Essay Henk-Jelle de Groot

Acoustic Fingerprints / Space as an object / Material Sound

.0 Intro

The essay will be a one on one reflection of my graduation work. Starting with the early processes and experimentation till the completion of the work and self-reflection on the process and findings within the graduation research. They aim of this essay is to accompany my work process as a method to help reflect on the graduation project. The reader will gain knowledge of the process and related subjects.

.1 Engagement

With this project I'm aiming to surprise the viewer with a new perception of a space, and to connect the viewer to the space in a different way. The idea of engaging the viewer with the space comes from the idea that there are acoustics properties that you might not be aware of. Through these properties of a space I can visualize my research and let the viewer be engaged and connect to the space in different way. Some of the subject matter on impulse response is hard to grab. I could choose to leave the technical explanation out, this in case that the work is strong enough and doesn't need any technical details to explain the work. What I need to tell in a technical aspect is defined by the outcome of my research.

.2 Research & Experiments

My research focuses on what possibilities sonology & impulse response can offer for the development of sculptures, and how they can give a different awareness of places and spaces. My sculptures will give the viewer an object to look at. And make the viewer aware of their presence in the sculpture and space. Through this sculpture a different awareness of spaces and their acoustics properties is created.

Impulse response. The idea behind an Impulse Response (IR for short) is that a frequency sweep is played in a certain space. A frequency sweep is a sweep at a constant decibel level ranging from low frequencies to high frequencies. With using this method we are sure that every possible frequency is played in that space and it will give us a clear data set of the reflective properties of that space.

My IR setup works the same but is only played once. The frequency sweep is played back in a space and is recorded through a microphone. The recording is put through a convolution algorithm where the acoustic data is captured and calculated. What happens through this process is that the original sound is "deducted" from the recorded sound, what are left is the frequencies that amplify or extinguish themselves within that particular space. The IR method has many appliances. In my own practice I use the IR method to give certain sound or dialogue a reverberant character. Imagine a sound score that consist of sounds recorded in "dry" rooms that have no reflection. These sounds are like blank canvases that can be enhanced by applying a reverberation process. These reverberations that I use are all

produced through IR processes. These reverberation characteristics can put “dry” dialogue in a car “environment” through the use of impulse responses.

An example if this method is the famous experiment I’m sitting in a room (1969) by composer Alvin Lucier. By recording a sentence spoken by Lucier and playing it back multiple times within a room. Lucier captured the acoustic properties in that room like an IR. After playing back and recording this sentence multiple times a garbled recording is left with vague sounds that contain only frequencies that reflect the best within that room.

Below are the basic sound examples of a Impulse Response technique.
A clean sweep to play - [A sine sweep from 20Hz to 20kHz]
A sine sweep from 20Hz to 20kHz recorded trough a microphone in a room - File:R1.ogg
Impulse Response through deconvolution method - File:Jar Response.ogg

These pictures show a representation of an impulse response. The way in witch the impulse response is shown is called a waterfall diagram.

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Waterfall diagram of a Impulse response from a kitchen
(measured in dB and Frequency)

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Waterfall diagram of a Impulse response from an auditorium
(measured in dB and Frequency)

.3 Initial Trials / Experiments
I started by setting up speakers in a 90 degree order with a microphone in between. This system, if mirrored and pointed to the opposite side of the room, can provide me with 4 impulse responses, 1 for each speaker repeated once. I found out that when I put the outcome of these four measurements trough my visualization workflow, that the amount of measurements was not enough to give a detailed model of the room. So I quickly abandoned my 2 speaker setup with 4 measurements. And went for a single speaker setup with 8 measurements. More work to get the angle of the speaker right but much more information due to more measurements. The distance of the microphone to the speaker is equal to all measurements and gave some weird mic placements within the measurement technique. I decided to leave the room in the way as I found it and to not mess around with furniture between measurements.

- Initial setup

- Second setup

- Measurement 5 gave me some interesting microphone placement

- Keeping equal distance

These are the recordings and the 8 measurements of that particular space (room 2.9 wdka)
Measurement 1
Measurement 2
Measurement 3
Measurement 4
Measurement 5
Measurement 6
Measurement 7
Measurement 8

From here the visualization research started. I looked at different ways to get a detailed curve out of the wave files, and the best way that worked for me was to import the audio in After Effects and apply the Wave Form filter to a solid and link the filter to my

measurements. This gave me a tweak able visualization, where I could change the amount of points, lines, height and offset of the audio file. After I exported a Tiff image with the waveform, I imported the image in Adobe Illustrator to trace the image into a spline. With the spline of each measurement (8 total) I created a sphere like object in autodesk maya. This method if done with only 4 measurements gives a less detailed object to work with, this was the main reason to go from 4 measurements to 8.

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Splines as exported from Illustrator

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Splines imported into Autodesk Maya and shaped in a spherical setup

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The gaps between the splines are now filled and the visualization is complete

First thing that I found out is that a multiple speaker setup is quite hard to do, and makes thing unnecessary complex. The best way is to stick with multiple measurements trough the placement of 1 speaker and 1 microphone. I have measured on a horizontal level. After experiencing the horizontal method I question it may also be a good idea to go in height directions, moving the speakers up and directing outwards in a 360 degrees spherical angle.
The moment the waveform is analyzed with the After Effects method, the measurements will loose the 1:1 accuracy. From here on out the model is not scientific accurate anymore. How this influences my research and what it does to the project I have yet to determine.
With the first prototype made in a 3d shape, the next step is to put this model into the physical world. For my other prototype I have been experimenting with visualizing impulse response through 3e printing (see below)
I could do the same and find out what kind of shape I'll get. Some questions came out the feedback session and it seems good to research them:

During the tryouts with the above method, I experimented with different spaces and setups. One that worked well and had interesting

results was the impulse response from a glass jar. The jar was placed under a microphone and a speaker was placed inside the jar. One measurement was taken and visualized through the same process as above. Through the 3d process a flower like object was generated. With the nature of the sound in mind and the flower like shape that was developed through the process, I decided to print the object in 3d and put it back in its "origin".

- Glass Jar with speaker

- Print process

- Final Product

Through these experiments and trials I gained more direction in what is to become a "final" product. The first experiment didn't give me the results I was looking for. The 8 measurements gave me a "dull" object that had no relation to the space or surroundings where the IR was taken. If I could transform the object in a physical way the object would come to complex and almost not recognizable as an acoustic reflection of a space. The second experiment was much more direct and simple in a way that it could convey a new awareness of an

object or space.

04. The Object.
This object derived from the precise measurement is now the focus of the project. This object should have to properties of explaining itself with little context and still be objective to the viewer. The sculpture that came out of this research is quite a “classic” sculpture, comparable with artist such as Starck and Brian Wilshire.

After the research and trials I tried to find a way to contextualize the sculptures. Within the talks with David Haines we found out that the method I use to construct the sculptures is strong, both technical and visual. The next question is, what is the context? And in which way does it need to have context and is it an objective project instead of a project that is really informs the viewer of what they see. This has manifested itself in a research in materials and the connection of said materials to the sculpture. The earlier prototypes are made out of plastic, and had no particular meaning or link to the object the IR was taken from.

My view on the sculpture is that the sculpture itself “reveals” the origin of the form and the material represents the presence of the viewer. The material is a direct link to the material the sculpture originated from.

The characteristics of what the jar is in sound reflections are captured within the object. The jar is made out of glass. So the next step was to find similar material to make the sculpture out to either have connection with the jar. I’m searching for materials that are reflective, like metal, glass, ceramics and other materials who can be polished to become reflective. When you have the measurement of the room the equipment and you are present in the room, so in some way you alter the room. It’s not really clean, because you’ve been there, the sound waves reflect on you and you make the measurement different than it could be. The presence alters the result. And if I make the sculpture out of a shiny object and the object is put back in the room and you are not there it is natural environment, let’s say a zero point. But as soon someone wants to look closer at the sculpture you distort the object because your reflection is giving within that object and you alter the same way you’ve done with. This is one aspect that I find interesting. The idea to give the viewer a new engagement with space, I think this comes close to what I imagined. It’s a clever way to somehow engage and incorporate the audience in the sculpture. When you look at the sculpture I‘ve engaged you in altering my sculpture in the same way as the origin of the sculpture. I think my personal breakthrough. No matter what happens in these next months/years is that within the state of mind that I’m normally in working also towards an end product, like i do daily in my studio, it’s not, if you want to be really creative or different, you have to look more carefully to every step you’re making and don’t be fixed on the end point. That is like maybe for some people, they already knew this, but for me it is quit revelation.

05. Sculpture Process.
During the early stages of prototyping I found it was difficult to maintain the level of detail of the 3d model in a physical sculpture. With this in mind and through talks with David Haines we concluded that going “bigger” was a great solution in getting the details and it would gives us the opportunity to look at the object in a different size.

//Glass
Through a CNC mill that can mill blocks of different materials, I started making bigger prototypes. (See pictures) Through this method I came in to contact with materials that could suit my sculpture. I tried different materials ranging from foam to wood and MDF. In this process of try and failure I came to the conclusion that a block of wood made out of stacked woodplex (?) was the best solution. The wood has a high density so it is both sturdy and can hold the details from the initial 3D model. Due to the fact of the CNC mill’s restriction of 7cm of height, I would have to come up with a way to make to use the CNC but construction a bigger model. I made the diameter of the 3D sculpture exact 28 cm. That is 4x7, so I divided my 3D model in 4 parts and each part was milled out of wood and stuck together to form 1 half of the sculpture.

During this period of prototyping / sculpting and material research I can to a important conclusion, in order for the sculpture to reflect the acoustic measurement it would be really nice to have the sculpture made out of the same material as the original object.

Luckily with the current workflow of the acoustic reflections of the glass jar I was a good half way in making a ceramic mold for the glass object.

The wooden base that I milled was now ready to be made into a ceramic mold. The base was covered in rubber so it would capture every detail and the rubber mold was covered in plaster to support the mold. After this process I casted 2 positives from the rubber mold and joined them together. The new plaster positive is then sanded and ready to be made into a ceramic mold. This method is a common method on producing glass objects trough molding. The next step is to make the ceramic mold and cast glass. I’m aiming at doing al this at the WDKA workshops.

//Metal
In the early stages of prototyping and researching my sculpture and sculpture method I found that the basic measurement of 28 in with and 50 in length really suits my desire at this time. The scale of the object is not to big to overpower, lets say a exhibition space, and it’s also not to small **(revision)**

So with the basic measurements and scale in mind I could think of different materials and object to transform into a acoustic sculpture. During the early stages I have made more measurements then glass. **(audio examples)**

The next sculpture I’m aiming for is a metal one, the process of a metal one is quite different than glass. The method of construction the metal object this size is best done through a lathe. The idea is to divide the object in 3 parts. **A long rod to capture the point and the small peaks of the sculpture.** And two discs to represents the bigger peaks. The process of milling on a lathe needs

the exact measurements and angles of every wave. With a technical drawing an exact representation can be made **(insert drawing)**

06. Display

The display possibilities of the sculptures and the processes during the making of the sculpture are all interesting in one way or another. For me the most important thing is the visualization of sound and the awareness that it could raise within the viewer. The process or the sculpture could help in this way. The form I'm thinking about right now is a presentation of multiple sculptures linked to the process of capturing the acoustic properties through subtle hints.

With one almost complete sculpture I'm ready to look at in which ways the sculpture can be presented. Should it stand up straight, what does it look like horizontal? How does the height of the plinth play a role in this? How close would I put multiple sculptures together?

Then how does the context play a role in the presentation? Some ideas that I have are:

- Refer through nomination, like the work of Michael Craig (like an oak tree)

- Put the object next to the sculpture so a correlation between the sculpture and object is visible, like the works of Rachel Whiteread

- Make the sound hearable

- 2D presentation of the process through pictures and drawings

- Written context

ARTIST RESEARCCHH

Artist Description: Michael Craig Martin

If I look at the work of Michael Craig Martin I immediately see a bold image. [it works on two levels as 1) the context = he challenges the viewer by giving it another title and to see what he sees within the glass of water - this is through nomination. 2) the physical manifestation within the exhibition, the arrangement and positioning of the objects, the actual, physical presence. What happens depends on the viewer after encountering both the text and the object one thinks differently about this mundane thing (a glass of water). One also thinks about the general (oak trees, glasses of water) and the specific (this particular glass of water /oak tree). [see also Marcel Duchamp's] Fountain]He makes the viewer aware of how things can change through the change of context or nomination. Whether it is a Illustration, painting or installation, his works are strong. If I look at specific work like An Oak Tree(1973) I see a glass of water on top of a glass shelf. The description in the form of an interview is beneath the shelf. The composition of the work is quite strong in a way that it pushes you to focus on the description more than on the shelf. The idea behind this work is the change of physical substance of a glass of water in an oak tree, without changing the appearance. This kind of work relates directly to my own work in a sense that my

work transformed a acoustic resonance of a certain space in a sculpture. [what is the role of the audience/viewer in your work in relation to RCM?]

Where Michael Craig changed the physical substance of a glass of water, I have changed the perception of acoustics in a physical object.
Describe the work / think of what it does to you and others

- An Oak Tree

- An Oak Tree

Both need some form of context for it to work. In the case of Michael Craig “An Oak Tree” the context is in form of a description and a name of the object. My own work could also benefit from a name that is relevant to the sculpture and could explain its origins. Furthermore there is this sculpture of a scale on a wall with a weight on one end and a weight on the other with a picture of the opposite weight on it. This simple gesture of putting the picture on the opposite weight clarifies and demystifies the art work. The reflection of the weight on the opposite weight is a clear reference to the other form. Within my own context the physical manifestation of the origin is to clear and will break up the strong visual language of the sculpture.

Artist Description: Barbara Hepworth

I have no particular work that I would like to describe. But her sculptures feel really organic and have distinct presence. The main focal point of her work and a big reason for starting modernist sculpture is the piercing of each sculpture. A carefully placed hole within each sculpture is what marks her work. The fluid and organic lines within her work speak to me the most. The feel of her work to me is futuristic. The main thing that lacks between her sculptures and mine is symmetry. Where my own sculptures have certain symmetry within the design hers do not. Even if her work very well lends

itself t be symmetric she choose not to make them symmetric. She works with various materials like stone / concrete / wood / plaster. Something I do the same. For me the material is very important and for her as well. Most of her work doesn’t have a reflective material. As if she would not approve the world or surroundings to be reflected in her sculptures. For me the surroundings and the presence of an audience are very important. The reflectiveness of my sculptures is there to remind you of the origins of the sculpture.

- Barbara Hepworth

- Oval sculpture 1943 kettles yard

Bibliography:

http://www.tate.org.uk/art/artists/dame-barbara-hepworth-1274
Impulse Response as explained by AudioEase
Sound Design by David Sonnenschein
Audio Check Test Tones

Similair Work
Driessen & Verstappen Solid Spaces

Technical Tools
Maya 3d software
Paper Mockup Software Pepakura

[**S: task for next time:** edit this text; transcribe today's recording; describe whiteread, Neuman and other artists dealing with similar issues