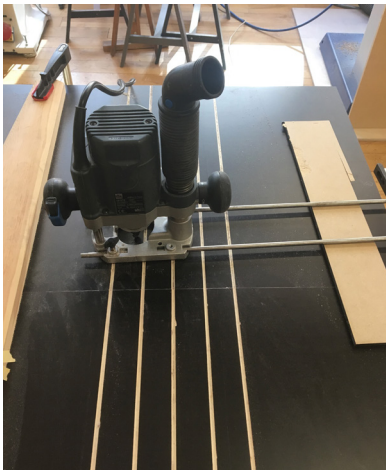
I and Lindström were also discussing how to choose a scale that would create a good composition for the park. Lindström gave me the tips of a pentatonic scale that will always sound good together. I made one bigger and one smaller vibraphone with a one-octave difference from each other in order to get different sound plays on each side of the pavilion. I mounted the vibraphones sticking out from the beams so the rain can fall on the middle of the vibraphone bars where it sounds the most. Esthetically it didn't look so coherent, but since it's a prototype I thought it was a good way to test it since I'm a workshop beginner and instead I can show rendering how I would like to develop my design proposal.



[50] Fridh, K; *Japanese Rooms (Japanska Rum)* (2004) p. 82

[51] Lindström, H. Civil engineer, hobby music instrument maker. Meeting (27-03-2019)

In order to try out my installation in the park, I have made a full scale prototype. I made several construction drawings inspired by my sketch models, but, in the end, I decided to make a simple construction in order to focus on the findings more than the form. I found inspiration from garden gates, which also got in line with the portal into another atmosphere. At first, I also thought of integrating Kronhusparken in the design by doing a floral pattern in the arch to the pavilion. But since I wasn't able to place it there at the moment I thought that a less site-specific pattern could be good. Therefore I made a symbolic rain and music pattern instead so people could easier understand the purpose of the installation. I laser-cut the rain pattern on MDF wooden sheets. I needed to do several layers so it could be strong enough to hold up the roof. On the roof, I carved out the gutters for the rain to run through so I more could guide the rainwater to the vibraphone bars.



The vaults are ready and I could start putting the pieces together with clamps in order to try out different heights of the vibraphone. I painted it white, so the wood could handle the rain better, and also to brighten up the usually grey rainy days.

Workshop- building rain shelters

-What's happening when rain is falling from the sky and meet hard, soft, green, blue or grey surfaces in the city?

-Gothenburg City in collaboration with Recetas Urbanas.

During this project, I also joined a workshop of building rain shelters for an upcoming outdoor classroom in *Frihamnen*, since the workshop was very linked to my project. The workshop was being organized of the Spanish architecture collective *Recetas Urbanas*, in collaboration with Gothenburg City [52]. During the workshop, I helped out as a volunteer with some drilling, sawing and carrying beams in order for the next room to take place. The pictures are from how far the construction work has gone in 3 out of 4 weeks. Although it was freezing cold and windy day at the open building spot in Frihamnen it was great company. I never worked at a construction site before and I felt I learned a lot when it comes to building on a bigger scale than my little portal/pavilion, using more powerful tools.

Installation and interaction in Vasaparken

I made three exhibits of a couple of hours in *Vasaparken*. During the first time, there was a rain prognosis, but it didn't rain during the whole time so I had to pour water myself from a water pitcher. The second time it was light rain, but it barely made any sounds on the vibraphones. Although there were many preschool kids playing in the park and once two kids started trying out the vibraphones, the sound spread through the whole park, and a lot of kids came rushing to try out the installation. It became common that four kids were playing at the same time since I attached four drumsticks on my newly named *Dropophone*. The rain stopped, and the kids stood outside the installation playing, probably because they couldn't fit four of them inside and also since the rain stopped. Although at two times, when a pair of girls were playing, they stood inside the Dropohone playing back to back. They both switched after a while so they could try both vibraphones.

Portal placed on the top of the hill at Vasaparken

[52] http://alvstaden.goteborg.se/jubileumsparken/open-call-recetas-urbanas/

Play with drum sticks and umbrella.

Interactive play of five participants.

Parent with kid playing with a branch.

Vibraphone duet in the Dropophone.

Trill/ostinato created by funnels with filters.

Forte/piano with transparent Shishi Odoshi made in PVC-plastic

In order for me to create audible music out of the rain, I found out that either it has to rain a lot, so the rain can be collected, for example in funnels that can direct the drops and with attached filters that are building up water pressure and heavier drops. When I tried this method indoors I could clearly hear a melodic rhythm reminded me of a *trill* or *ostinato* referred to the musical language. In other words, the melody got quite repetitive where I only could hear a few tones making a rhythmic play, but with small changes after a while. I got a quite exotic feeling out of this, I could really hear the soft *timbre* [53] from the vibraphone coming through. Unfortunately, when I tried it outdoors the sound got very low, because of all the background noises, so I would really need to enhance the sound with the help of contact microphones, as Lindström suggested. [54]

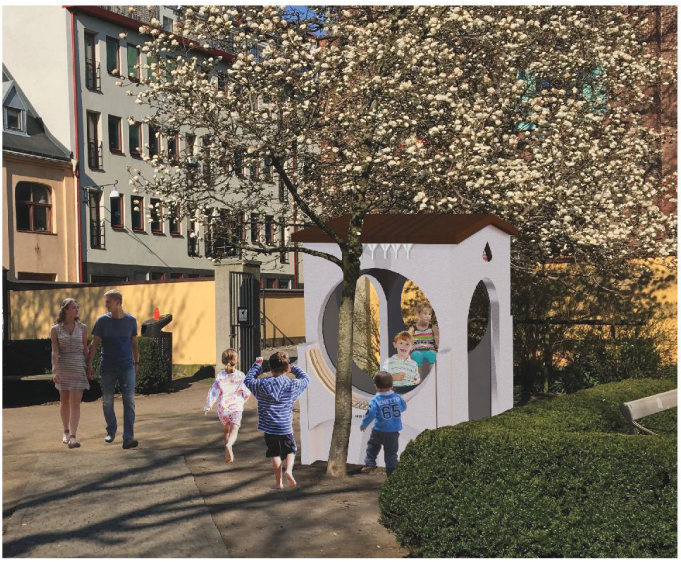
Another technique I used was several Shishi Odoshis that I constructed in transparent PVC-plastic. Since it was very hard to find the perfect balance for it I needed to add some weight in the form of wooden balls. At first, I thought that the plastic tube would sound when it hit the vibraphone bar, but it didn't work out with plastic against metal when the force is quite low. So, I had to attach a wooden ball there also, imitating the drumstick. But still, I couldn't make any sound when I assume that the backward force was still to little. But when I tried it out in the shower it worked perfectly fine, so I'm sure it can work in the reality, but the relation and positioning of all the elements need to be very calculated and exact in order to make it work. But considering the sounds I could make in the shower, it created a *forte - piano* musical term relation. First when the water falls out on the underlay with a big force, and after when the tubing softly returns to its starting position.

As mentioned earlier, in reality, this construction would need to be placed for example in gables of the construction, where downpipes are placed, since it needs that collected water force to move.

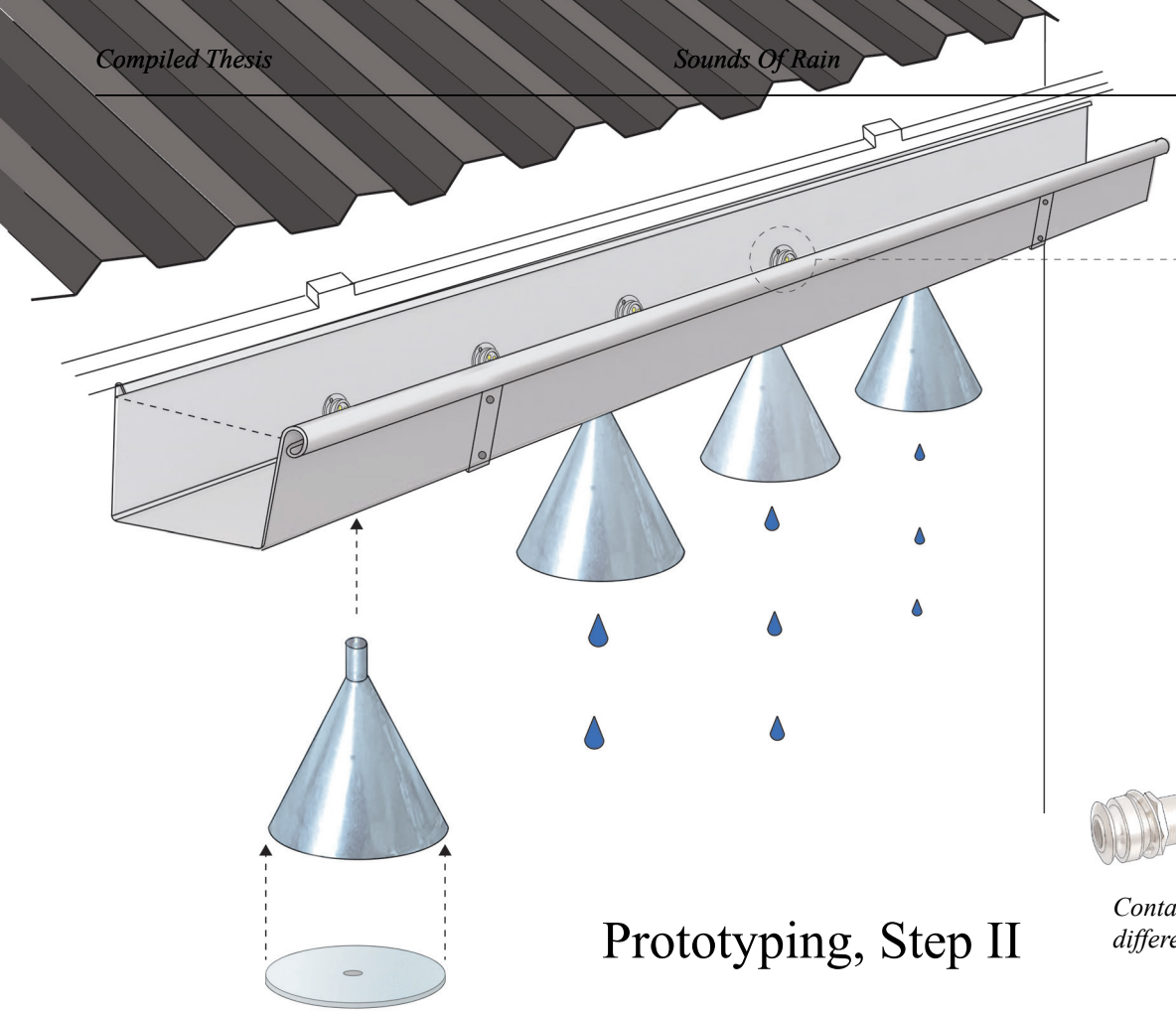
[53] http://www.classicalworks.com/html/glossary.html

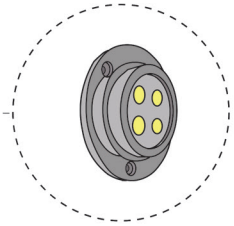
[54] Lindström, H. Civil engineer, hobby music instrument maker. Meeting (27-03-2019)

Visualization I in Kronhusparken

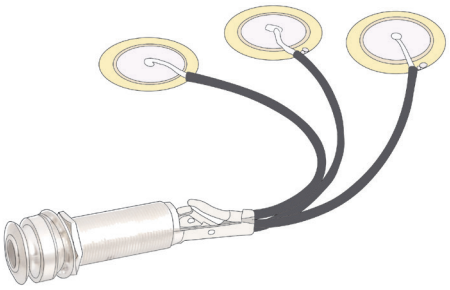


With these renderings, I want to show a form development of the park exhibited Dropophone with seating opportunities integrated in the walls of the pavilion/ portal. The pictures are taken from Kronhusparken, where I placed the portal at the entrance to the former Herbal garden and linked to the diagonal path.





Underwater lamp



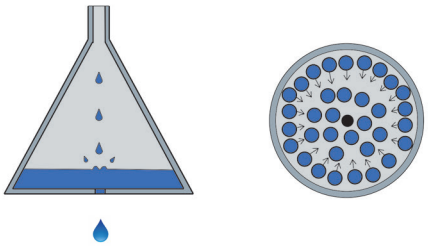
Contact mike with several mikes for the different vibraphone bars.

Prototyping, Step II

When I tried out the built Dropophone in Vasaparken, it never rained very much- which resulted in very low sounds. Another affecting factor was the many sounds from the close road, which also made it impossible to hear the sounds that the rain created. After talking to Lindström [55], he said that the sound can be reinforced by installing a contact mike connected under the vibraphone bars.

With this in mind, I also had to develop the final form suggestion as a whole architectural design proposal. Some changes I made was to turn the funnels upsidedown in order of creating a more sonic visual connection, so people can get a hint of the building's purpose, instead of the former integrated pattern that visually maybe took over the experience of the sonic components. With the upside-down form, it can also get a connection to a gramophone/speakers.

After experimenting I also realised that when it rains a lot, the funnels will be filled quickly, and maybe over-flood, so I had to integrate them into a bigger structure, and the gutter made perfect sense. With the upside-down shape, I also realized that I can integrate lighting into the forms, so they also can lit up the already quite dark park. In this case, it will also increase the safety mode in the park. A glass layer is mounted at the bottom of the funnel with a hole in the middle to collect the water and to create an interesting light play with the transparent layer together with the rainwater movement.



Section and plan of the funnel.

When the funnel starts getting filled with rainwater, it will create a surface tension to start with. [56] Although when enough water has been collected the water molecules can't hold together anymore and the pressure will start the water to drip out from the hole. In this way, I suppose that the waterdrops that come out are a bit bigger and thereby heavier because of the pressure, which will create a louder sound on the vibraphone bars. The surface tension will also delay the rainwater which is good for the stormwater management, [57] and also will create an interesting light play.

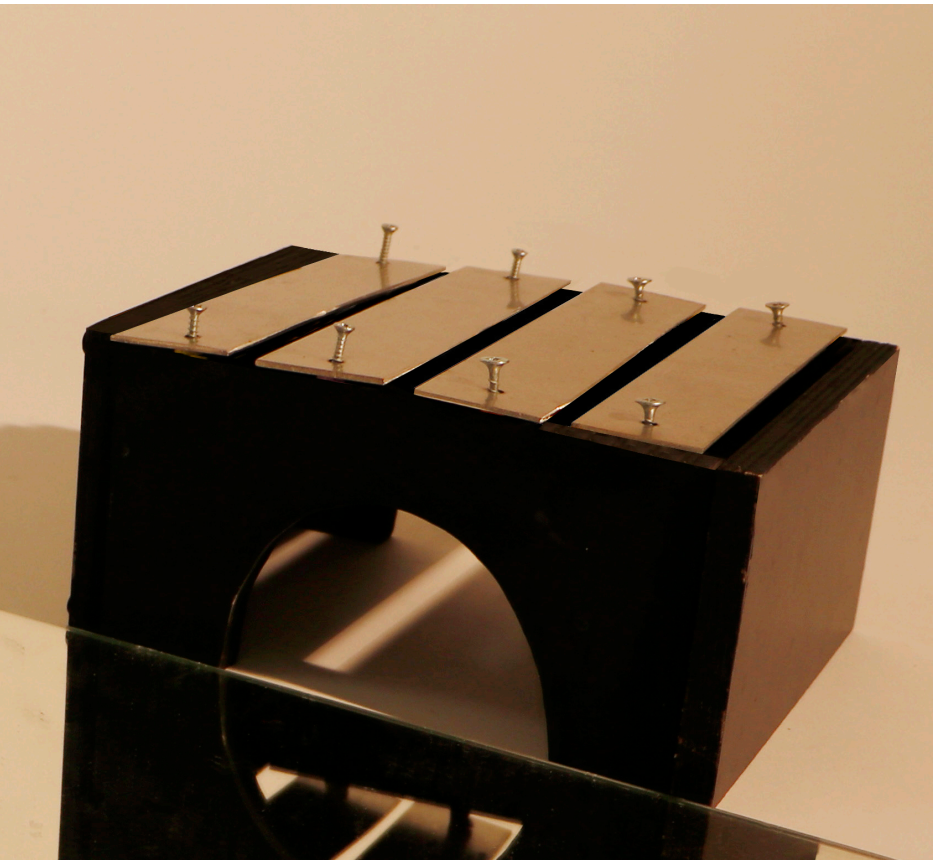
[55] Lindström, H. Civil engineer, hobby music instrument maker. Meeting (27-03-2019)

[56] https://www.tomtit.se/vara-experiment/Plan2/ytspanningen/

[57] Thoms Ivarsson, J. Creative Director, Cyclops and water, Göteborgs Stad. Meeting (15-02-2019)

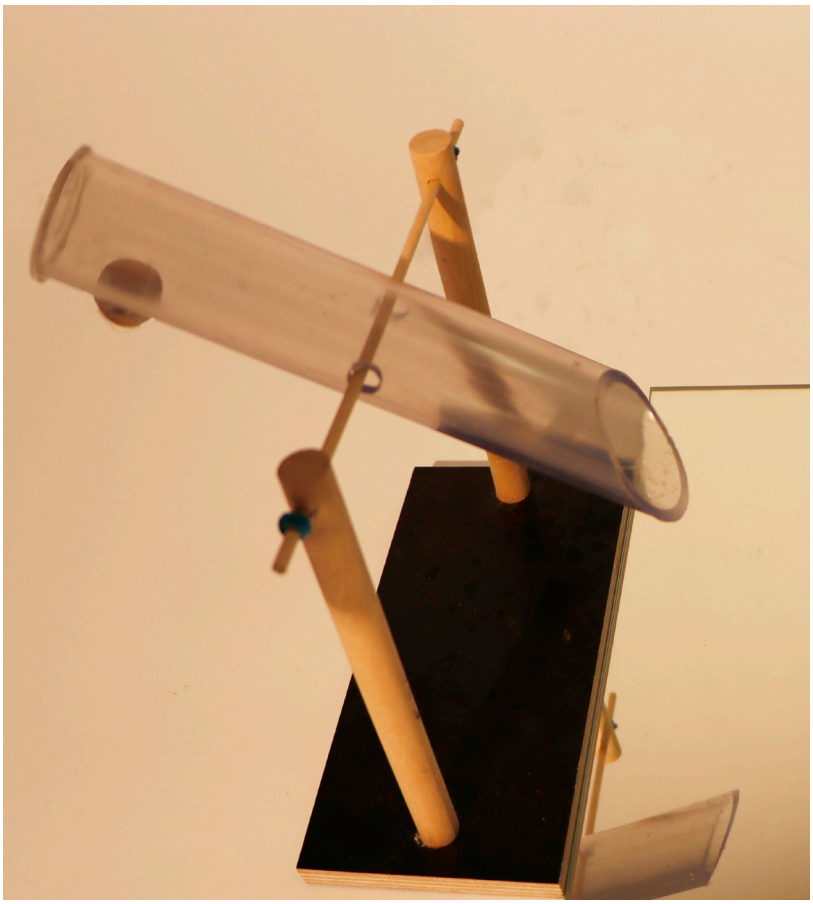
Module building: Gutter, Funnels & Vibraphone

Gutter + funnels. In this prototype, I've built a squared gutter to don't destroy the already existing pipes of the prototyping area. I've built a quick prototype in wood. The upside-down funnels in plastic are attached and superglued in the drilled holes of the gutter.

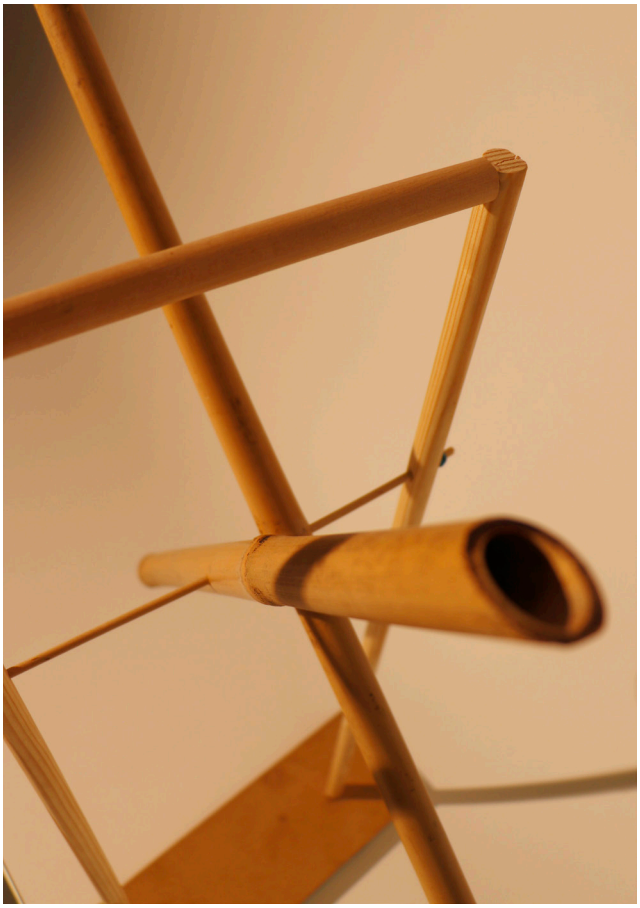


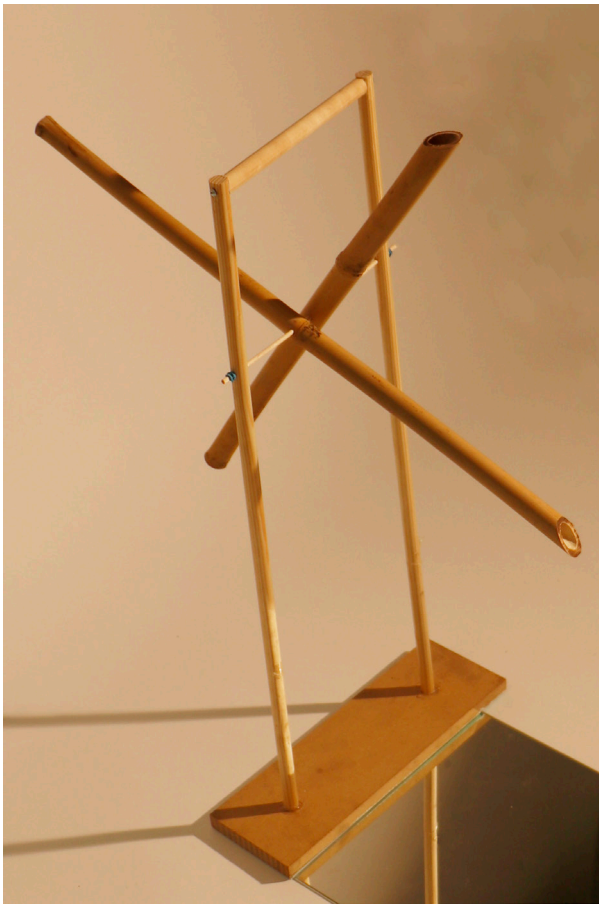
The Vibraphone *(See page 9 for a more detailed sonic description.)* During this project, I tried out different metals (like copper and sheet metals) in different thicknesses to see which would resonate the most. My answer was stainless steel with a thickness of 2 mm.

Module building- Shishi Odoshi



The other built element I decided to use in the final Dropophone proposal is the Shishi Odoshi. I choose the transparent version of PVC plastic because of the Scandinavian climate where the bamboo might easily crack. It will also create an interesting visual connection where you can see the pipe getting filled with rainwater. A wooden base attached to the PVC will also be in need to create a louder sonic effect.





The first built model of the traditional Shishi Odoshi. The difference is that I experimented with several pipes with the idea that they could play different bars, instead of the traditional singular pipe.

Module Testing, Daytime

I hung up the prototype with ropes connected to the grooved metal sheet roof. You can see the vibraphone at the bottom of the left picture. Some improvements I made was adding the felt of protective pads where the bars are resting on to make a more flat, yet resilient ground for the somewhat tilted bars. I also changed the screws to nails to create less friction.

This time I tried out the prototype in the garden of my family house, so it was a bit quieter than in a park environment. But I also now found out that the rain sound drowned the sound from the vibraphone. So an adjustment can be that this proposal will be an “after-the-rain”-installation.

Module testing, Nighttime

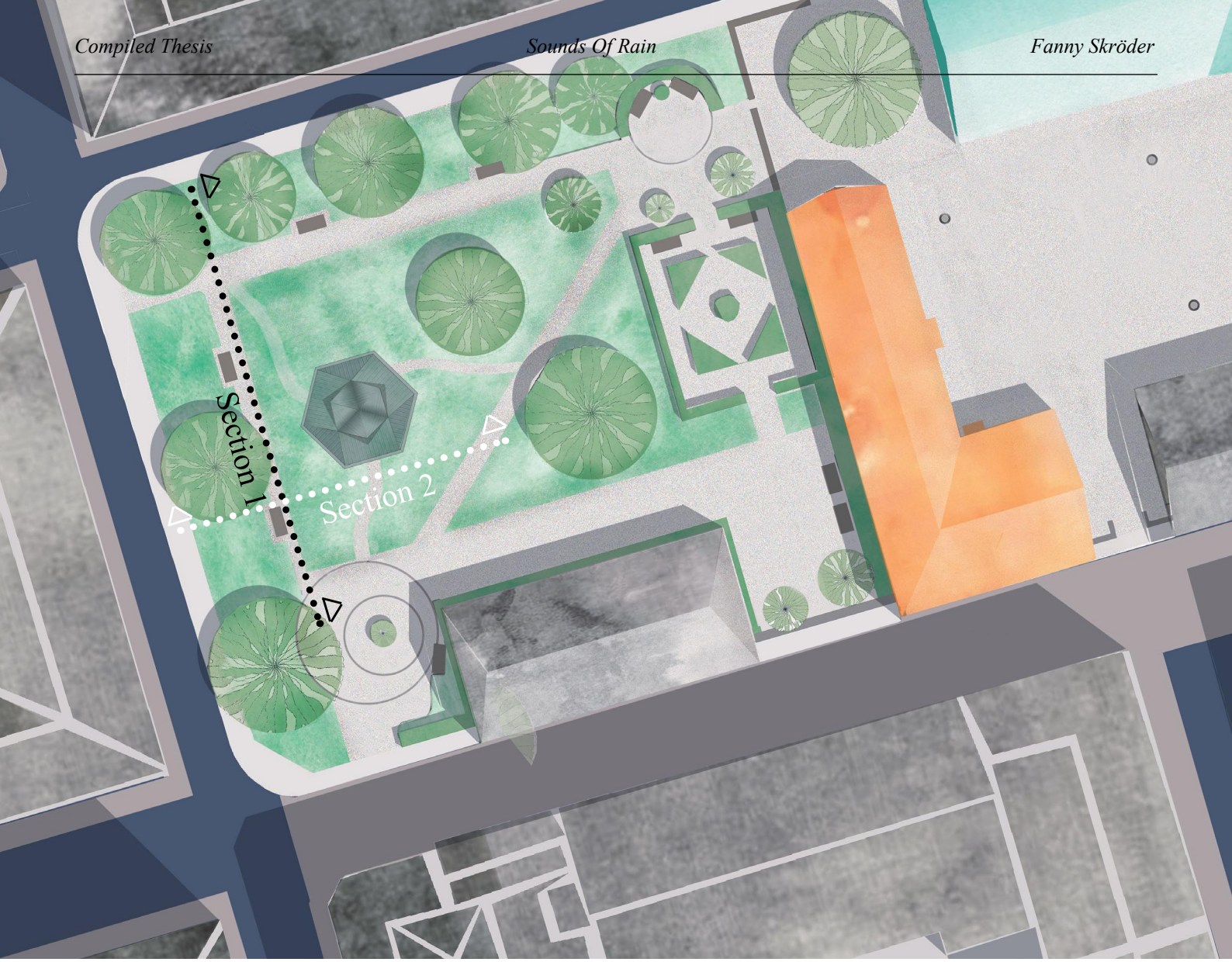


Experiment Reference: Water and light movement. (See page 20).

Similar to my cymatics experiment the water and light will create a beautiful light play in the park.

Two water lamps. The effect of the drops reminded me of flash lighting, it was quite striking to me. One sonic problem that would need to be developed though was that the drops came to fast following another which created a very repetitive soundscape. It worked good after the rain stopped as well, it could continue a very long time afterwards.

Light test with one water-filled lamp at the surface tension state. Two torches are placed upon the gutter. The roof also gets affected by the torches.



Description of Result

Visualization in Kronhusparken, part II

As a traditional park building, I chose to make the final visualisation in the form of a gazebo [58]. According to my meeting with HIGAB [59], I needed to consider the placement of the installation in the park, so it wouldn't disturb the people working in the surrounding buildings. The view from the gazebo is also important, and therefore I chose to place it in the middle of the park, surrounded by the trees. I created some organic paths from the roads into the building, so people will slow down their movement, and maybe take a detour from their original diagonal path. In the following pages, you can see section A and B, marked out on this map.

[58] http://www.bebyggelseregistret.raa.se/bbr2/byggnad/visaHistorik.raa?byggnadId=21400000720890&page=historik&visaHistorik=true
[59] C. Gasparini. Developer of Culture Environments, HIGAB. Meeting (03-04-2019)

Section 1

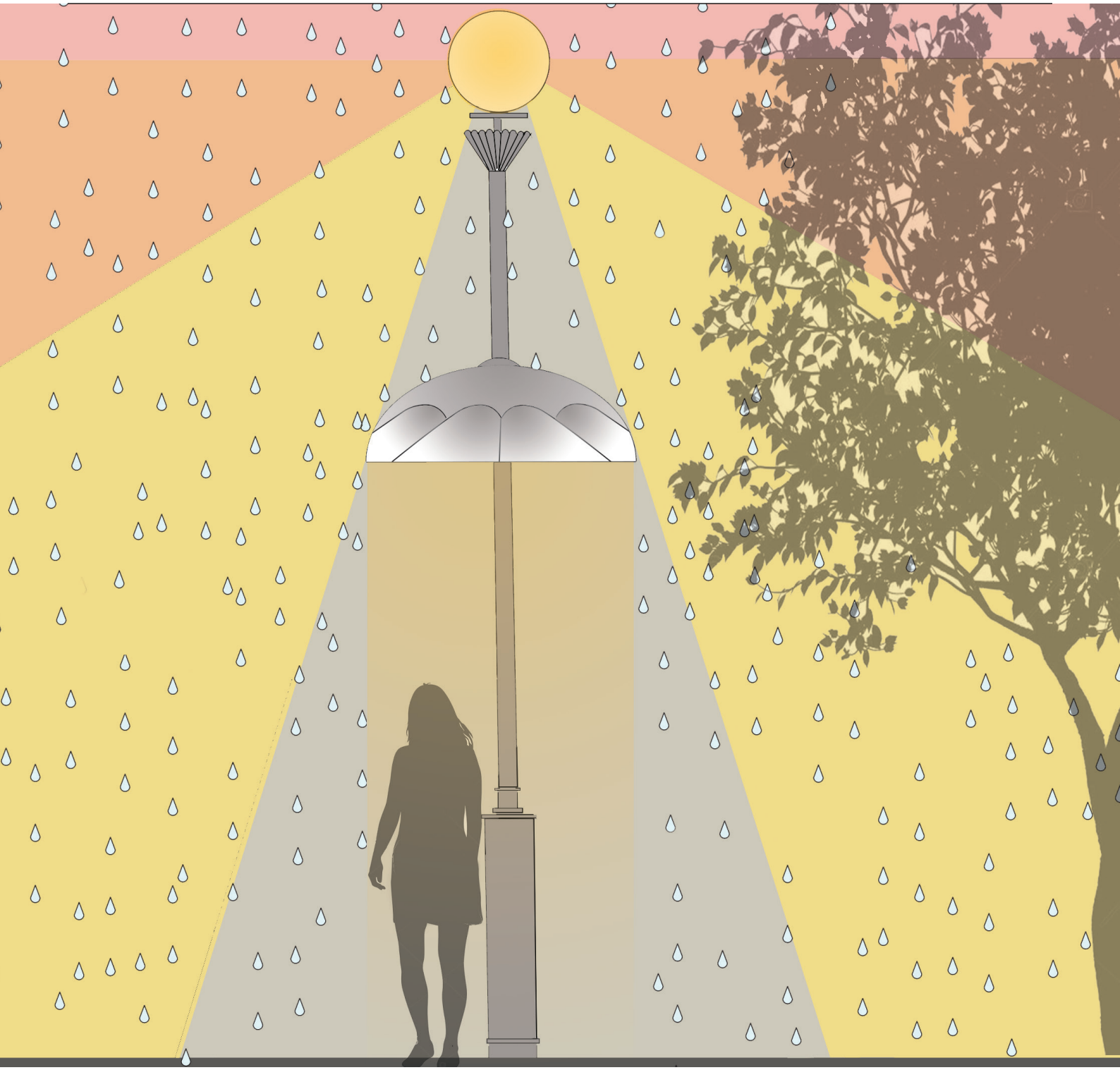
The top roof has a steeper angle to collect and make the water run down with a higher force in order to make the Shishi odoshi move. The openings of the top roof will also bring some natural light into the middle of the building.

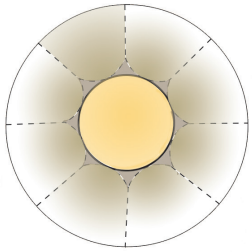
The materials I chose is nuclear oak for the structure because it is very resistant to rot even in humid environments. In a Scandinavian context, oak is our most enduring wood species and suitable for outdoor use.[60] I also think that oak will give a warm and welcoming feeling in contrast to the rest of the material choices. For the roof, I chose a classical grooved roofing sheet, to create canals and guide the rain and also for its sustainability.
The Shishi odoshi's is made by PVC except for the bottom part in wood. The transparent material will allow the participant to follow the movement of the rain and get a hint when the pipe will start to move. At least the gutter is made of classic metal alike the funnels.

[60] http://www.tracentrum.se/sv/publikationer/traslagsinformation/ek/

Section 2

I also made a design proposal for the existing street lamps in the park, connected to my earlier ideas *(see The Hank drum, page 19.)* You can read about the idea of the streetlamp on the following page.





Plan of the Hank drum Street Light

Earlier in the process, I had the idea to discover how a hank drum or steel pan would sound in the rain. But due to time constraints, I decided to explore the vibraphone at first. The existing ball street lamp in Kronhusparken is commonly used in the park areas of Gothenburg, for example also in Slottsskogen and Vasaparken. In this suggestion to put half of a hank drum or an upside-down steel pan, it will work as a musical umbrella on the sight. Since the ball lamp will direct less light to the ground, being covered by the steel drum, I also integrated some lighting at the edges of the steel drum. I also considered putting the steeldrum covering the ball lamp, but I think that the sound level wouldn't be heard that easily than plus that it wouldn't be that effective for rain shelter either, I think this was a better suggestion with two light sources, that also can add a feeling of more security to the park.

Visualization of the closeby waterplay from the funnel-lamps on the vibraphone bars.

Visualization of the waterplay from a forward heavy Sishi odoshi.

Visualization of the inside construction with the hangout spaces on the triangular benches.

Conclusion

One of my intentions with this project has been to create **music out of the rain**, which also worked out, considering some constraints. One constraint is a *quiet surrounding*, which rarely considers public spaces- not even parks. To solve this problem the usage of water-proof contact microphones connected to the sound source can help solve the problem. Another constraint is that the rain itself produce white noise that will mask some of the sounds from the installation. Therefore this installation became a more time specific "after the rain- installation."

After my exhibit of the prototype in Vasaparken, mainly kids interacted with it. One thing can be that the vibraphones were placed at a low level at a suitable height for children. I placed the vibraphones at a low level because I needed a big distance from the roof down to the instrument to create heavier drops. Another factor can be that a small vibraphone itself has connotations for kids, considering that it is a common toy musical instrument. One reason for this can be that it's easy to play for beginners. when the method of playing in tune is guaranteed. Considering other potential stakeholders, I met a couple of dog walkers that were curious asking about the purpose of the installation, but no one tried it out. One reason for this can also be that I was always nearby the prototype documenting the different scenarios. If I would have exhibited the installation for a longer time, I would need police permission. In that situation maybe other stakeholders would also show up.

Considering the well-being aspect, I would say that the music play created a lot of well-being for the kids, being the main stakeholders. They were playing on it constantly during their lunch break and the pedagogues seemed to appreciate the installation as well, except one that seemed annoyed that sounds were created constantly. Other people (parents, teachers, strollers, dog walkers) that I explained the installation for also showed much enthusiasm about the idea. Although when I developed the design proposal in the end I chose to place the vibraphones on a ground level, and without having any mallets attached to the construction. This is because my main intention with this project has been about the sonic relation to the rain and also to relate to the public space as an environment for different people to enjoy and therefore I want to avoid that the installation will function primarily as a toy.

My last intention was also to raise the value of acoustics within architecture. What I learned from the Japanese water sound installations; (The Shishi Odoshi and the Suikinkutsu) is that the purpose of these installations is to make the observer lose the feeling of time and space and start hearing the surroundings. The intention of my Dropophone is the same when the weather is the musician. The unexpected sounds will hopefully create a curiosity for the space and thereafter a feeling of lingering within the space. This was also my main intention with this project, inspired by the Danish Architect Jan Gehl, who emphasizes the importance of measuring "small data" to improve city living, for example, the lingering in public spaces. [62]

[62] Valdez Young, A; *Meassure What Matters- People!* (22-05-2018)

Contribution to the field of design and the design discourse:

After finishing this project as a contribution of a design investigation/suggestion, I will send it to *Rain Gothenburg,* according to our collaboration.

As mentioned earlier, the rain installations that exist in Gothenburg is by far most created by engineers and very few percents by designers/artists. And related to the architect role, a typical design sequence may be described as; "architects make space, engineers add water". *But architects had the role of designing water infra-structures before, and in a context of climate change and rapid urbanization, it is time for the design community to reengage and embrace urban water challenges as a design opportunity.* [63]

Since *none out of 51 mapped sound installations in Sweden are working with weather forces like wind, rushing water or rain,* [64] it makes this project a new contribution within the field of sound design/art. Another factor that this sound installation can contribute with is that it will create a more dynamic soundscape thanks to the sudden change of weather, that will result in a more permanent in-stallation when the built element can correspond to the constant changes of space. Both considering the compositions made by Weather or musicians.

[63] Muller, B ; *From Grey to Blue: How Architecture Play a Role in a Water-Wise World.* (13-14-2018)

[64] Erlandsson, T; Sound installations in the outdoor environments of Sweden, Ljudinstallationer i Sveriges utemiljö, Master degree project in Landscape architecture, SLU (2010) p. 56 .

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With a special
Thanks for guidance and
support:

Catharina Dyrssén

Cina Gasparini

Frej Wichmann

Hans Lindström

Jens Forssén

Jens Thoms Ivarsson

Jesper Norda

Kristina Fridh

Markus Bergström

Minna Siikaluoma

Nathalie Dackelid

Olle Niklasson

Rasmus Malbert

Shereen Khateeb

Ting-Hsuan Chang