soundshapes of soundscapes

to formulate visible notations
of sound experiences

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Listen. Before reading this text you now have in front of you, imagine you writing that word in black ink onto the back of your hand. Now it is there as a reminder – a reminder that this is what this thesis is inviting you to do – to listen.

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introduction

abstract

There is an invisible architecture, a sonically experienced space – a soundscape. The aim of this thesis is to explore how that experience can be formulated and communicated visually. This will be investigated through the idea of translation defined as a "rendering of the same ideas in a different language from the original". Invisible impermanent sound experience in ear are, through sensitive formulating hands, translated to a visible permanence, which enables a communicative process.

Today, there is a developed symbolic language for visual architecture, but symbols for aural architecture seem to be sparse. This thesis is trans-disciplinary, building on knowledge from the disciplines of architecture, music and semiotics. By developing a system of symbols to represent sound experiences - a prescriptive notational system like the musical notations, this thesis aims to contribute to the discussion of how architects can communicate desirable soundscapes in the design process.

How can invisible sound experiences be formulated and communicated visually?

To answer the question this thesis is divided into four main sections. The first section presents, nine well-selected sound experiences recorded on Iceland – a land with a fascinating soundscape. In the second section the recorded sounds are explored and understood through five different experiments – various medias are formed during intensive listening. In the third, the outcome from the five experiments is summarized into a prescriptive notational system that tries to tell the eye what the ear will hear - a translation of the sound experiences, caught in one visual soundshape – a sound cube. In the fourth and last section, the sound cubes are read as instructions to create aural spaces – a first sketch of design.

This thesis should be seen as a curious exploration to look beyond the obvious, rather than an attempt to explain sound as a phenomenon. Rather than seeking for one answer, the aim is to find new ways to visually express sound experiences, make sound a natural part of the design process and in turn make the ear a more integral part of experiencing architecture.

Keywords:
design process, listening, notations, sound, soundscape

student background

EDUCATION

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thesis background

CLAIM

Focus on aural architecture in the design process by develop visual notations.

FROM invisible impermanent sound experience in ear *THROUGH* sensitive formulating hands *TO* a visible permanence which enables a communicative process.

PURPOSE

There is an invisible architecture, a sonically experienced space. The aim of this master thesis is to explore how that experience can be communicated visually. This will be investigated through the idea of translation defined as a "rendering of the same ideas in a different language from the original", where invisible sound experiences are translated into visible notations. The intention is to make aural architecture more noticeable in the architectural dialogue and make sound a natural part of the design process.

DISCOURSE

Today, there is a developed symbolic language for visual architecture, but symbols for aural architecture seem to be sparse. This master thesis is trans-disciplinary, building on knowledge from the disciplines of architecture, music and semiotics.

There are analogies between the disciplines of architecture and music. Both communicate their ideas through notations. These notations serve as external support for the mind that makes it possible to preserve and communicate their authors' ideas or instructions.

In this thesis the main source of inspiration is taken from the composers' way of expressing and inform how something should sound. By developing a prescriptive notational system for sound experiences, this thesis aims to contribute to the discussion of how architects can communicate sound as a phenomena to visualize desirable soundscapes in the design process and in turn, make the ear a more integral part of experiencing architecture.

THESIS QUESTIONS

How can invisible sound experiences be formulated and communicated visually?

DELIMITATIONS

This master's thesis is primarily an investigation of how invisible impermanent sound experiences can be translated to a visible permanence. It should be seen as a curious exploration rather than an attempt to explain sound as a phenomenon. What is visually communicated is not only intended to describe but also to prescribe to motivate a continuation. Rather than seeking one answer, the aim is to find new ways to approach visual notations of sound experiences to express aural architecture and make sound a natural part of the design process.

Sound in architecture is often seen as a technical aspect associated to specific functional needs; noise reduction in the city or acoustic design in concert halls. That's not what this thesis is about. This thesis is more interested in experiential aspects of sound in everyday environments. Neither is it a thesis about noise barriers. This thesis investigates the positive qualities of sound. In a try to turn the negative approach to noise into a positive search, for how sound could be used to generate architecture that makes the ear a more integral part of experiencing space.

METHOD

The thesis question will be investigated through the idea of translation defined as a "rendering of the same ideas in a different language from the original". A methodology, to translate invisible sound experiences into a visible system of notations, are developed to describe and prescribe to motivate a continuation. The sound experiences from a trip to Iceland is the point of departure.

The method used is an open-end method where one step is allowed to shape the next without working towards a set goal from start. The process is more important than the outcome. This is something observed by Mau (1998) in his Incomplete Manifesto for Growth: *"When the outcome drives the process we will only ever go to where we've already been. If process drives outcome we may not know where we're going, but we will know we want to be there"* (Mau, 1998:1).

The study is divided into four main sections, see figure 1, p.14. In the first (introduced in chapter 3, *soundscapes*), nine well-selected sound experiences, recorded on Iceland are described. In the second (introduced in chapter 4, *formulating hands*), the recorded sounds are explored and understood trough five different experiments. In the third (introduced in chapter 5, *soundshapes*), the outcome from the five experiments is summarized into a prescriptive notational system - a translation of the sound experiences, caught in a visual soundshape – sound cube. In the fourth and last section (introduced in chapter 6, sketches), the soundshape is read as an instruction to create aural spaces – a first sketch of spatial sequence.

READING INSTRUCTIONS

This booklet is divided into seven main chapters. *Introduction* introduces the thesis background - claim, purpose, discourse, thesis question, delimitation and method. *Theory* introduces various ways of listening – with ears, hands and eyes and ends up with the idea of the architect as a composer – an organizer of sound. *Soundscapes, formulating hands, soundshapes* and *sketches* introduces the main material, described above. *Discussion* introduces a reflection and conclusion on the outcome in relation to the thesis question. The chapters are structured in the same way as the process. Read from start to finish. Always read the images of the sounscapes and sounshapes in the same order (see figure 2, p. 15).

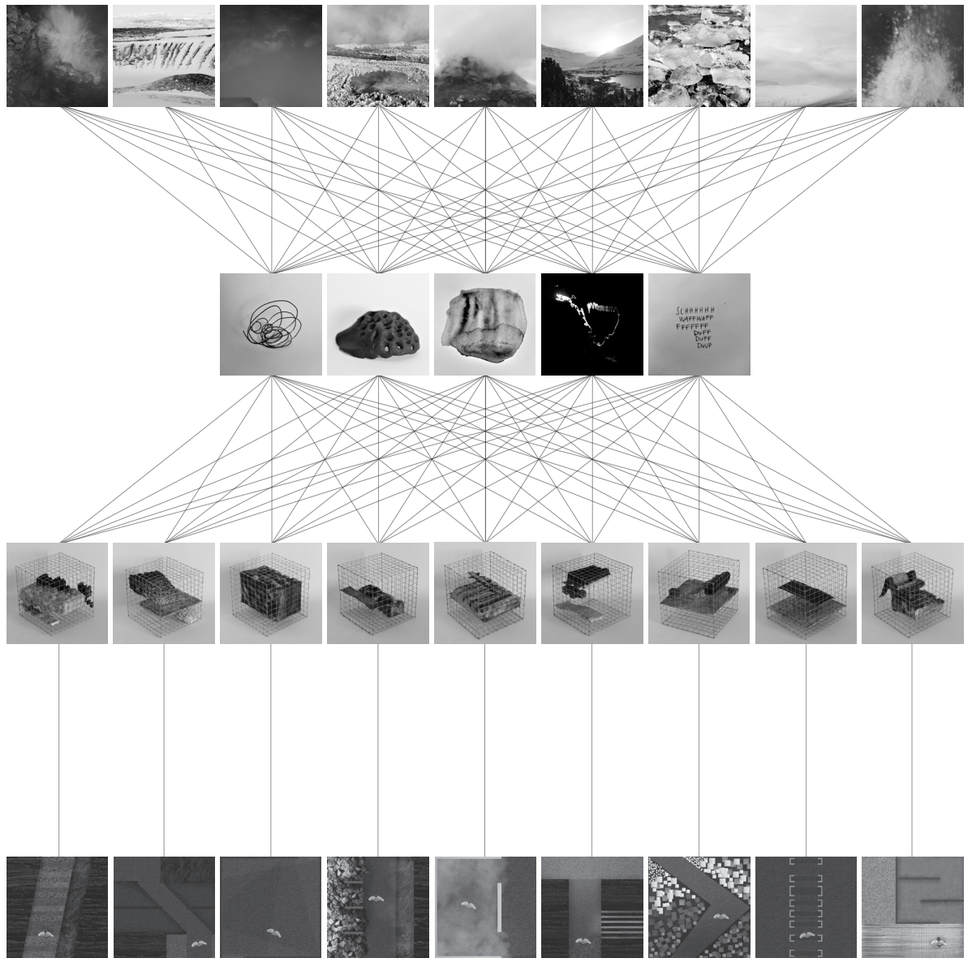

fig.1 - study structure - nine soundscapes in four steps - top to bottom

Deildartunguhver	Hverir I	Breiðamerkursandur
Hverfjall	Hverir II	Vík
Grjótagjá	Seyðisfjörður	Strokkur

fig.2 - always read the images of the sounscapes and sounshapes in this order

2

theory

listening ears

At every moment in life, we constantly experience the presence of sound. The American composer and sound artist John Cage (1961) argues, after entering an anechoic chamber, that there is no silence. In the absolute silent room, he could hear the sound of his blood in circulation and determine that *"until I die there will be sounds"* (Cage, 1961:8).

The acoustical environment in which we situate ourselves in is called the soundscape and is the aural equivalent of a landscape. The term was formulated by the Canadian composer Raymond Murray Schafer in 1967. Schafer (1994) states that the soundscape of the world is now changing, and the result is noise pollution and universal deafness if we don´t learn to listen carefully. In his book *A Sound Education: 100 Exercises in Listening and Sound Making* (1992) he argues, *"I believe that the way to improve the world's soundscape is quite simple. We must learn how to listen. It seems to be a habit we have forgotten. We must sensitize the ear to the miraculous world of sound around us"* (Schafer, 1992:11).

Listening as a solution to not be disturbed by noise becomes important for John Cage as well. *"Wherever we are, what we hear is mostly noise. When we ignore it, it disturbs us. When we listen to it, we find it fascinating"* (Cage 1961:3).

As humans we are unable to close our ears which mean that there is no way to not hear. According to Schafer (1996) listening goes on constantly whether we want it or not but just having ears does not guarantee their effectiveness. The French composer and filmmaker Micael Chion (1994) point out that there are at least three modes of listening. *Causal listening* - often a clear connection between the sound and its cause; *Semantic listening* - integrates a code or a language to interpret a message; and *reduced listening* – focuses on the traits of the sound itself independent of its cause or its meaning.

listening hands

Everything cannot be kept in mind. When being fascinated by sound the memory needs external support that makes it possible to preserve and communicate the aural experiences. Notations are needed. The drawing and the score, notations by the architect and the composer, are visual modes of information, waiting to be interpreted by the viewer for further creating. According to Sällström (1991) notation is a link between the idea and the finished work - a temporary device that will motivate a continuation.

It is said that architects think with the pencil (Rosell, 1990). With intensive sketching they investigate the impossible and possible in a visual brainstorming. These sketched notations both support memory and enable other initiated to understand the concept.

Ferguson (1993) describes three different types of sketching. The *thinking* sketch is used to focus and guide nonverbal thinking. The *talking* sketch support communication with colleagues - it makes it possible to explain ideas. The *prescriptive* sketch is used as instruction to form a final drawing.

Sketching is thinking - an interplay between brain and hand. To sketch something aural is to make the invisible visible. According to Schaffer (1994) we can describe and prescribe aural facts either by talk about them or draw them. He describes three graphic notational systems that can be used when representing sound: acoustics, phonetics and musical notations. The first two systems are descriptive and the last is prescriptive.

To prescript aural architecture by a graphic notational system is a challenge. According to Blesser & Salter (2007) a comprehensive symbolic language is created for visual architecture, while the language of aural architecture is sparse and fragmented. It has to be learnt to interpret. Listening eyes are needed.

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listening eyes

Semiotic is the science of signs and codes. A sign is something that refers to a thing other than itself; a signifier for something signified (Smith et al, 2005). If the eye should be able to interpret a sign and understand which content (aural, visual or sensed in other ways) the sign symbolizes, there must be knowledge about the used notational system. We sometimes make associations between, for example, heard sounds and visual shapes even without being aware of this knowledge. Levin and Lieberman (2004) describes how Wolfgang Köhler already in 1927 found that people tend to associate specific sounds with certain shapes. In his experiment, the participants would pair two words with two different visual forms. The result was that nearly all viewers linked the word *maluma* with a round and soft shape, while the word *takete* was considered to describe an angular and hard shape.

If sound could be seen, what might it look like? In the Oscar-nominated short film *Reci Reci Reci* (Words Words Words) by the Czech animator Michaela Pavlátová (1991), this question is explored. The human voice is made visible in a hand-drawn animation. Various abstract forms and symbols represents the conversations of café visitors. By looking at the shapes and colors, you can with your eyes read the character of the different speech sounds.

For a really experienced reader of signs, the eyes transform the notations immediately to an inner experience. Sällström (1991) describes how an experienced musician can look at musical notations and use the eyes to hear the music. Musical notations can be detailed instructive. The notations can be read and interpreted, manipulated and transformed to a content that is performed. All this happens simultaneously and notations make it possible. Composing is really helped by the notations.

the composer

There are analogies between the disciplines of architecture and music, the architect and the composer, drawing and score. Just as the composer must understand which instruments should play what notes for a desired soundscape, the architect needs to have an awareness of the characteristics of the materials and how they should interact to form a required soundscape. The architect Peter Zumthor (2006) encourages us to *"Listen! Interiors are like large instruments, collecting sound, amplifying it, transmitting it elsewhere. That has to do with the shape peculiar to each room and with the surface of materials they contain, and the way those materials have been applied"* (Zumthor, 2006:29).

The composer's understanding of how the musician can handle the instrument, how quickly a string can be drawn over a violin, also points out the importance of an architect's awareness of the human who will use the space. People form a soundscape in interaction with architecture in the same way as a musician form a soundscape in interaction with the music instrument.

As said before, Cage (1961) means that there is no such a thing as silence. Silence understood as the lack of sounds does not exist. In 1952 his composition, *4'33"*, explored the use of the sound made by the environment as a piece of music. In four minutes and thirty-three seconds no instruments are playing, the composition consists of only silent pauses. When playing it (*4'33"*), it would seem that the room would be filled with silence. But after a while, you can hear the sounds that until that moment have been mistakenly associated with silence - rustling of clothes, ventilation systems, murmur. All these sounds create, according to Cage, a rich musical experience, where the listener becomes the composer.

We talk to a building with our presence; with each speech and movement we make within it. With our ears we can hear its response. To move through architecture is to compose the soundscape. Cage's way of treating the soundscape as a musical composition imply that there is an opportunity for architects to compose an aural experience of our environment, be the organizer of sound.

3

soundscapes

fig.3 - nine places

a trip to Iceland

In the middle of the Atlantic Continental Crack lies Iceland, a small Nordic island country created by rifting and accretion through volcanism. The geography is both varied and unusual and the island is volcanically and geologically active.

Iceland is quiet and don't have much to say at a distance, when visiting it in the beginning of March. The snow that covers the country at this time of year isolates the sounds. Iceland, whose fascinating soundscape is a point of departure for this thesis, asks one to listen carefully and beyond the obvious to be aware of the acoustic environment. To put your feet on Iceland's blackish-gray rock floor and see the steam leave the ground gives an understanding for that deep beneath your feet lies the thing that birth it. What you see and what you hear are products of untamed fire. Around the snow-covered and silenced island unique sound experiences can be found, further afield than you can imagine or closer than you dare. Whispering, screaming or something in between the sounds reveal themselves in the presence of visitors. In this thesis nine of these unique sounds - voices of Iceland – are to be explored and translated to visual notations.

In order to relive the sound experiences in further studies, the selected sounds have been recorded binaurally - two separate microphones have been attached to the ears. This in order to be able to record sounds in a way that we are used to hear them. The sounds recorded through this technique gives a more accurate picture of the sound experience at the location, as you are able to hear the directions of the different sounds. The sound experience will be heard three-dimensional and not flat as it would have been if the sound were recorded with one microphone only.

In this section, words are used to communicate and describe the sound experiences. Sonic Experience: A guide to everyday sounds (2006) provides a rich lexicon of words that has been of great help to communicate the incommunicable listening experiences.

By scanning the QR-codes you can listen and experience the sound yourself. Use headphones.

Deildartunguhver

In west Iceland, located in Reyholtsdalur lies Deildartunguhver, the highest flowing hot spring in Europe.
It is something with the water here. In a rapid flow rate of 180 liters per second it sputters, boils and pumps, both horizontally and vertically. Many sounds from the same material; water, are combined in this soundscape. Like a chorus of different tunes.

In the loud water, one believes to find a beat, a clear repetition of similar sound occurrences. The water pumps up and falls down repeatedly, just under a few seconds. But when you think that you have pinpointed the rhythm, the regularity is disturbed. It is interrupted by a new rhythm of pumping water, which takes over the attention completely - without respecting the previous rhythm.

According to Augoyard and Torgue (2006), this effect is called desynchronization: a sound emission that breaks the regularity of a rhythm. The character is described in the same way, as when someone interrupts a conversation without respecting the rhythmic shift of the talk.

The desynchronization that occurs in Deildartunguhver creates an exciting soundscape, that would not occur if the rhythm of the pumping water was always the same.

The photo (see figure 4) shows the pumping water in its extreme position, in the moment just before landing. What will the sound of the landing be? Will the sound be the same as before? It will be a surprise every time.

scan with phone
use headphones

fig.4 - Deildartunguhver

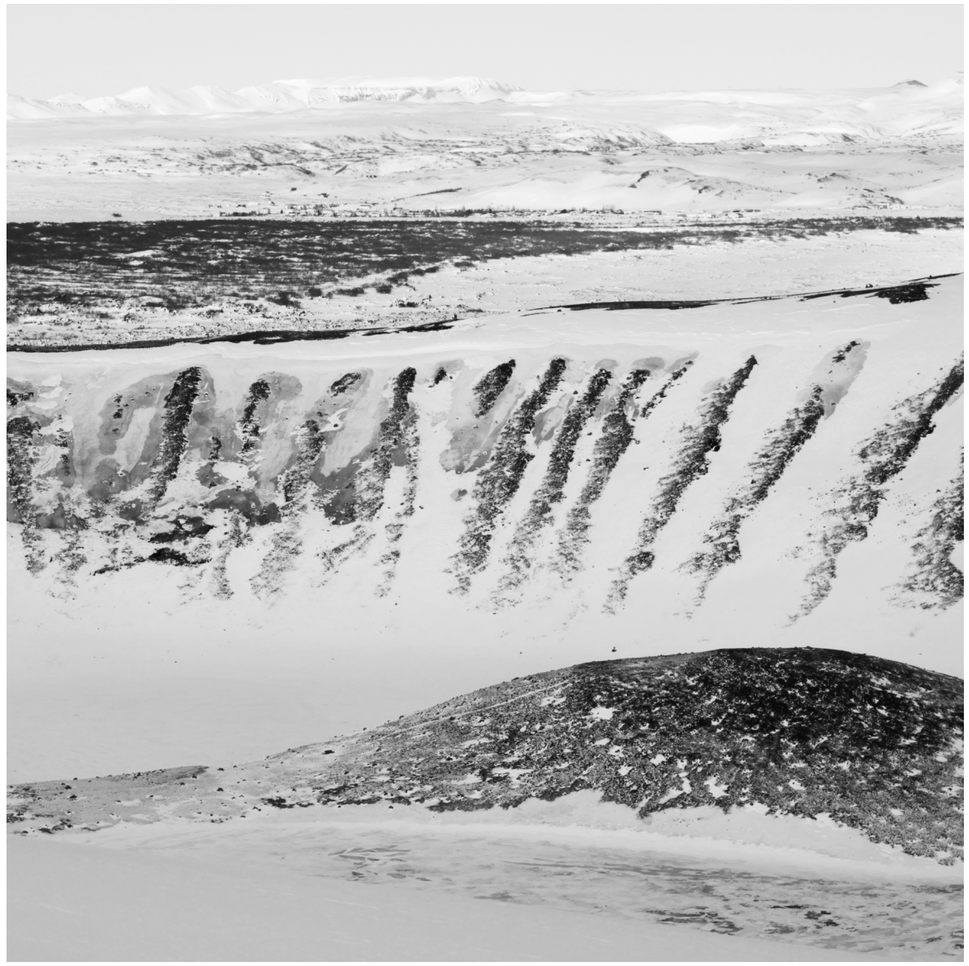


fig.5 - Hverfjall

Hverfjall

In north Iceland, near the eastern shore of lake Myvatn, Hverfjall is located – a volcano with a large, circular explosion crater, almost 1 kilometer in diameter.

In this very large context, a small beautiful sound glade is found. Light vibrating snow crystals rolls on the sloping snow walls, which creates a crunchy yet fluid sound. The sound is recorded in the middle of the slope, the snow crystals rolls by quickly just to continue until they cannot longer be heard. Far away, in distance a snowmobile accompanies the slowly diminishing sound, with its steady hum.

The effect of the diminishing sound, is mentioned by Augoyard and Torgue (2006) as a decrescendo – an effect produced by a progressive reduction of sound intensity, as in this case arise when the sound source is moving away.

The silence that spreads out over the snow-covered landscape around this sound glade, allows sounds that arise several miles away, to be heard clearly. The soundscape becomes larger.

The photo (see figure 5) shows a section of the Hverfjall crater. Beyond this, the rest of Iceland spreads out. In this large context, sounds arise but the source is barely visible. The sound causes one to zoom in, into this large landscape, while the humming snowmobile widens the soundscape over again. Two scales of sound makes the soundscape dynamic.

scan with phone
use headphones

fig.6 - Grjótagjá

Grjótagjá

In north Iceland, near the Lake Myvatn, Grjótagjá is located – a small lava cave flooded with hot and crystal-clear water.
By entering the cave the sound is tangible. Here water meets water in the moment when the drops of water join together with the surface. In turn, the water surface moves and touches the walls of stone. The heat is noticeable and melts the snow that has found its way in. The large pieces that fall into the water are reflected in an exciting way.

Everything described above, is really just a guess made with the ears. Inside the cave nothing could be seen due to the steam. Terrified of falling into the water that constantly emitted sounds, there was a desire to understand and to be able to see the sources of the broad soundscape. It was not done, because of the blurred field of view

Augoyard and Torgue (2006) describe an effect called ubiquity: the difficulty or impossibility of locating a sound source. The sounds seem to come from everywhere, anywhere and nowhere at the same time. In the cave the sound seems to come from a single source and from several sources at the same time.

Further, Augoyard and Torgue (2006) also mentions delocalization, a form of the ubiquity effect, where the listener knows exactly where the sounds seems to come from, while at the same time being aware of that it is an illusion. The effect is noticeable in the cave where several sounds are reflected from all directions.

The photo (see figure 6) is an attempt to capture something that was impossible to see. Thankfully the image does not show the actual source of the sound, as this was one of the strongest sound experiences on Iceland. We should close our eyes more often – sometimes hearing is enough.

scan with phone
use headphones

fig.7 - Hverir I

Hverir I

In Northeast Iceland, on the east side of Lake Mývatn, Hverir is located - a geothermal field.

In the fog, the sound of boiling mud reveals from the ground you walk on. It sounds like the mud may struggle to cope, almost like the sound of a very heavy breathing. The effect seems to stop at any time, but it does not.

The sparse landscape, bare of any vegetation and the fact that the ground is actually boiling, really make you feel like visiting something out-of-this world. Here you feel connected to the power of earth.

The mud pools are at times hidden in fog, but due to the ears, you know exactly where the sound source is. The effect of a sound source is one that automatically attracts the listener's attention on the location of emission, is by Augoyard and Torgue (2006) called hyperlocalization. They describes that when a sound source moves, the listener continues to follow it. The mud in the pools does not move as much sideways, but without seeing how the mud is "boiling" the ears are following how the mud rises and falls.

The soundscape that revolves around the mud pools are accompanied by sounds further away. The sound of a vehicle that drives down the valley cuts through the landscape like a hovering, steady wind. Together, these two sounds create an interesting depth in the soundscape.

The photo (see figure 7) shows the sound source, a hole with boiling mud, where the steam has just withdrawn. Even before the source was seen, it was already detected with the ears.

scan with phone
use headphones

fig.8 - Hverir II

Hverir II

Except from boiling mud pots, the geothermal field Hverir also offers natural steam vents with a very loud hissing noise.

The steam is a product of something that happens deep beneath the surface, and by a massive pressure is pushed up through the rock formations on site. At distance you can hear the wheezing sound, and as you approach the rock formations you step into a whole new soundscape – different from the rest of the site. The closer you get, the more the sound takes over, and suddenly you are so close that you are completely surrounded by it - something that does not become less palpable when the steam wraps around you.

The feeling of being surrounded by a body of sound is by Augoyard and Torgue (2006), described as envelopment. They mean that the ability of this effect is marked by enjoyment, with no need to question the origin of the sound. In this case, the sound source is already located. But to stand in front of the source, to close your eyes and feel completely surrounded, is an experience full of fascination and joy.

The photo (see figure 8) shows the rock formation, from which the sound together with the steam is pushed up from. Captured in the moment, the steam looks to be calm and quiet, but with the sound it swiftly becomes wild.

scan with phone
use headphones

fig.9 - Seyðisfjörður

Seyðisfjörður

In east Iceland, Seyðisfjörður is located – a small fishing village with a harbor and a fjord, skillfully carved by the ice age glacier.

Here the sea, ferries and birds are echoing between the mountain slopes. A large sound context is captured in the recording. A few creaking steps on the snow are interrupted by the screaming song of a bird, just to shift over into the larger context of water, wind and a ferry about to leave the bay. Sounds that have been in the background, ends up to being the only sounds that are heard.

Incursion is a sound effect as according to Augoyard and Torgue (2006) refers to unexpected sound events that modify the atmosphere of a moment and the behavior of a listener. When the bird in this sound experience interrupt the mood of the moment the focus is shifting from the creaking snow to the new sound. When the bird stopped singing, the focus moves towards the only sound that is left.

The creaking snow was something that was noticed just after the sound of the bird was no longer to be heard. Such a sound effect could be linked to what Augoyard and Torgue (2006) call blurring. It refers to an unnoticeable disappearance of a sound mood. The sound is typically only noticed when the sound is completed.

The photo (see figure 9) shows the larger context, and the sound sources that affect the tranquility of the place are not known at the moment the photo is captured. It is a later surprise.

scan with phone
use headphones

fig.10 - Breiðamerkursandur

Breiðamerkursandur

In southeast Iceland, close to the glacier lagoon Jökulsárlón, Breiðamerkursandur is located. A jet-black beach where pieces of the Vatnajökull glacier flows ashore and covers it in translucent ice sculptures, sparkling in the sun.

Here big sounds from the sea are mixed with small sounds of water that sweep around the ice. Two scales of sound effects.

The sound experience from this site is from a wave that sweeps across the land and meets the ice. It starts as a soft, bubbling touch, so quiet that the wind from the sea occasionally takes over, just to surge in a rough rise. As if nothing has happened, the wave continues without any problems. The intensity of the sound increases progressively. An effect called crescendo (Augoyard & Torgue, 2006).

The sound experience not only seems to increase in intensity, but also in speed. Something Augoyard and Torgue (2006) would call accelerando – an increase in the tempo.

The photo (see figure 10) shows the ice sculptures on the jet-black beach, as the waves in the background folds around in the end.

scan with phone
use headphones

fig.11 - Vík

Vík

In south Iceland, the village Vík is located. Here a snowstorm went wild and a sound of a solid wind expressed itself. The cottage, protected from the external forces, had loose parts that gave off a flutter in the wind and triggered the whole house to vibrate.

The storm outside was roughly stable, like a constant layer with almost no noticeable variation in intensity. The wind acted like a permanent bass note of humming over which the loose vibrating parts were laid, which spread a liveliness.

Augoyard and Torgue (2006) would call the sound effect of the loose parts for tremolo - an effect that creates a change in volume; or vibration – a continuous variation of intensity or pitch.

The photo (see figure 11) shows the storm with a thin snow cover that the wind pulls along as it sweeps forth. The air turns into a solid mass that hides the landscape. As the strength of the wind decreases, the snow settles and parts of the landscape can be distinguished, just to be covered all over again as the wind is accelerating. A continuous variation and change in wind intensity makes the experience of tremolo and vibration visually experienced.

scan with phone
use headphones

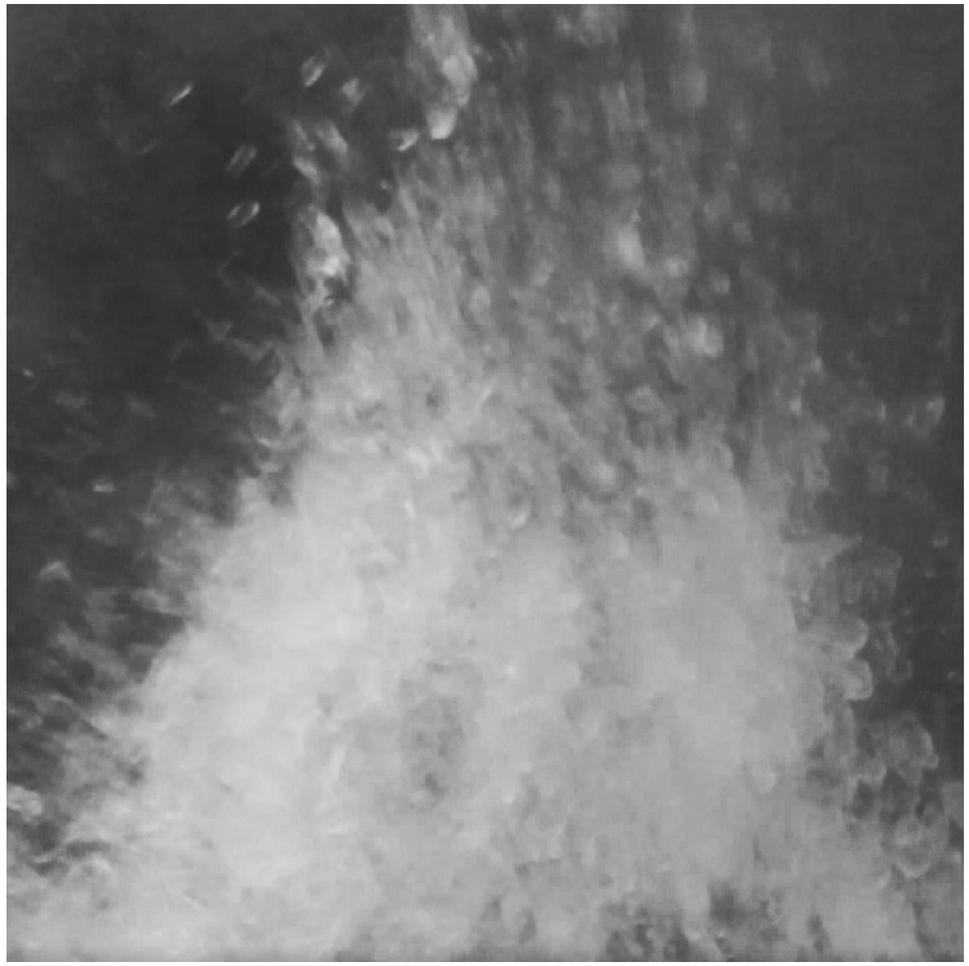


fig.12 - Strokkur

Strokkur

In southwest Iceland, in the Geysir Geothermal Area, Strokkur is located – a geyser, a hot spring that more or less regularly throws up a fountain of water and steam.

The recording made here captures the voice of man in fascination, in pace with that rush of water. Expectantly, visitors are waiting for the next outbreak and when it comes, their fascination is expressed in happy “wow’s”. When the water recedes, the experience is expressed in bubbling conversation - A wide chorus of delight.

The recorded sounds consist of many exciting effects. The sound of the water being thrown up is almost completely covered by the cheers of the visitors and could be likened to a form of masking effect. The effect is described by Augoyard and Torgue (2006) as something that refers to a sound that partially or totally masks another sound, erases the perception of it, because of its intensity or the distribution of its frequencies. The broad cheers from the visitors occur in a chain reaction. Augoyard and Torgue (ibid.) describe the chain effect as one sound event that triggers a sound reaction, which generates another and so on. Like the applause that follows a show may be started by a single person, and then gradually get the whole audience into a sea of clapping.

When the water then falls and a huggermugger of murmur takes over, an effect called cocktail or cocktail party arises. It refers to our capacity to focus on the speech of a specific speaker by ignoring irrelevant information coming from the surroundings (ibid.).

The photo (see figure 12) shows just the top of the entire fountain of water and tries to catch the crackling sound of water droplets bursting. The sound almost drowned in voices.

scan with phone
use headphones

4

formulating hands

fig.13 - formulating hands

five experiments

If the soundscape of Iceland could be seen, what might it look like? Although we can sense sound with our ears, it is invisible to us. The five experiments presented in this section develop a way to note the sound experiences of Iceland visually, to understand the sounds through senses other than hearing.

Different aspects of the sound experiences are examined through different media such as steel wire, clay, aquarelle, movement and words. During intensive listening hands have been allowed to shape in the selected medias, what was heard when listening to the recordings. The medias were translated into visual forms but the choice of medias was not what was important, it was the translation process itself that enriched the understanding of the sound experiences.

The hands have shaped the sounds and the result has raised questions that would not have been asked, without making the thoughts about the sound experiences visible. In a dialogue between the shaped and the one shaping, ideas were tested. They were criticized and modified in a constant communication between evaluation and exploration.

The process has been at heart in this visually thinking and translation. The notations in the experiments became support for the memory. The objective was not to communicate with others but to think high and visually. A process in comparison with the procedure of formulating thoughts into words. A way to bring clarity to thing that are obscure in mind.

The five experiments are not translations of the total sound experiences. It is just fragments that are examined.

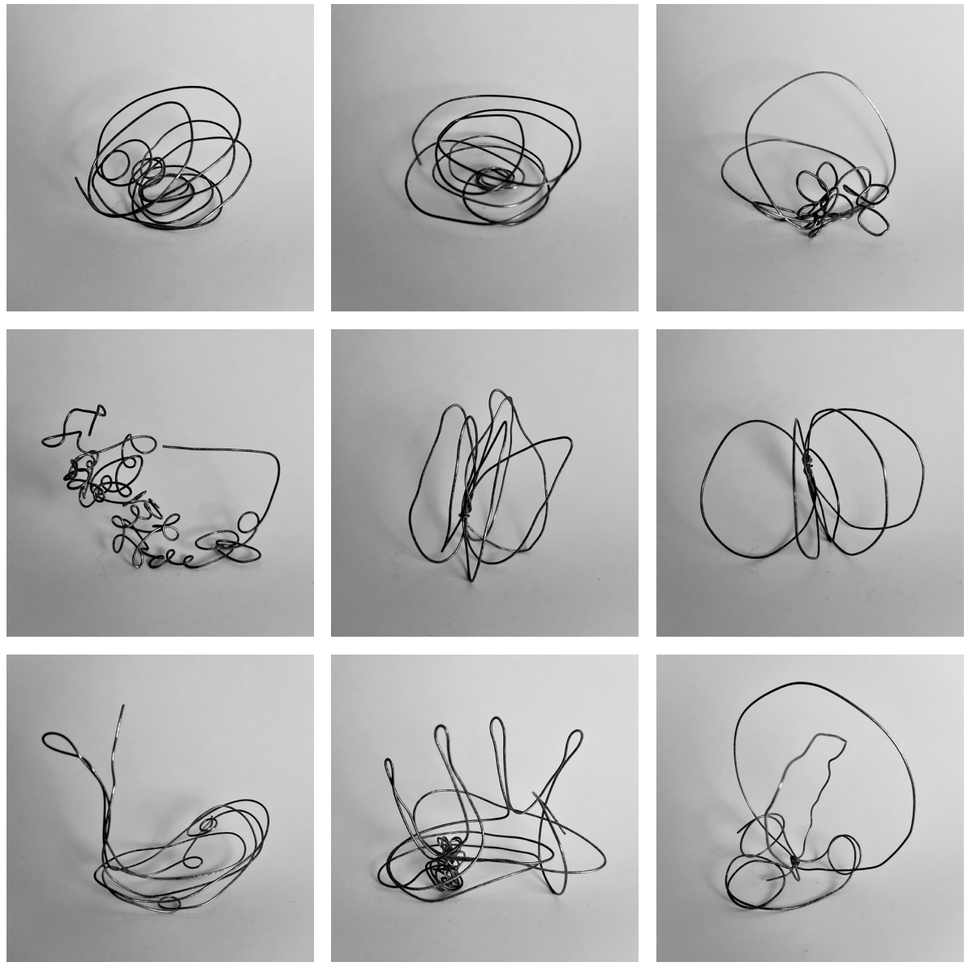


fig.14 - notations of time and space

steel wire

PROCESS

In this experiment steel wire is used to note the sound experiences, see figure 14. One single piece with two ends is shaped by hands in the moment of listening to the recordings. By holding the steel wire in hand, the material in this experiment invites you to listen for a beginning and an end. Hands are then asked to shape the body of sounds in between. Time as a component becomes clear.

For some sound experiences, the duration is easy to note. Like a sentence they can be linearly notated, from left to right, but certain sounds also move in space. Some of them move from right to left while some are not moving at all, which makes it hard follow linearly and the process becomes fumbling.

REFLECTION

In this experiment it becomes clear that if sound moves in space the duration of sound cannot be linearly represented. Many of the recorded sound experiences also consists of more than one single sound. The different sounds make up the total experience and needs to be followed with their own steel wire. In such a model, the connection between the different sounds could be discovered.

The models made in this experiment are not notations of the total sound experiences. They are rather catching a first overall impressions of time and space.

fig.15 - notations of texture

clay

PROCESS

In this experiment clay is used to note the sound experiences, see figure 15. A small piece of clay is shaped by hand in the moment of listening to the recordings. By holding the clay in hand, it invites you to listen for texture; how the sound would feel if you could touch it. By shaping models by hand, it expresses the sounds in a way how they might look like, to feel. The idea of sound as something tactile becomes clear.

REFLECTION

In this experiment a reduced listening becomes obvious, focusing only on characteristics of the sound itself independent of its cause or its meaning. Even though the sound source was known from the moment of recording, it could be ignored just to be able to feel the texture of the sound. It is interesting when you can open up your ears and don't necessarily try to hear what you want to hear in the sounds, but just to listen to what they say, that's where a lot of the discovery happens. Many of the recorded sounds are associated with water, but instead of shaping water the listening goes beyond that. Focusing on the meeting, smooth or rough, between the different sound sources in the recording.

The models made in this experiment are not notations of the total sound experiences. They rather catching a first overall impression of texture.

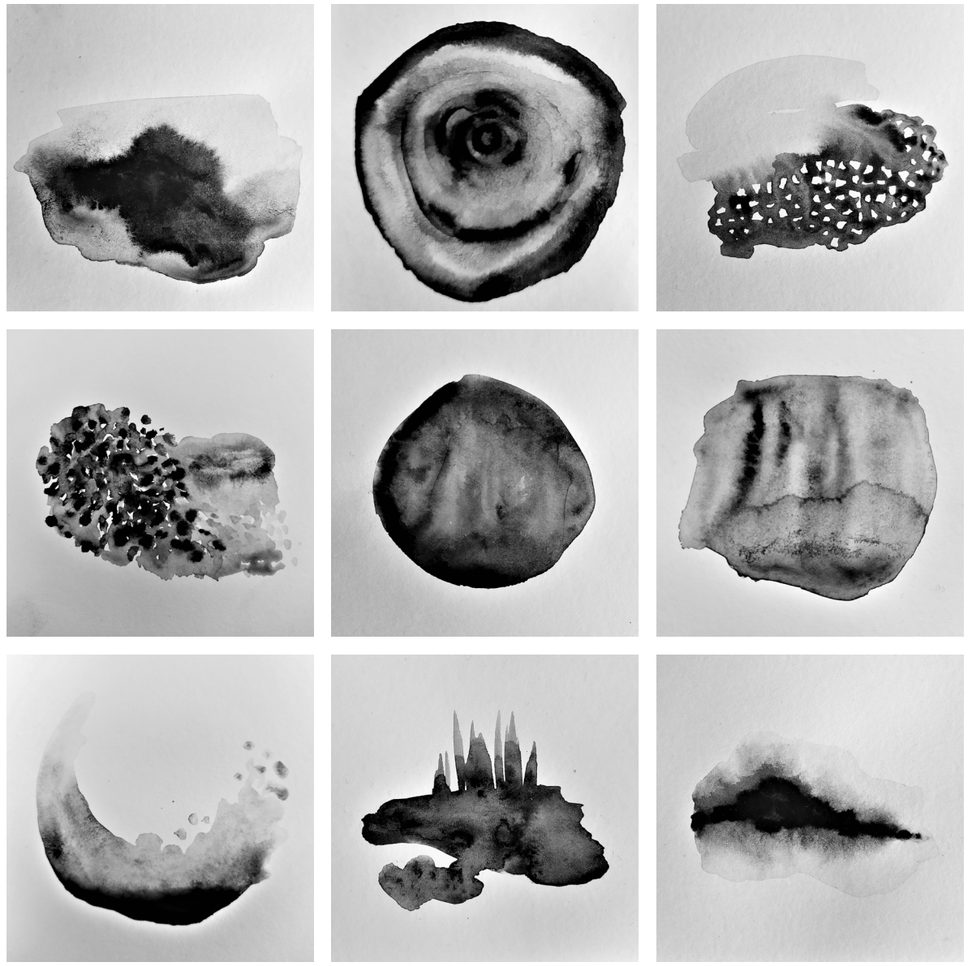


fig.16 - notations of dynamics

aquarell

PROCESS

In this experiment aquarelle is used to note the sound experiences, see figure 16. Simple paintings are shaped by hand in the moment of listening to the recordings. By holding the brush in hand, painting the sound experiences in a grayscale from white to black, the technique invites to listen for different volume levels from soft(white) to loud(black). By first painting invisible sketches in water only and then activate the water with different amounts of blackness based on listening, the idea of dynamics becomes clear.

Some sounds are more dynamic than others and give a livelier feel, while others are more flat, like a single gray mass. At first, when listening, some sounds just feel gray. But with a desire to create contrasts in the painting, the ears begin to zoom in to find small changes. This has to be in mind when comparing the paintings.

REFLECTION

In this experiment, the differences in dynamic between the softest and the loudest sounds from the recorded sound experiences becomes clear. The different sounds show a sudden or a gradual change in volume. Some of the sounds are more dynamic than others. It is interesting to hear the differences. One has to listen carefully to not mix up the dynamic with the frequency. The volume of the various sounds depends on how close or far from the sound source they are recorded. Some sounds could only be heard on the spot, and were not loud enough to be picked up by the microphones – and some sounds can just be heard through headphones. By raising and lowering the sound, one can distinguish which sounds that are taking over in loudness, and which ones that are barely audible. What's interesting is, when sounds that are further away becomes louder than those sounds that are close by.

The paintings made in this experiment are not notations of the total sound experiences. They rather catch a first overall impression of dynamics.

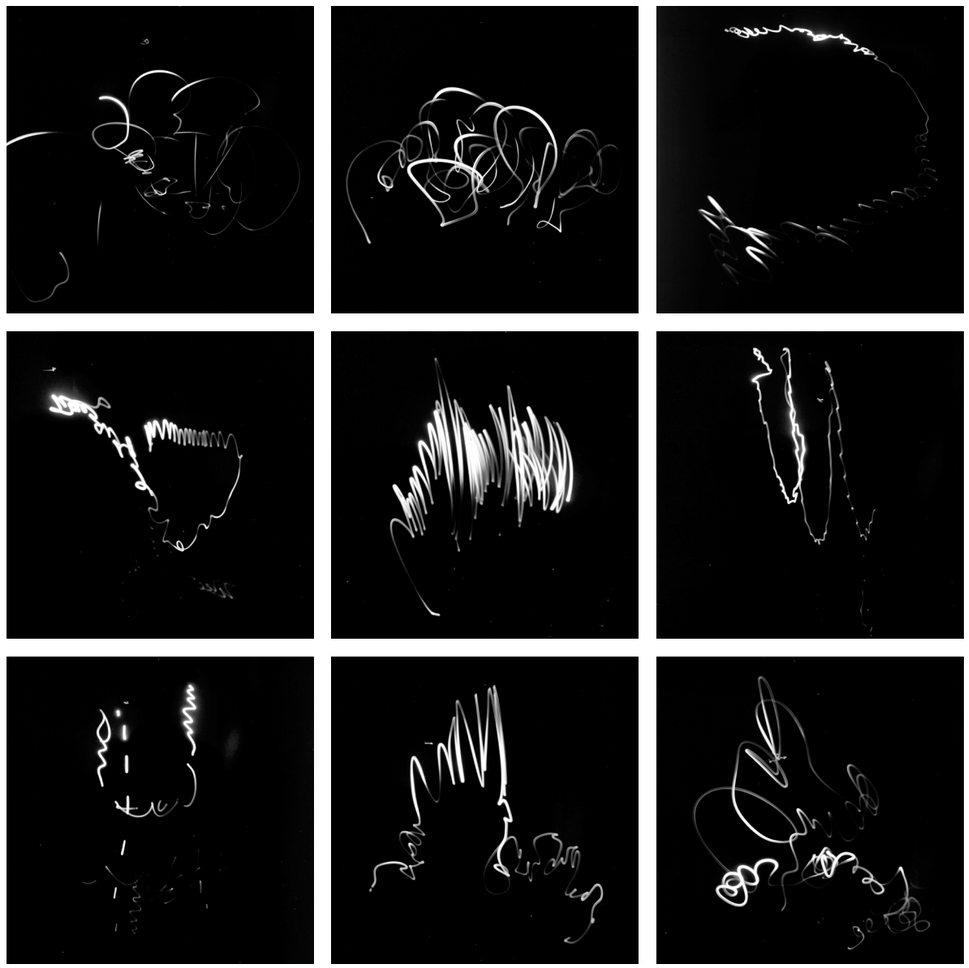


fig.17 - notations of frequency

movement

PROCESS

In this experiment movement is used to note the sound experiences, see figure 17. Light sketches are shaped in the air by hand in the moment of listening to the recordings. By holding nothing but a small lamp (for tracing the movement with a camera), the hand can move freely in the air without resistance, which allows the body to follow. It becomes clear how high sounds are light and rise above, while the lower one is heavy and falls further down. This experiment invites to listen for frequency.

REFLECTION

Unlike previous experiments, where the sound experiences are expressed in small notations, this experiment is about notating the sound experiences in an entire room and not only with hand, but with the entire body. Sounds previously expressed only externally also expressing themselves inside and becomes a part of the body. The rhythm can be felt from the sketching hand.

The sketches made in this experiment are not notations of the total sound experiences. It is rather a catch of a first overall impression of frequency.

fig.18 - notations of mass

onomatopoeia

PROCESS

In this experiment voice and written text is used to note the sound experiences, see figure 18. Words that phonetically imitates the sound experiences are shaped in the moment of listening to the recordings. By mimicking the sounds through voice and then try to formulate that on paper, gives an understanding for how some sounds sound in many frequencies at the same time, while others are clearer in one frequency. This experiment invites to listen for mass.

Mass is related to frequency. Some sounds have a clearly defined frequency while other sounds consist of a frequency cluster. It can either be narrow or broad.

REFLECTION

In this experiment, onomatopoeia is examined; the process of creating words that phonetically imitates the sound it describes. The formation of words is associated to the sounds heard. By reading the words you are able hear the sounds. The translation process has been tricky. How do you spell a buzzing sound? How do you put letters in the right order to make your mouth express water? In many cases, one voice is not enough to express all frequencies. To recreate the sound experiences a hole choir of voices are needed.

The words made in this experiment are not notations of the total sound experience. It is rather a catch of a first overall impression of mass.

5

soundshapes

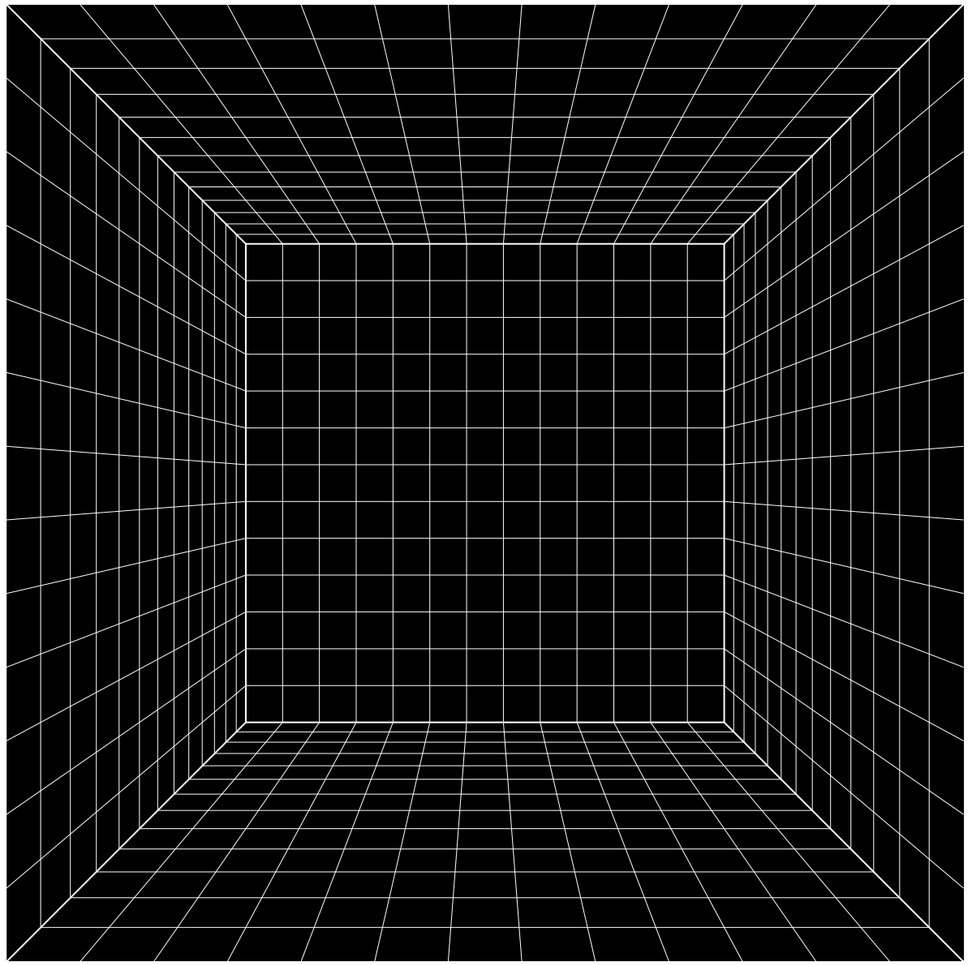


fig.19 - unprogrammed sound cube

sound cube

Continuing with the knowledge gained from the previous sound studies, where fragments of the invisible impermanent sound experiences from Iceland were made into visible permanent forms, this part of the process address a notational system. From the translation process of the five experiments, different descriptive characteristics of the total sound experiences - time and space, frequency, mass, texture and dynamics, were perceived. In this chapter, these components are summarized into a visible notational system. The system is then used to represents the total of every sound experience into one notation - a sound cube.

Because the sound in the recordings not only move in time but also in space the system had to be three-dimensional. A cube was formed to be able to nail the soundshape in the correct position. The cube create a grid system to separate, back from front – right from left – up from down.

The sound cube has three functions like the different sketching modes, described in the theory chapter. First of all, it is a tool to guide a nonverbal thinking. Second by second, the sound experience can be visible and thought about. Sound happens in time. In the pause, the sound disappears. By making the sound visible with the notational system, the pause is possible. The moment of sound can be observed for a long time. The sound cube becomes an opponent where the sound can be analyzed. Secondly, it is a tool that supports communication and makes it possible to explain the sound experiences visually. Thirdly, it is prescriptive and can be used as an instruction to form an aural space as the blueprint can be translated into a building.

In the following chapter, the notatinal system is described. Nine sound cubes, representing the different sound experiences from Iceland, were built as physical models. The ability to observe them second by second is demonstrated in a stop motion film.

the notational system

TIME

The duration of the sound is read from the back cover to the front. It can also be read from left to the right by looking from the left side of the cube.

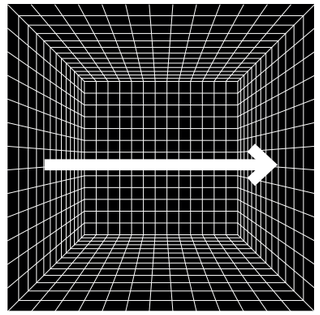


fig.20

SPACE

How the sound moves in space is read to the right and left.

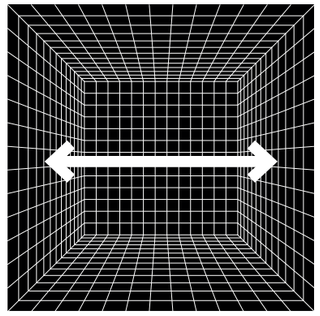


fig.21

FREQUENCY

Frequency is read up and down where up is high and down is low.

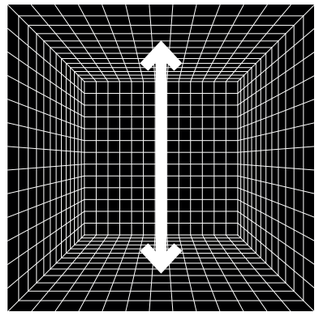


fig.22

MASS

Mass is read in the in the thickness of the material programmed in the cube in a gradient from narrow to broad. Depending on over how many frequencies the sound extends.

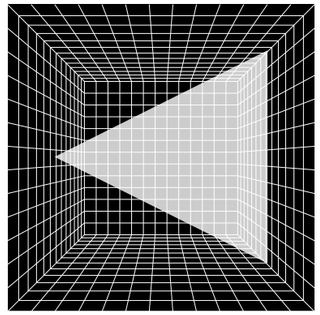


fig.23

TEXTURE

Texture is read in the surface of the material programmed in the cube in a gradient from rapid to slow variations and sharp to smooth.

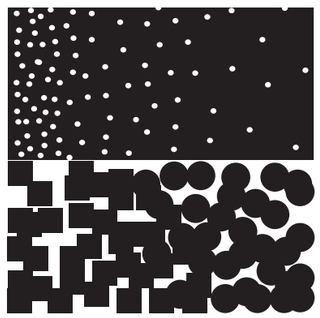


fig.24

DYNAMICS

Dynamics is read in a gradient from black to white where black is loud, and white is soft.

fig.25

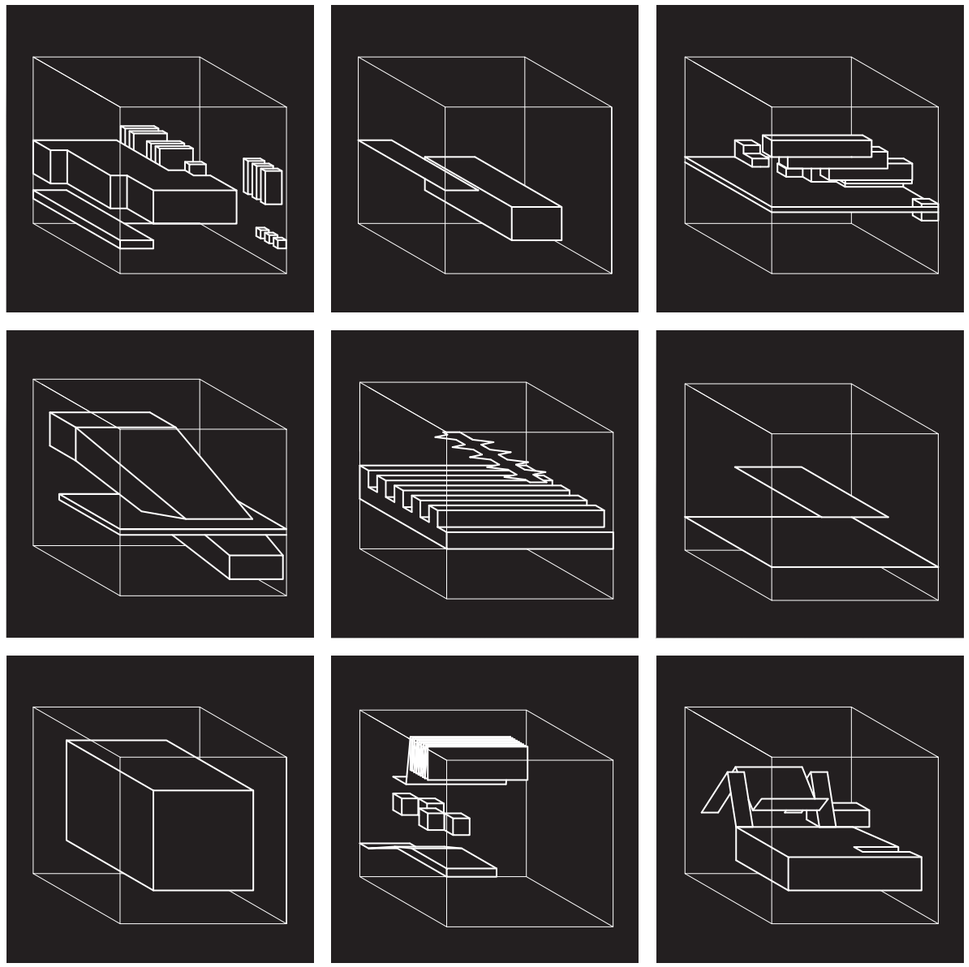


fig.26 - all soundshapes of soundscapes - structures of time, space, frequency and mass

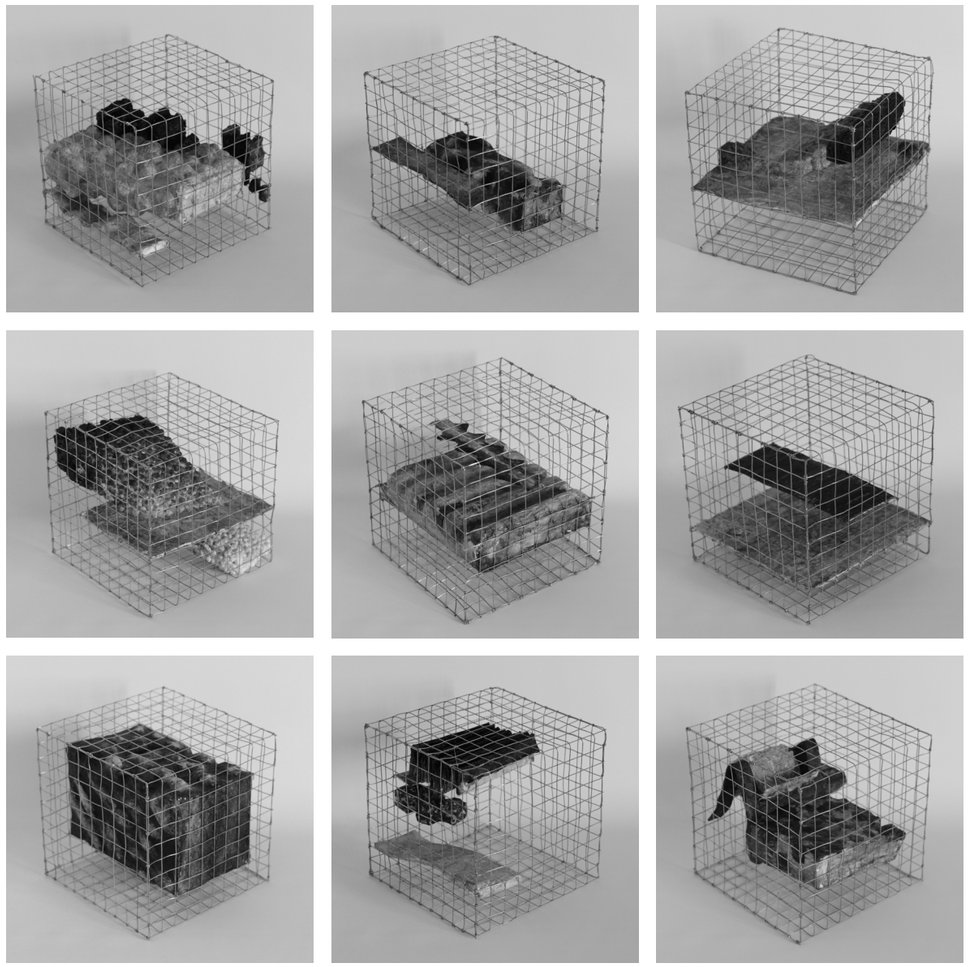


fig.27 - structures of time, space, frequency, mass, texture and dynamics

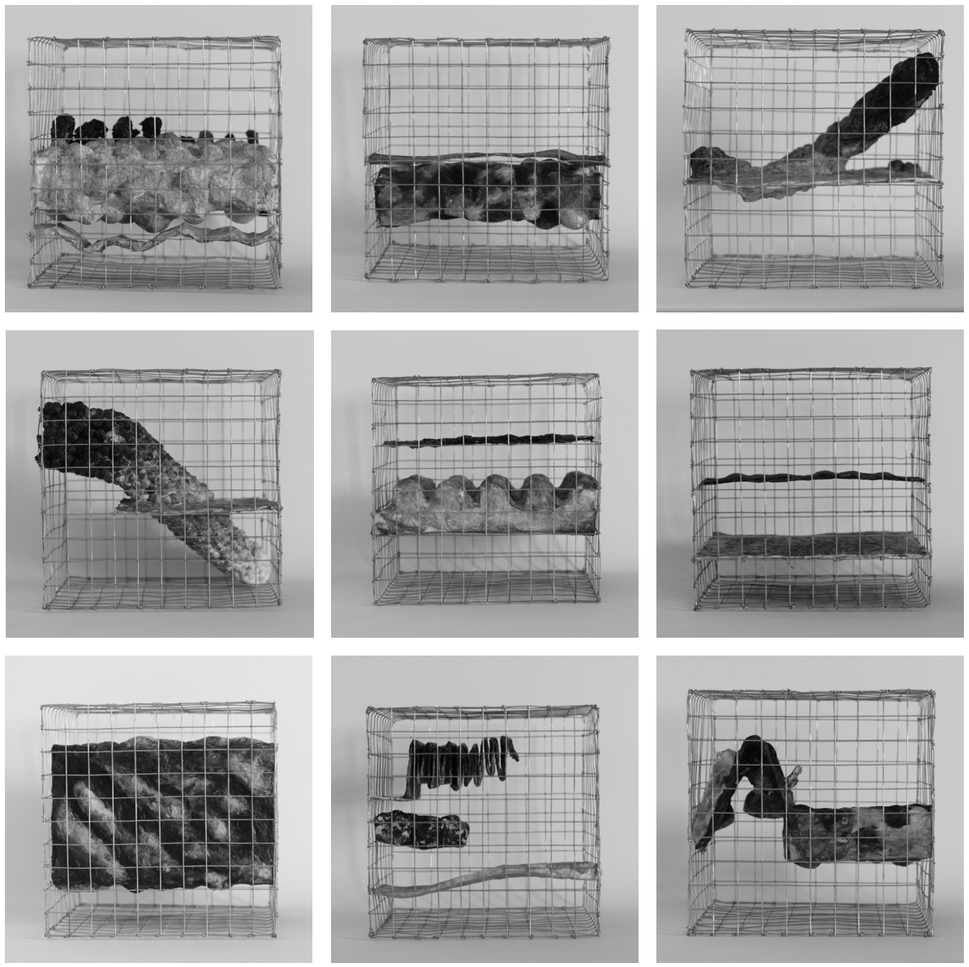


fig.28 - all soundshapes of soundscapes - time

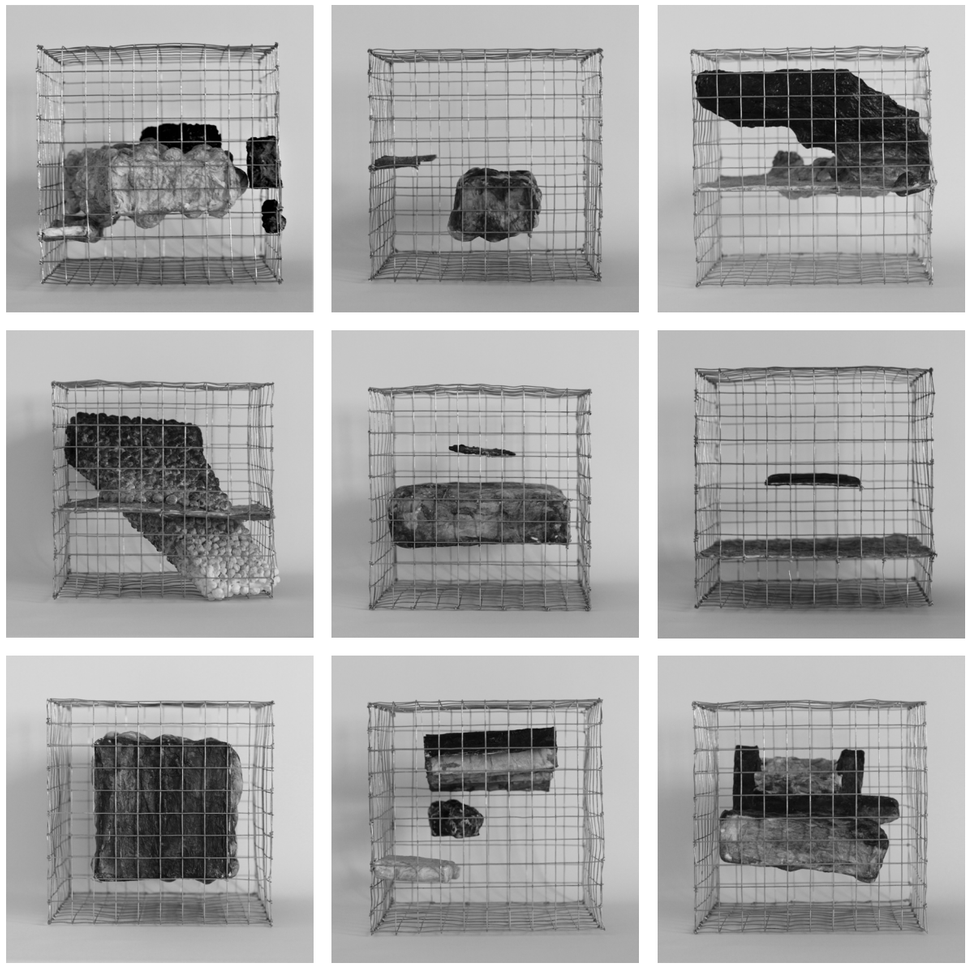


fig.29 - all soundshapes of soundscapes - space

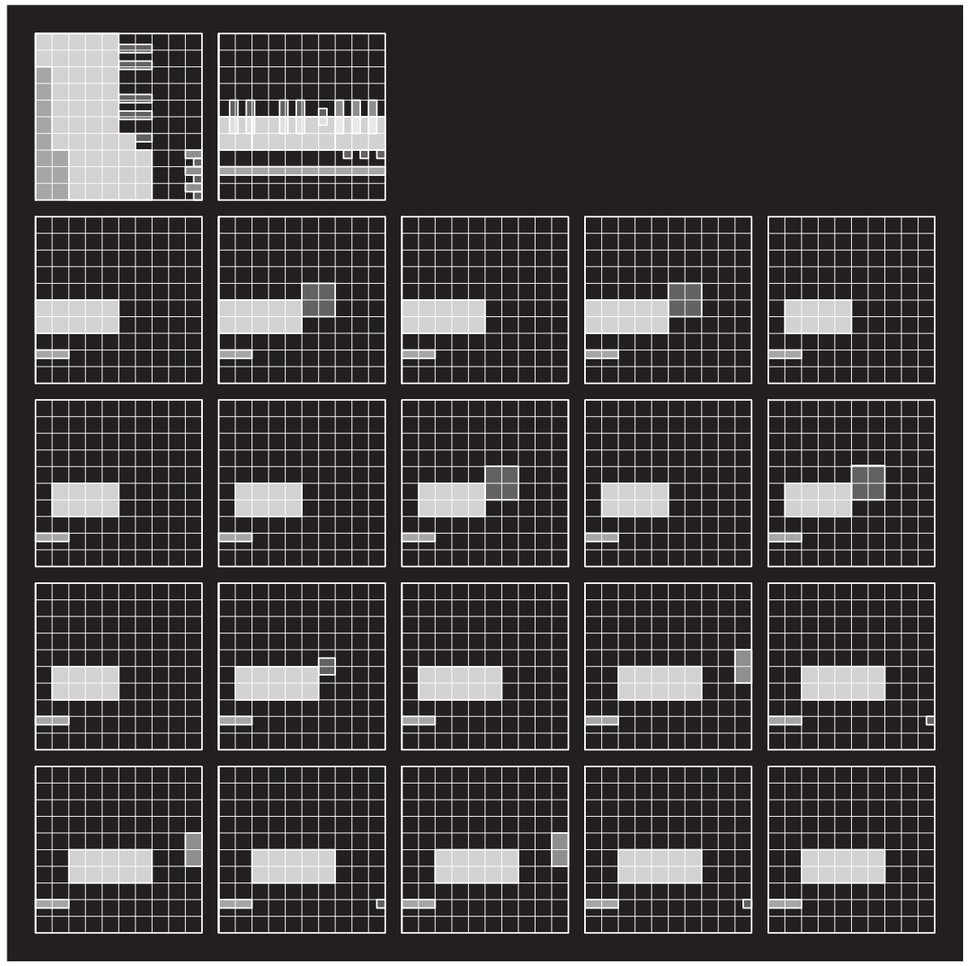


fig.30 - soundshape of Deildartunguhver - second by second

fig.31 - all soundshapes of soundscapes - second by second - use your phone to scan

6

sketches

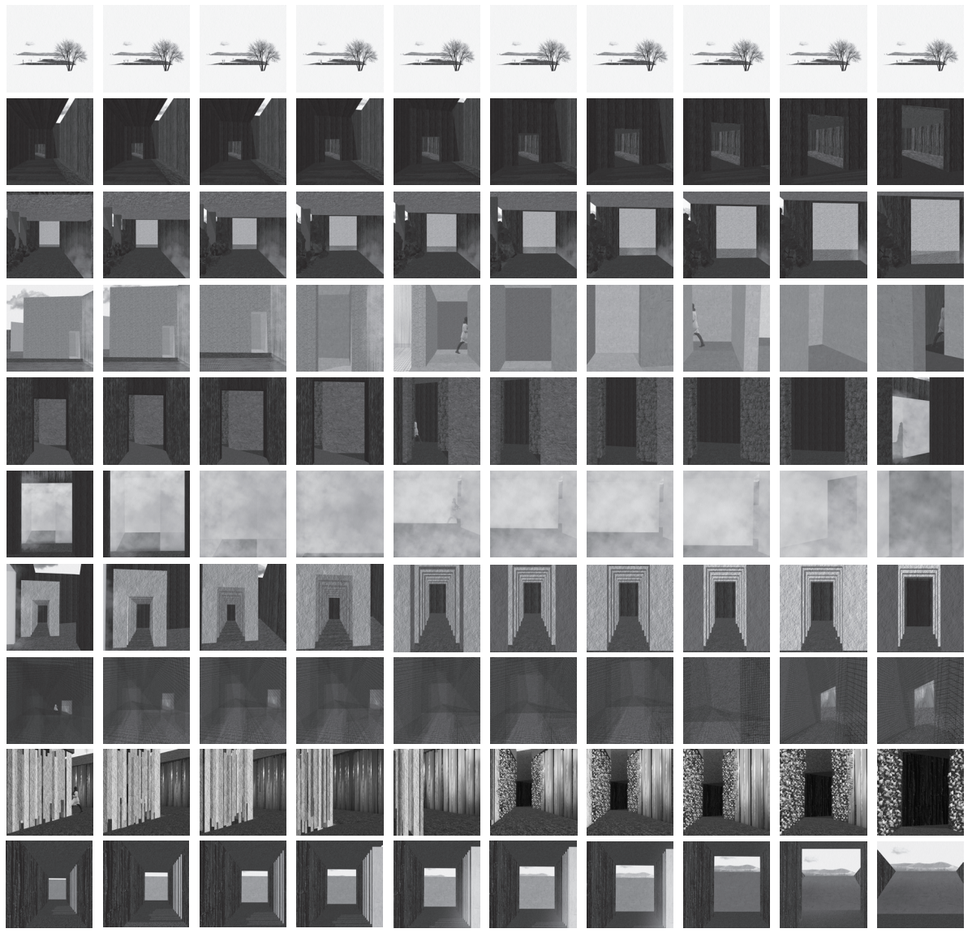


fig.32 - sketches of the spatial sequences - second by second

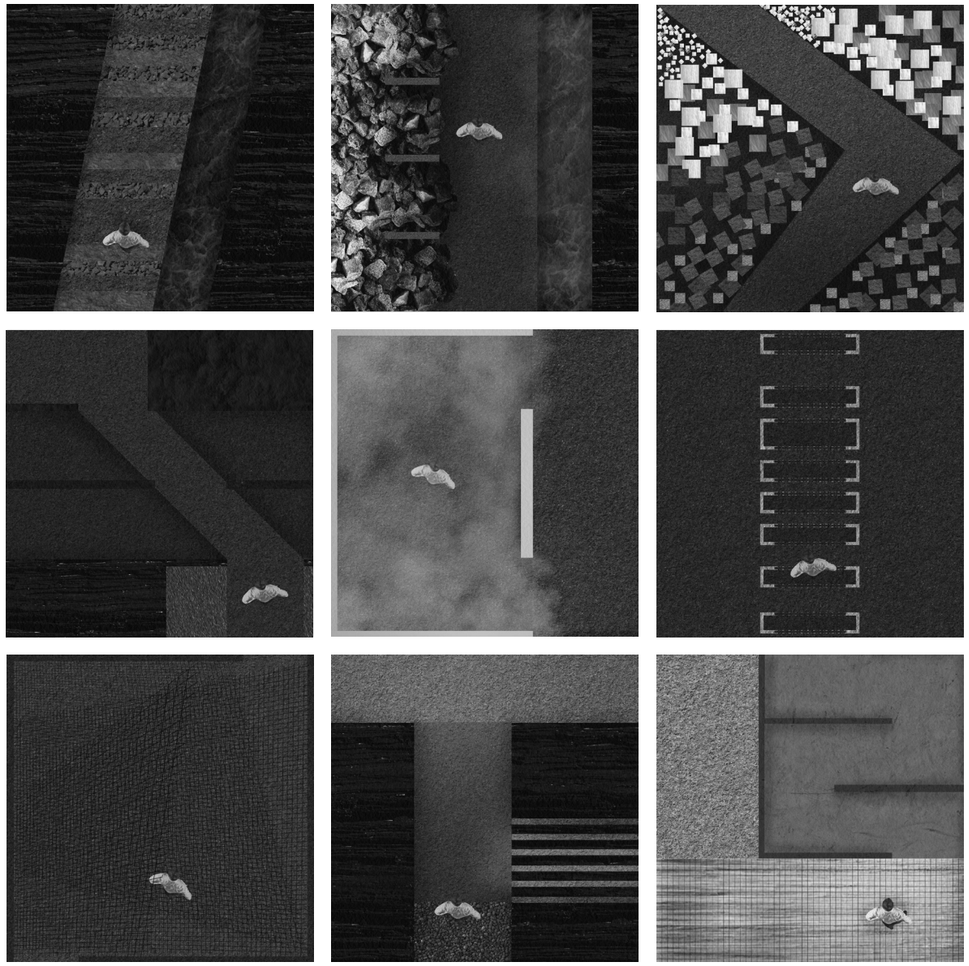
thoughts about a volcano museum

The function of the sound cube was to be prescriptive and to be able to use as an instruction to form an aural space. This section is just a first sketch of how it could be done. Before the process became more important than the outcome, and this thesis started to not work towards a set goal, there were thoughts about a volcano museum. With an idea to be the composer – the organizer of sound, aural architecture was to be designed in the soundscape of Iceland. This section reflects about how that could be done.

With the knowledge gained from previous sound studies – the first idea of a spatial sequence of the volcano museum is shaped by the nine sound cubes as instructions. Place by place, sound experience by sound experience, second by second – this is a first sketch in the format: stop motion. In the film, man becomes like the time in the sound cube – moving through the aural spaces of the museum, second by second, and step-by-step.

The constant question during this design process has been, what is the sound source? By looking at the cubes, the number of sound sources has been read and how they relate to each other. If they, in the spatial sequence, are the sounds of feet on floors, walls or other external influences have been tested in the sketches.

The recordings made on Iceland was added to test the idea of sound together with the spatial sequences. They are not the answer to how the spatial sequence will sound but used to explore how sound changes the experience of the visual. Which can stimulate and motivate the aural focus in the design process.



spatial sketches

SPACE OF DEILDARTUNGHUVER

What if your feet are the sound source when walking on different materials? In this space a bass tone of water and your feet on different materials are heard. Every step is a surprise like the sound of the pumping water in Deildartunghuver. You sound together with another moving sound source. You are the pumping water next to the more stable.

SPACE OF GRJÓTAGJÁ

What if the sound of your feet is not heard from where you put them down but from all over the place? In this space you walk on a net that creates a chain reaction of sounds, like Grjótagjá where several sounds are reflected from all directions. You know that your steps started the reaction, but the sound is not coming from your feet.

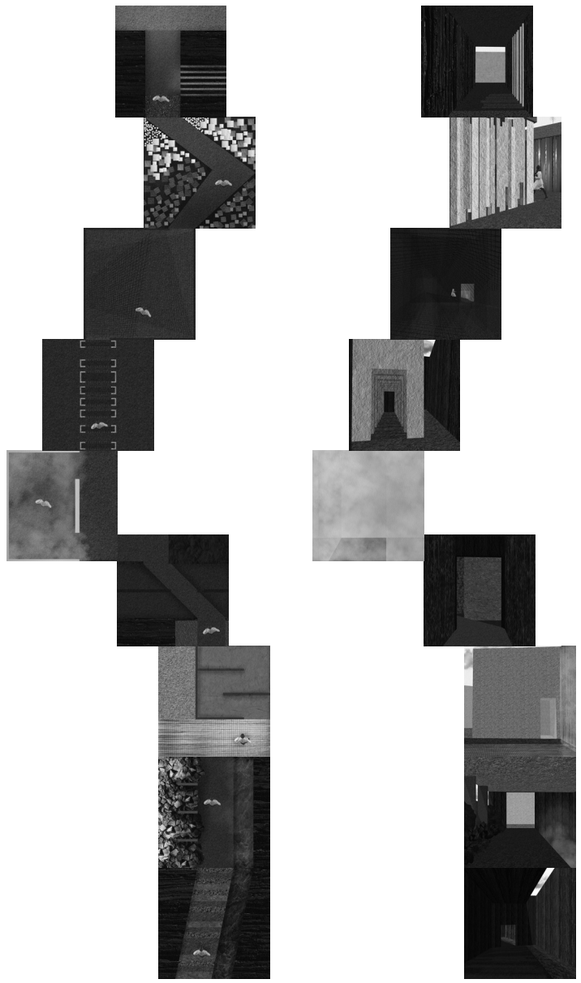
SPACE OF HVERFJALL

What if the sound source is standing still and you slowly move away? In this space you move trough the sound source. The sound fills the whole room but stays there when you move forward to the left and suddenly it does not sound at all. Like the sound of the snow rolling down from the slopes of Hverfjall.

SPACE OF HVERIR I

What if you move through two soundscapes at the same time? In this space you move along two sound sources at the same time. To the right there is a sound of heavy boiling water close to you and to the left there is a distant sound. It is the sound from the outside. The wall is open.

fig.33 - spatial sketches - plans



SPACE OF HVERIR II

What if the sound source does not matter - but how it totally surrounds you? In this space a hissing sound envelopes you, like walking in to the sound source and be a part of it.

SPACE OF SEYÐISFJÖRÐUR

What if the sound source are your feet - but then is interrupted by the outside sounds? In this space you first walk on gravel, like the sound of snow in Seyðisfjörður. Suddenly a sound from the left interrupts and takes over your attention. Only afterwards you notice that you are no longer walking on gravel and you continue straight into the soundscape of the landscape outside.

SPACE OF BREIÐAMERKURSANDUR

What if the walls are the sound source? In this space different pieces are hanging down from the ceiling and hit each other like giant wind chimes. The pieces consist of different materials and sizes, to change the soundscape along the way. From a low bass to a crispy crunch like the sound of the wave in Breiðamerkursandur.

SPACE OF VÍK

What if your movement creates the sound experience? In this space a quick variation in the soundscape is experienced when moving through portals that alternately exclude and expose you to the surrounding soundscape. Like the vibrating sound from the snowstorm in Vík.

SPACE OF STROKKUR

What if the sound of your feet is masked by another sound? In this space the sound of your own steps is almost masked by a rapid flow of water. Like the sound of humans almost mask the sound of Strokkur. Moving forward walls lead and help you to focus and find your way, even though the sound of murmur is all over the place.

fig.34 - spatial sketches combined to one sequence - use your phone to scan

7

final thoughts

conclusion

So, how can invisible sound experiences be formulated and communicated visually?
During an intensive listening this thesis has been developed. Hands have been allowed to shape in different medias what was heard when visiting Iceland. The question has been broad, but rather than seeking for one answer it has been there to make space for the curious explorations. It has been constantly asked to approach findings.

This master's thesis has primarily been an investigation of how invisible impermanent sound experiences can be translated to a visible permanence – a notational system. Just like the composer can hear a symphony in his head and write it down for someone else to read, a methodology has been developed to describe and prescribe sound experiences, to motivate a continuation – a way to use the ears as a tool to create a more sensible architecture.

The notational system developed in this master's thesis is one answer to the question, but the system has not been what was important. The translation process itself has been at heart. From invisible impermanent sound experience in ear, trough sensitive formulating hands, to a visible permanence. First, hands were allowed to shape freely in different medias what was heard. The objective was not to communicate with others but to think high and visually. A process in comparison with the procedure of formulating thoughts into words and bring clarity to things that are obscure in mind. Later in the process, to communicate with others became interesting. If the eye should be able to interpret a notation in a desirable way, there must be agreements on how the notation should be read. Rules were set and a notational system was developed. With knowledge about the used notational system the sound cubes can be read in the same way by many.

To translate freely or with rules have been two important processes forming this thesis. There is a developed symbolic language for visual architecture, rules are set. Symbols for aural architecture though, seem to be sparse. Rules of agreement is necessary if a prescriptive notational system for aural architecture should develop to the same extent as the visual. But maybe the more we formalize the way of notating sounds, the less they announce the experience qualities of the represented.

When the gently but intensely shaped sound experiences become lines on a blue print and a part of the technical language, do they not lose their poetic power to awaken a lively imagination? Musical notations are just five lines which oval note dots with shafts and flags are attached to. It is a cryptic script that don't tell what the music sound like, for those who have not learned to read it. Listening eyes - knowledge about the notational system - are needed to reawaken the sound the notation implies. Only then the notational system can shine.

Although, my architectural design process will never be the same again, because this thesis has been an "ear-opener". From now, communicating desirable soundscapes in my designs will be important to me. I will never stop listening to the miraculous world of sounds surrounding us.

8

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FIGURES

All pictures are the author's own images.