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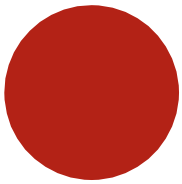
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Sound-image Relations

During a Musical Performance

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July 2019

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ABSTRACT

Daily life is full of examples of how visual information can have a powerful effect, and how this type of information plays a direct role in how music is perceived. But does sight dominate sound? Or does this rely on the type of artwork, or the arbitrary or personal association of an individual receiving it? This study is based on the creation and substantiation of visual components for an audiovisual performance, visuals that have an aim to not overwhelm the other elements or dominate the performance. This performance contains a growing number of musicians playing acoustical baroque music, and the visual aspect is created after conducting qualitative research. This research is done through experimenting with open rehearsals followed by in-depth interviews carried out on a varied sample of participants. Out of the collected primary and secondary data we conclude that the type of visual information plays a direct role on perception, just like the auditory element does. In this case one of the most important factors influencing the visuals is the harmony between these two elements, which means that what the audience sees and hears has to be connected. Ultimately this caused the performance to consist of visuals connected to the auditory element in a variety of ways.

RESUMO

O nosso quotidiano está repleto de exemplos de como a informação visual pode ter um efeito poderoso, e como este tipo de informação pode ter um papel importante na compreensão da música. Mas será que a visão domina o som? Ou estará esta dependente do tipo de trabalho artístico, ou da aleatoriedade de associações pessoais do indivíduo que a percepciona? Este estudo baseia-se na criação e concretização de componentes visuais para uma performance audiovisual, que pretendem relacionar-se simbioticamente com o resto dos elementos da performance. A performance é composta por vários momentos, sendo gradualmente adicionados intérpretes que tocam música do período barroco, e a componente visual criada após extensa e criteriosa pesquisa. Esta pesquisa foi feita através da experimentação em ensaios abertos seguidas de entrevistas levadas a cabo com participantes entre os 20 e os 40 anos de idade. Da informação recolhida primária e secundariamente pode-se concluir que os tipos de elementos visuais têm um papel tão preponderante na percepção como os elementos auditivos. Neste caso um dos factores mais importantes que influenciam os elementos visuais é a harmonia entre estes dois elementos, o que significa que o que o público vê e ouve tem que estar conectado. Isto fez com que a performance visual contenha elementos de vegetação, exibidos numa crescente projeção consistindo em naturais mas propositadas criações de movimentos intrinsecamente ligados ao elemento auditivo: a música.

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1 INTRODUCTION

Visual information can have a powerful effect on our social cognition, ranging from perception to consumer judgment (Tsay 2013, 14583). An example is music. Many researchers concluded that the type of visual information shown during music listening plays a direct role in how this music is perceived (Field 2007, 55). Others believe the focus is not always on the visual narrative (Moore 2010, 65), or that it is completely up to the arbitrary or personal association of an individual (Levin 2000).

This study is based on the description and substantiation of the creation of the visual components for an audiovisual performance. The aim is to balance these visuals with the musical elements, in a way that the visuals do not overwhelm the auditory elements or dominate the performance.

The musical aspect is being executed by Liliana Marinho, who will finish her bachelor in Ancient Music at Escola Superior de Música e Artes do Espetáculo (ESMAE) in Porto with a musical performance. The conceptual idea of the recital is *happiness is bigger when we share*, a theory that will be executed through the addition of musicians and instruments while playing different compositions.

The performance will start with a solo of Liliana Marinho on a Baroque flute, playing four compositions by Johann Sebastian Bach.[1] Thereafter a harpsichordist will join to play nine sonatas for flute and violin by Jacques Hotteterre.[2] The performance will finish with four more musicians on a cello, violins, and a viola, with three works by Carl Philipp Emanuel Bach.[3]

To accomplish the performance this study will start with a theoretical research, followed by a practice-based research. The theory will be centered around *sound-image relationships* and focuses on literature, experiments of other researchers, and sound-image relationships within specific performances or artworks.

1.1 MOTIVATION

For me visual artworks have always been intriguing, and this had most probably partly to do with the fact that my father is a photographer. Since a young age I started experimenting photography with him, while developing black and white photographs in the dark room at home. He taught me a lot about digital as well as analogue photography, often during our summer holidays in Portugal. He showed me how to look at every scenery differently, calmly, and to create beautiful imagery out of the simplest things. Some of the favorite photographs I have made are zoomed-in ones of plants or flowers [figure 1 and 2].

[1] Eisenach 1685 – Leipzig 1750
[2] Paris 1647 – Paris 1763
[3] Weimar 1714 – Hamburg 1788



Figure 1 - Sissinghurst Castle Garden, England, Vita Visser

I love to visit musical performances and festivals. Visiting concerts or festivals, both small and big ones, out in the open or inside, in the day or at night, containing a variety of genres, is something I have enjoyed since I am very young. I like the variety of the performances and notice that different elements can fulfill my expectations in different ways. For instance, the festival *Into the Great Wide Open* in The Netherlands which I have attended three times, takes place outside in the middle of the woods and mainly uses natural light or small hanging lights placed in the trees. In this case the beautiful location and atmosphere have the most impact on me. In other cases, other elements surprise me in their own way.

It had never occurred to me that I would be able to create anything close to an audiovisual artwork myself, until I joined the class where Rui Penha and João Beira taught us about multimedia for performing arts. We collaborated with the Jazz Orchestra of Matosinhos and created a concept for their jazz concerts. Even though the type of concept and performance was completely different, I got intrigued by the possibilities. And then Liliana came to me.

She spoke to me about the idea to collaborate for her graduation performance, with her working on the musical element while I would work on the visual element. While brainstorming about ideas for this recital with Miguel Carvalhais and André Rangel, the themes nature and vegetation came up. And because Liliana and I connect in our interest in music, nature and imagery, the visual concept was born: envisioning nature.



Figure 2 - Paradela, Sever do Vouga, Portugal, Vita Visser

1.2 OBJECTIVES

Because the audiovisual performance will consist of two components — audio and visual — our aim is to connect these in a way that the visuals do not overrule the musical performance itself. The main reason for this is because the auditory element will be Marinho's musical performance, and so the visuals will in this case have the intention to support the music.

But what is the best way to do this? Which type of visuals will be the most suiting ones in this case? And what would be the best way to combine these two elements together? This problem statement is translated into a research question, which will be used by conducting this research:

How to create visuals for a baroque music recital, where the visual component supports the auditory component instead of overwhelming the audience, and influencing their awareness too much?

The next section will explain these questions and objectives more elaborate.

1.3 DOCUMENT STRUCTURE

This document consists of five chapters, including this one, and five appendices.

It starts with the *State of The Art*, which consists of five main sections: *Audiovisual Art*, *Sound-image Relations*, *Performance Art*, *Audience Experience*, and the *Research Questions*. The first section discusses pioneers of audiovisual art their influential installations or artworks that relate to sound and image. Because of the extensiveness of this field, the second part presents four different types of audiovisual art. Subsequently it reviews literature and experiments concerning sound-image relationships. Since the aim is to create a musical audiovisual performance, the third part is narrowed down to performance art. The fourth part focuses on different types of audiences and their experience, and the last section returns to the research question and its sub-questions whom are translated out of the problem statement and used to conduct further research.

The types of qualitative research conducted to answer these research questions are presented in chapter 3, *Design Experiments*. Hereby it articulates the auditory and visual components used within the performance, and the software used to compose the chosen visuals.

After that, in chapter 4, *Open Rehearsals*, the three conducted experiments and the results of the in-depth interviews carried out are explained. These open rehearsals are conducted on different stages in the development of the performance, on different locations, and with slightly different auditory and visual elements present. The results are explained and shown through graphs.

The outcomes of this research are summarized in chapter 5, *Conclusions*. On top of that it gives a short feedback on the final performance and presents some directions for possible further research.

The document ends up with appendices that show in-depth information on a variety of sections. The first one presents how the musical pieces are visualized on paper, during the learning and understanding of the music. The second three contain a floorplan of the rehearsals and stills of the documentation video produced, and the fifth appendix presents the analysis of the unstructured in-depth interviews conducted.

2 STATE OF THE ART

2.1 AUDIOVISUAL ART

In the physical world, nearly any object or material is an *audiovisual substance*, possessing both an appearance and a set of associated or potentially associated sounds or behaviors. These associations are intrinsic to our objects and materials are essentially immutable: a drinking-glass basically looks like a glass, and the sound it makes when it drops and shatters is unmistakable. In the computer's world of pure information, however, the designer of a synthetic audiovisual substance must establish these associations entirely by themselves. However, when any such mapping is created between image and sound it will nearly always be an arbitrary or personal association: there is no "objective" mapping from sounds to image or vice versa (Levin 2000, 122).

One of the strongest visual attractors of attention is motion. Just like young kittens that seem completely at the mercy of any moving thing, as though their eyes were tied to it, humans are similarly attracted by movement. This is shown in the much greater popular appeal of flashing neon signs, television commercials or performances (dance, theatre or musical) in motion or as compared to immobile photography, painting, sculpture, or architecture (Arnheim 1974, 372).

Throughout history, the investigation of the relations between the visual and auditory domains has proposed a variety of manifestations, involving a diverseness of creative, aesthetic and technical enterprises (Ribas 2011, 23).

2.1.1 PIONEERS OF AUDIOVISUAL ART

The synchrony of abstract image and sound, variably known as ocular music, visual music, color music, or music for the eyes, has a history that spans several centuries of work by dozens of gifted practitioners (Ritter 1993). Although some contemporary researchers who are pursuing similar work with computerized equipment claim the concept began with sequencing software and real time computer graphics, this field of study originates in the early eighteenth century.

One of the most influential pre-computational attempts to relate sound and image is Louis-Bertrand Castel's *Clavecin Oculaire*.

2.1.1.1 CLAVECIN OCULAIRE

The earliest known device for performing visual music was built in 1734 by the Jesuit priest and mathematician Louis-Bertrand Castel.[4] Castel's *Clavecin Oculaire*[5] coupled the action of a traditional

[4] Montpellier 1688 – Paris 1757
[5] Ocular Harpsichord

harpsichord to the display of transparent paper tapes, whose colors were believed by Castel to correspond to the notes of the Western music scale (Levin 2000, 22).

In November 1725, a letter from Castel appeared in one of France's cultural newspapers named *Mercure de France*, entitled *Clavecin pour les yeux, avec part de peindre les sons, et toutes sortes de pieces de musique*[6] (Mercure de France 1725). In this letter, Castel set out to prove that there was an analogy between the phenomena of sound and light, and between tones and colors, such that what had up until then been performed only with sound. That is, arranging different tones in such a way that we appreciate the effect as a form of art, should be equally possible by arranging different colors, so a whole new form of art would emerge: a music of colors.

As arguments for this review he referred to the work of his Jesuit predecessor Athanasius Kircher. It was Kircher who had concluded that there had to be an analogy between the art forms of tone and color: *"*If, when a musical instrument sounds, someone would perceive the finest movements of the air, he certainly would see nothing but a painting with an extraordinary variety of colors" (Franssen 1991, 19).

And, "the colors also have their harmony, which pleases no less than music, and this analogous harmony even has a very strong power to excite the effects of the mind" (Kircher in Crane 1956).

Castel's design consisted of a 6-foot square screen mounted above a normal harpsichord. When a key was depressed, the shutter would open, permitting candlelight to pass through one of the transparent tapes. An improved model built in 1754, was designed for a much larger audience and used some 500 candles with reflecting mirrors (Levin 2000, 22).

Even after Castel's death in 1757, there were still some descriptions of the *Clavecin Oculaire* found, although they differ widely [figure 3 and 4] (Franssen 1991. 33).

[6] Harpsichord for the eyes, with parts to paint the sounds, and all sorts of pieces of music

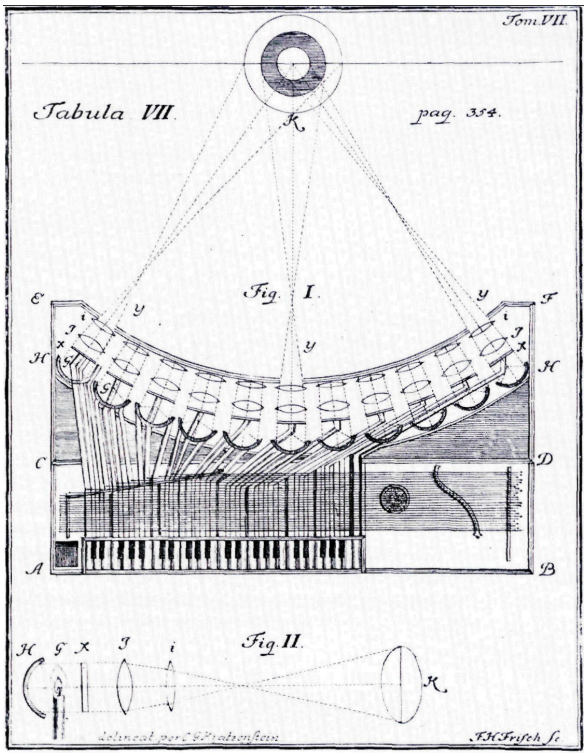


Figure 3 - Johann Gottlob Kriiger's design for a Clavelin Oculaire (Franssen 1991)

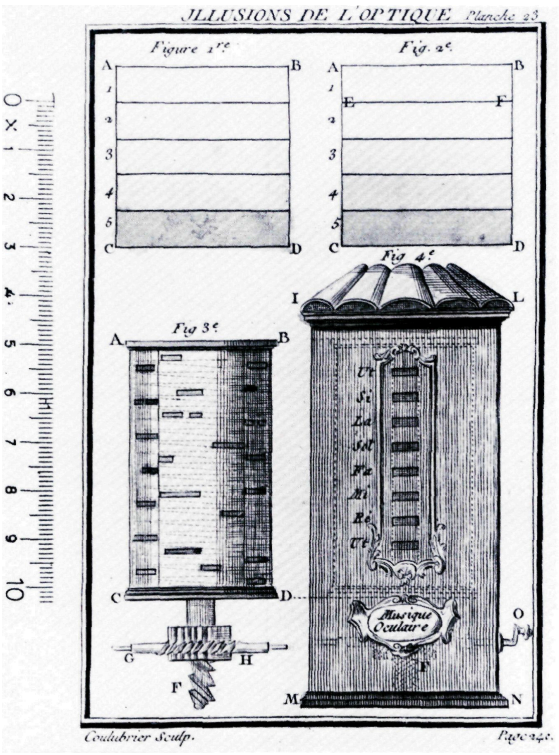


Figure 4 - Guyot's toy version of the Clavelin Oculaire (Franssen 1991)

This aspiration to see sound as a graphic trace is also shown in Thomas Alva Edison's[7] *Kinetoscope* from 1877, where he devised a mode of inscription that enabled the reproduction of sound. This Kinetoscope would "do for the eye what the phonograph does for the ear" (Zielinski 1999, 38).

Other audiovisual media art forms emerged within the nineteenth century, and following Castel, various artists and inventors deployed devices that either produced light and sound simultaneously or explored the aesthetic qualities of color and light in a purely visual manner. Principles from scientists like German Hermann von Helmholtz's[8] and his fundamental contributions to physiology, optics, electrodynamics, mathematics, and meteorology, were later translated into media-technological applications (Daniels et al. 2011, 448).

Within these developments there is a gradual shift from strict color-tone correspondences to a free play of kinetic light and color, as a new art form emancipated from music, as proposed by Lumia from Thomas Wilfred[9] (Ribas 2016), where – in contrast to conventional artists – he sculptured light directly by creating a composition of light, color, and form which changes slowly in time. It exhibits a very wide range of light intensity and a broad spectrum of delicate colors and shapes (Wilfred 1930).

While innovators like Castel and Wilfred developed real-time tools for the performance of visual music, other pioneers composed elaborate visual statements in the off-line laboratory of the animation studio (Levin 2000, 30).

[7] Milan (Ohio) 1847 – West Orange 1931
[8] Potsdam 1821 – Charlottenburg 1894
[9] Næstved 1889 – Nyack 1968

2.1.1.2 LICHTSPIEL: OPUS

Walter Ruttmann[10] was a German film director. In cooperation with Viking Eggeling, Oskar Fischinger and Hans Richter he was an early practitioner of experimental film. Ruttmann's first productions were abstract animated films, and were also the first fully animated cartoon works produced in Germany. *Lichtspiel: Opus I,* produced between 1919 and 1921, is the oldest fully abstract motion picture to survive, using only animated geometric forms, arranged and shown without reference to any representational imagery [figure 5]. This film was followed by *Lichtspiel: Opus II* (premiered in April 1922), and *Lichstpiel: Opus III* & *IV* (both premiered in May 1925) (Betancourt 2011).



Figure 5 - still of *Lichtspiel: Opus I* (Ruttmann 1921)

Following the reproductive function of the cinematic medium, new productive possibilities appeared within optical sound technology (Ribas 2016). Once again, Fischinger[11] was one of the earliest and most skilled pioneers of this technique. He and his assistants painted sound waveforms called *sound scrolls* on sheets of paper [figure 6]. While photographically exposing the soundtracks of his films through images of these scrolls, he was able to create completely synthetic music to accompany his animation (Levin 2000, 31). Within all of these fields of artistic experimentation, almost each individual musician, artist or inventor developed their own scheme of color-sound analogies.

[10] Frankfurt am Main 1887 – Berlin 1941
[11] Gelnhausen 1900 – Los Angeles 1967



Figure 6 - Oskar Fischinger with a *sound scroll* of the soundtrack of one of his films (Levin 2000, 31)

Computer technology has made it possible for visual music designers to surpass the limitations of psychics, mechanics and optics, and overcome the conflict which is essential in electromechanical and optomechanical visual instruments (Levin 2000, 33). Within this computational medium all previously conceived relations can co-exist and be reformulated, this universal machine can integrate all formats, and imitate all functional principles of previous media technologies, while creating new ones.

Some of the first artists to take advantage of these means are brothers John[12] and James Whitney[13] with their *infrasonic pendulums* (1950s), and abstract animator Barry Spinello active during the 1970s. All are important because they have suggested a way in which visual patterns can be used to directly and physically generate sound (Levin 2000, 32). As well as sound-technology, electric lighting systems made a landmark within the developments. For instance watercolorist and inventor Alexander Wallace Rimington[14] who accompanied Alexander Scriabin's symphony *Prométhée: Le Poème du Feu*[15] in 1915, by building an instrument to perform colored lights in harmony with music (Ritter 1993).

However, the invention of the stored program electronic digital computer in the 1940s truly opened the way for the present era of sound synthesis (Roads and Strawn 1996).

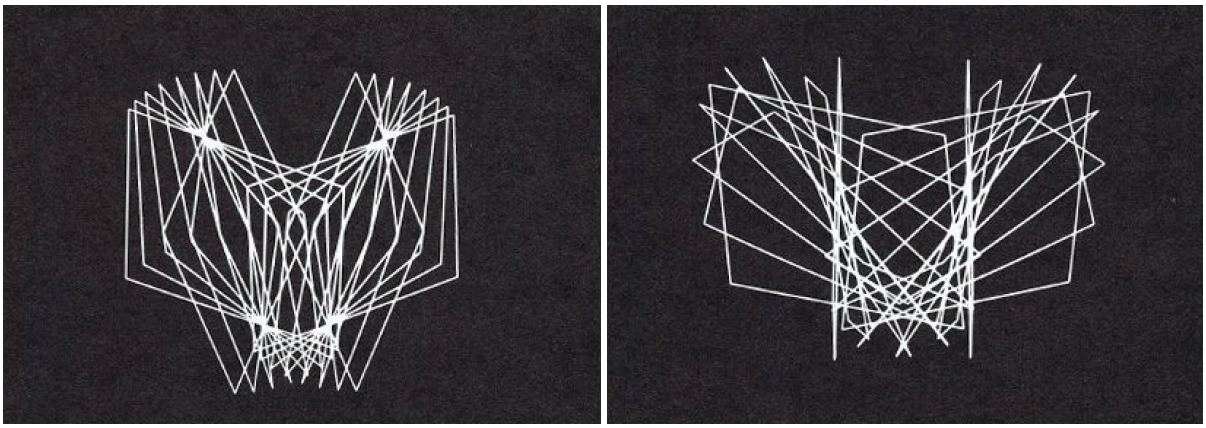
[12] Pasadena 1917 – Los Angeles 1995
[13] Pasadena 1921 – Los Angeles 1982
[14] London 1853 – London 1918
[15] The Poem of Fire

2.1.1.3 The Silver Scale

Engineer Max Vernon Mathews,[16] also called "The First Computer Musician" (Dubois 2011), started his computational sound experiments in 1957. While not being the first person to make sound with a computer, he was the first one to do so with a replicable combination of hardware and software that allowed the user to specify which tones he or she wanted to hear. His piece called *The Silver Scale* was made with an IBM 704 mainframe computer at the Bell Telephone Laboratories in Murray Hill New Jersey, and composed by Newman Guttman. With this computer Mathews generated 17 seconds of music and recorded the result for posterity (Dubois 2011). After this experiment, dozens of other sound techniques have been invented (Levin 2000, 33).

Even though in the late 1960s and 1970s technical advances took place in both computer graphics and computer music, the potential to generate *both* media in real-time was still several years away. This is why many significant experiments like that of Matthews as *MATHOMS* (1972) by Lilian Schwartz with music by F. Richard Moore, were nonetheless concentrated in the offline context of the film studio (Levin 2009).

Only later, there were artists who combined computer-based synthesis in one medium, with a traditional live performance in another. An example are the productions *Rotations* and *Projections* (ca. 1974), which German graphics pioneer Herbert W. Franke describes in *Artist and Computer* (1975). These productions exist both of ten minute graphic music films in which live jazz musicians freely improvise in response to the projected patterns of abstract animated lines [figures 7 and 8] (Levin 2009).



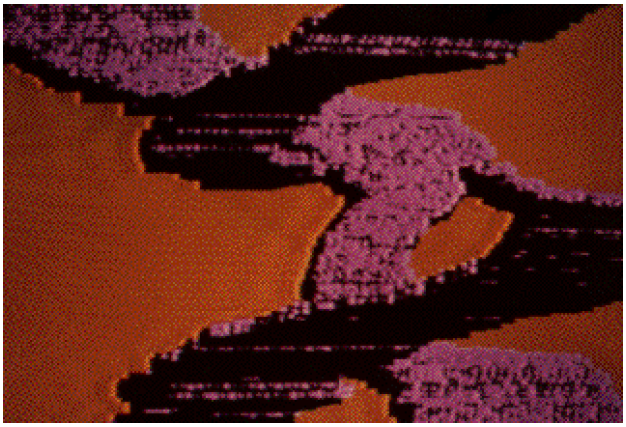
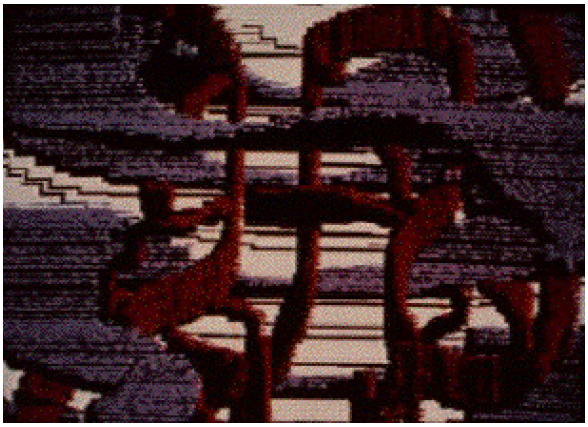
Figures 7 and 8 - stills from the films used to create graphic music (Franke 1975)

2.1.1.4 VAMPIRE

It is possible that the first computer system capable of synthesizing both animation and sound in real-time, was the *VAMPIRE (Video and Music Program for Interactive Real-time Exploration/Experimentation)* system developed by Laurie Spiegel between 1974 and 1976. As well as Mathews she worked at Bell Laboratories and created on his computer music research the system *GROOVE (Generating Real-time Operations on Voltage-controlled Equipment)* during 1973 and 1978. Using GROOVE, she created VAMPIRE, an interactive system that mixed color with music. VAMPIRE offered a drawing tablet, foot pedal, and a large number of continuous knobs and buttons—all of which

[16] Nebraska 1926 – San Francisco 2011

could be used to modulate and perform a variety of image and/or sound parameters [figures 9 and 10] (Levin 2009).

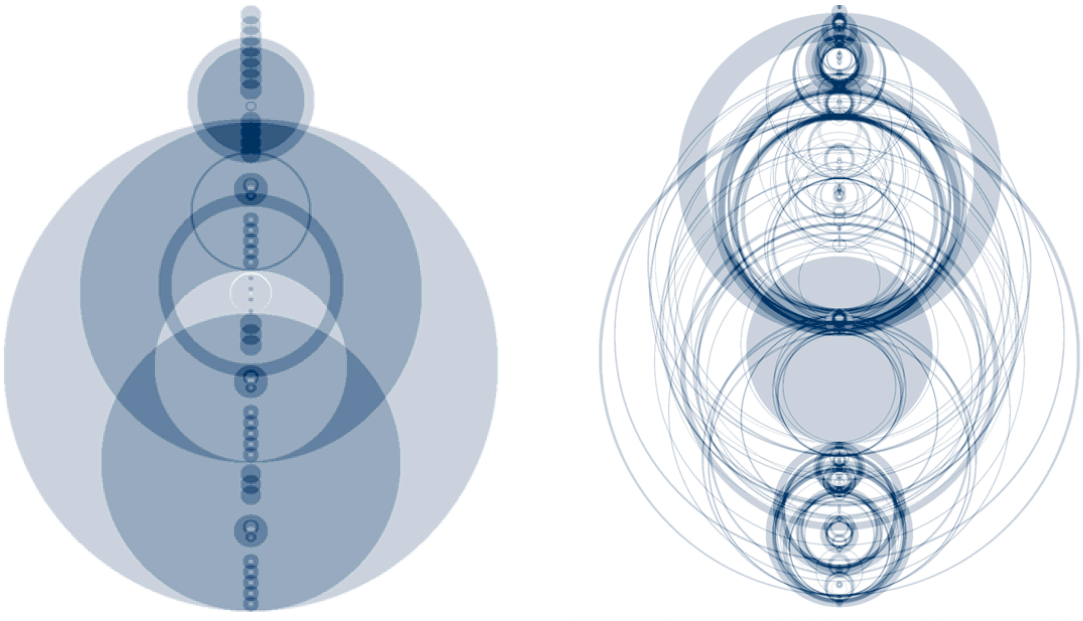
Figures 9 and 10 - images created in 1974-76 by Laurie Spiegel using a Rand Tablet and FORTRAN IV software she called “a drawing program” (Spiegel n.d.)

An early example of a software artist who has approached the challenge of visualizing music not to produce entertainment of entrancing aesthetic experiences but to provide analytic insight into the structure of a musical signal, is Stephen Malinowski. During 1982 and 2001 he created the *Music Animation Machine*. This machine is a software artwork which generated scrolling piano roll representations of sound files as a real-time graphic accompaniment to the music’s playback. The earliest versions of this artwork portrayed notes with colored bars which corresponded to their pitch. Most of the later versions of this project imbibed an additional visual schema to represent the harmonic or dissonant qualities of the musical chords, the timbres of different instruments, and the spans of melodic intervals (Levin 2009).

Even though it was and is common for audio visualization artworks to present real-time animated graphics as an accompaniment to sound, like the *Music Animation Machine* did, Martin Wattenberg created an exception with his software artwork *The Shape of Song* (2001). With this artwork Wattenberg introduced a new visualization method, which displays the ways in which the essential passages and phrases are repeated in a larger piece of music (Levin 2009).

> The Shape of Song began as a quest to ‘see’ musical form. I created a visualization method called an arc diagram that highlighted repeated sections of music – or of any sequence – with translucent arcs. The resulting images reflect the full range of musical forms, from the deep structure of Bach to the crystalline beauty of Philip Glass [figures 11 and 12] (Wattenberg 2001).

New media artist, composer, performer and engineer Golan Levin states that “The Shape of Song is necessarily a non-real-time visualization of music, as any real-time version would require perfect future knowledge of repetitions yet to happen” (Levin 2009).



Figures 11 and 12 - *The Shape of Song* visualizations by Martin Wattenberg of pieces *As She Was* by the Talking Heads (left) and *Autumn* from *The Four Seasons* by Vivaldi (right) (2001)

2.1.1.5 Boundary Functions

Interactive media artist, researcher and entrepreneur Scott Snibbe is one of the artists who worked with projector-based interactivity and made particularly important developments in the field of software systems for the interactive abstract animation. His first and well-known full-body interactive work *Boundary Functions* (1998) is a set of lines projected from overhead onto the floor, dividing people in the room from one another. When there is only one person present, nothing happens. But when two or more people are present, a lines divide the space between them, dynamically changing as they move [figure 13] (Snibbe 1998a).

> These lines describe each person's personal space. The space closer to them than to anyone else. As people move, these tiles move and change to show their changing personal relationships. The piece reveals that personal space, that we call it our own, is defined by others and changes without our control. It is a social work of art that says much about relationships between people inside the artwork, as it is about the art itself. (Snibbe 1998b)

Snibbe has managed to create a reversal of the lonely self-reflection of virtual reality or the frustration of virtual communities: this is a virtual space which can only exist with more than one person, in physical space (Snibbe 1998a). This artwork can be relevant for this thesis due to its interactivity with the audience.



Figure 13 - *Boundary Functions* by Scott Snibbe (1998b)

2.1.1.6 Music Insects

According to Levin, the audiovisual software created by Japanese new-media artist Toshio Iwai *Music Insects* (1991) is in a category by itself. It is a hybrid of a classic, MacPaint-style program, with an interactively-modifiable sequencer (2000, 52). The core logic of this inventive software application is a graphic step-sequencer wherein animated graphical 'insects' trigger musical notes, and/or change their direction of movement when they bump into big colored pixels places in their path by the user. Each insect represents a different instrument and has its own sound when it encounters the squares. This means one of the 'bugs' produces piano sounds while the others produce bass guitar, trumpet sounds, or percussion when it collides with the pixels (Levin 2009).

This artwork comes remarkably close to offering a complete balances solution for producing image and sound simultaneously. This because "the system's score-elements are reductionist pixels as opposed to well-articulated symbols, moreover, the granularity of the visual substance is just right for the creation of abstract or representational images, and the visual output of the system may be read equally well as a painting or a score" (Levin 2000, 49).

Even though this overview of diversified conceptions of some of audiovisuals art pioneers displays a small part of the creative core, a more extensive explanation with examples can be read in Levin's *Painterly Interfaces for Audiovisual Performance* (2000) and *The Nature of Sound-image Relations in Digital Interactive Systems* by Luísa Ribas (2011).

2.2 SOUND-IMAGE RELATIONS

The relationships between sound and image are much more than the simple translation of sound frequencies to color and shapes. They are, for instance, also about expressivity, dynamics, rhythm, motion, and time (Carvalho 2018, 17).

Within audiovisual art, the sound and visual components support each other while interacting but referring to the relationship between visual and audible components suggest that they may not work hand in hand. Possibly there is a competition for the audience's attention and to influence the understanding of the project or performance. This relationship between both elements can be normative or traditional, or challenge norms. The first and traditional view emphasizes perceivable causality: what the audience sees provides information about the sound and how it is produced and/or its affective state. The visual information itself does not contribute to this interference. The challenging norms of sound and visual information vary by genre, but even artists operating within traditional norms sometimes challenge them by manipulating the relationship between the two elements. Examples are the classical and psychedelic rock music concerts that provided lightshows in the late 1960s (Auslander 2013, 1). Within a traditional relationship of sound and image elements during an audiovisual performance, the visuals will react to the music and allows for the attention to focus on the relation between the sound themselves.

"This is challenging, because usually vision dominates over audition", states Adriana Sá in her thesis *A Perceptual Approach to Audio-Visual Instrument Design, Composition and Performance* (2016). Luísa Ribas (2011) explains how French musician Hervé Zénouda (2008) emphasizes on the difficulty of describing this relation of sound and image when they become the means and responses of interaction. In order to introduce an alternative perspective, he begins by considering sound-image relations in terms of the subordinate roles that they assume in different audiovisual media. Therefore, he sketches a division between the three main classes of sound-image relations: (1) sound is at the service of image, as mere accompaniment or illustration; (2) image at the service of sound, when used as a means to navigate or manipulate sound. The potential (3) balanced relation is conceived at the level of audiovisual production "where program, sound and image" are "equal partners". This means there is no priority of elements whatsoever, because both modes are equally controlled by a program.

Just like Zénouda, Rodrigo Carvalho constructed six categories of transformations of digital data between different domains, which are displayed on his weblog *S-V-M* (*Sound+Visual+Movement*). The categories of projects with similar characteristics and technologies, with the main focus of transmutability of digital data and the input/output relations between sound movement, and visual domain on interactive systems are: (1) motion sculptures where motion is transformed into visual shapes and forms; (2) sound sculptures where sound is mapped into three dimensional physical shapes; (3) graphic sound visualizers where sound is visualized graphically; (4) shaping sound where sound is generated from shapes and graphical features; (5) movement sonification where sound is generated from movement, and (6) kinetic structures where movement is generated, setting in motion digitally controlled mechanisms and performing robotic agents (2018, 64).

The next sections will describe audiovisual categories (1) natural audiovisual substances; (2) visualizing sound; (3) sonifying visuals or sonification; and (4) synchresis; and continue with the sound-image relationship from different perspectives.

2.2.1 NATURAL AUDIOVISUAL SUBSTANCE

Like stated before, in the physical world nearly any object or material is an *audiovisual substance* (Levin 2000, 122). In humans and non-human primates, the ability to integrate auditory and visual elements input features to detect and recognize objects, other individuals, or communicative gestures, can according to psychologists Marcus J. Naumer and Jochem Kaiser (2010), be a critical cognitive function for survival.

Examples of intermodal invariant features can be when viewing and hearing a basketball bouncing to rest, or when localizing acoustic and visual information originating from the same location in space (Naumer and Kaiser, 155). To clarify, these features are physical attributes of visual and auditory signal inputs which share direct commonalities of an object or an event (Lewkowicz 2000, 281).

In view of the perception of real-world environments, there is no clear knowledge about what people hear when they are not wittingly listening for a particular sound (Botteldooren et al. 2011). The effect that at the visual sensor has on the attention of the auditory scene is not very known, while it may be true that visual stimulation can bias the auditory perception and vice versa (Bonebright 2012).

2.2.1.1 TIMBER

The use of natural and environmental objects can as well be used for audiovisual artworks. A clear example of this is the song *Timber* (1997) by the English electronic music duo Coldcut (Matt Black and Jonathan More) in a politically-charged collaboration with electronic music duo Hexstatic (Stuart Warren Hill and Robin Brunson). In this track, recontextualised sounds are used imitatively to create images of deforestation. The design of the rhythmic material is especially interesting, since the samples are sequenced and manipulated to simulate actions of cutting, sawing, and chopping wood (Ratcliffe 2014, 101). According to Robert Ratcliffe, the sampled materials of electronic dance music can be grouped into four main categories: (1) short and isolated fragments; (2) loops and phrases; (3) larger elements; and (4) transformed material (2014, 98).

Category 1 can be further divided in four sub-categories. One of these contains “musical material formed through the organization of non-musical sound” (Ratcliffe 2014, 102). This means that short samples originated from a non-musical object are recontextualized as individual components within a musical phrase or sequence, and the chainsaw solo in *Timber* is a specific example of this (2014, 102).

2.2.1.2 RAPTURE

In 2015, multimedia artist Camille Norment represented Norway in the 56th Venice Biennial of Art, for which she created *Rapture*. *Rapture* is a three-part project, that consists of a solo exhibition in The Nordic Pavilion, a series of sonic performances unfolding from physical and referential elements within the installation, and a three-part publication that explores the greater context of this investigation through

a variety of essays relating sound to the body and society [figure 14] (Norment 2015).

For this artwork Norment worked with the *glass harmonica* (1761), an instrument invented by Benjamin Franklin[17] that creates music from the touch of fingers on glass and water (The Franklin Institute n.d.), and a choir of 12 female voices. By melting these elements together within the Nordic Pavilion, she created an immersive and multi-sensory space, that reflects upon the history of sound, contemporary concepts of harmony and dissonance, and the water, glass and light of Venice (Azzarello 2015).



Figure 14 - *Rapture* by Camille Norment (2015)

This project is based on the idea of vibration by sound shaking the glass window installations, and exploring the relationship between fear and excitement (Buffenstein 2016).

> I am interested in how music has long been used to facilitate both the forging and transgressing of cultural norms. Sound permeates all borders. Throughout history, fear has been associated with the paradoxical effects that music has on the body and mind, and its power as a reward-giving de-centralizer of control. Recognized as capable of inducing states akin to sex and drugs, music is still seen by many in the world as an experience to be controlled – especially in relation to the female body – and yet it is also increasingly used as a tool for control under the justification of war. (Norment in Azzarello 2015)

The use of vibration is also constructed in Norment's audiovisual installation *Rhythm Wars - Crazy Army* from 2012, where sixteen oil drums vibrate with deep slow tunes, while the lids rumble and rattle to the contrasting rhythm of drum solo *Crazy Army* (1934) by Ed Lemley [figure 15] (Norment 2012).

[17] Boston 1706 – Philadelphia 1790



Figure 15 - *Rhythm Wars – Crazy Army* by Camille Norment (2012)

2.2.1.3 Technological Nature

> What if your shower could cause a rainbow, you could encounter the wonder of the Northern Lights in your fridge or observe the sunset in your artificial panorama window? How would you view technology if you realized everything was controlled through an augmentation of nature's wonders? (Jelonek 2017)

Media artist, researcher and designer Daria Jelonek has made use of everyday life by investigating the imitation, recreation and augmentation of natural phenomena. Through her audiovisual installation *Technological Nature* (2017), she aims to create a new mindset for the hybrid of traditional biophysical nature, and the nature of technology. This is realized through moving image, an audiovisual immersive installation and WebVR [figures 16 and 17].

> In my recent research I suggest that you don't need special machines to recreate nature, especially since our everyday objects are also able to create light phenomena's if the conditions are right. The soundscape in the project derives from sound recordings of these everyday objects. (Jelonek 2017)

With this project she is aiming to start a discussion, about how human beings will live with the increasing amount of technology around them (2017).

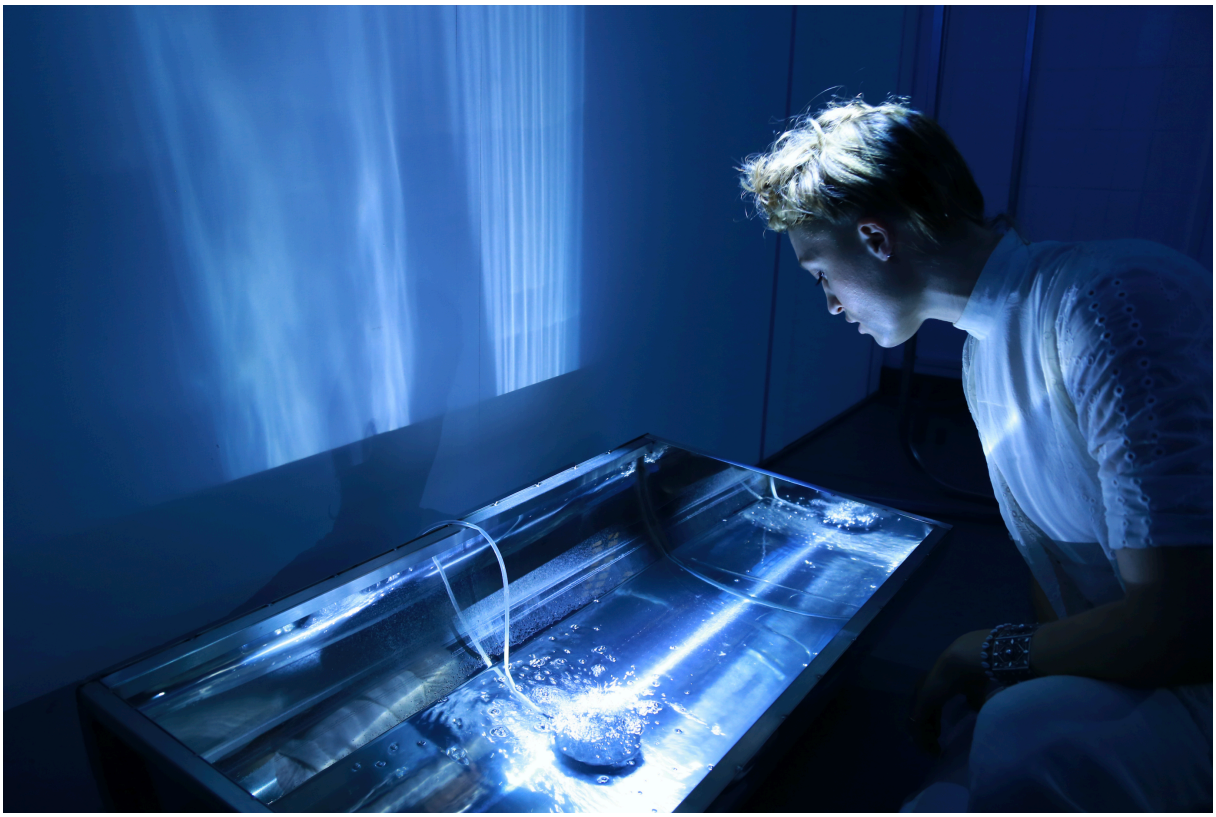


Figure 16 - *Technological Nature* by Daira Jelonek (2017)



Figure 17 - *Technological Nature* by Daira Jelonek (2017)

A fourth example of the use of natural objects for audiovisual purposes is Marty Quinn's *The Climate Symphony and Other Sonifications of Ice Core, Radar, DNA, Seismic and Solar Wind Data* (2000). This artwork is stated under the third category: sonifying visuals.

2.2.2 VISUALIZING SOUND

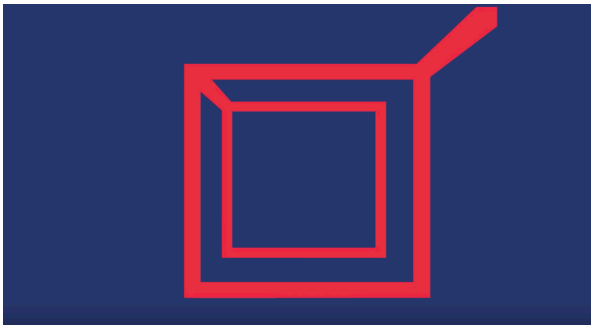
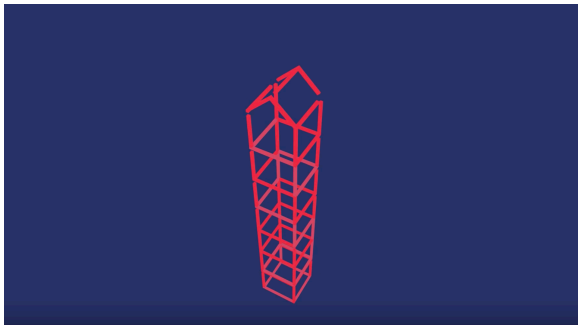
Sound can be used as a source to generate or manipulate visual content. Strategies to achieve this vary from direct visual feedback from analog signals, to representation of sound frequencies, or more experimental visualizations (Carvalho 2018, 56).

Some software artists have approached the challenge of visualizing music not to produce entertaining or entrancing experiences, but to provide analytic insight into the structure of a musical signal. An early example of this was done by Malinowski through his *Music Animation Machine*.

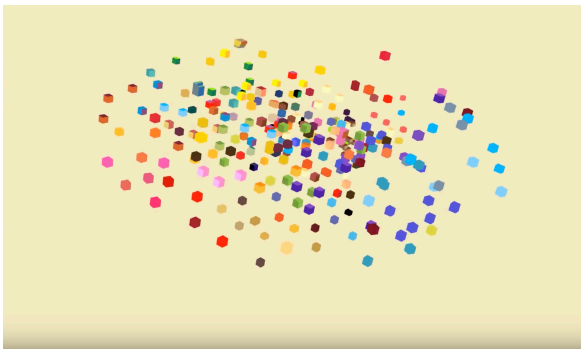
2.2.2.1 GIANT STEPS

Another classic example of visualizing sound was made by Michal Levy's animation called *Giant Steps* with music of John Coltrane from 2001 [figures 18, 19, 20 and 21], where she made use of synesthesia (Levy 2016). Synesthesia is a neurological condition in which one sense's (for example hearing) is perceived at the same time as one or more additional senses (such as vision). An example can be hearing music and simultaneously sensing the sound as swirls, patterns or colors (Psychology Today n.d.).

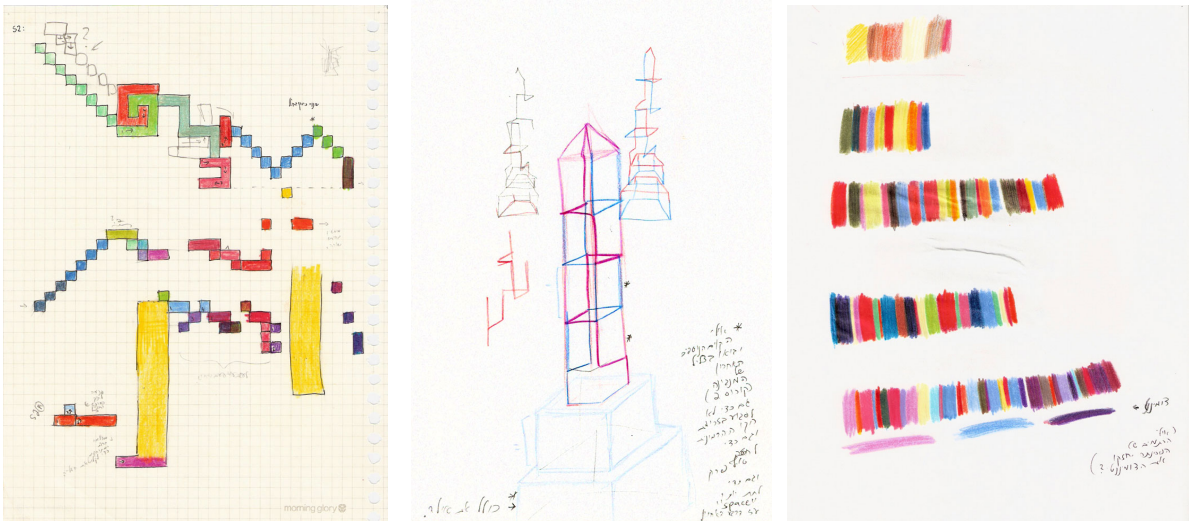
In Levy's animation, she attempted to visualize Coltrane's complex harmonic structure. "The melody's repeated pattern reminded me of a building's structure. It is played twice, and similarly the framework of the building in the film is complete only when constructed twice" (2001). Figures 22, 23 and 24 show some sketches of her work progress.

Figures 18 and 19 - stills of Michal Levy's *Giant Steps* animation storyboard (2016)

Figures 20 and 21 - stills of Michal Levy's *Giant Steps* animation storyboard (2016)



Figures 22, 23 and 24 - sketches and the work progress of Michal Levy's *Giant Steps* animation (2001)

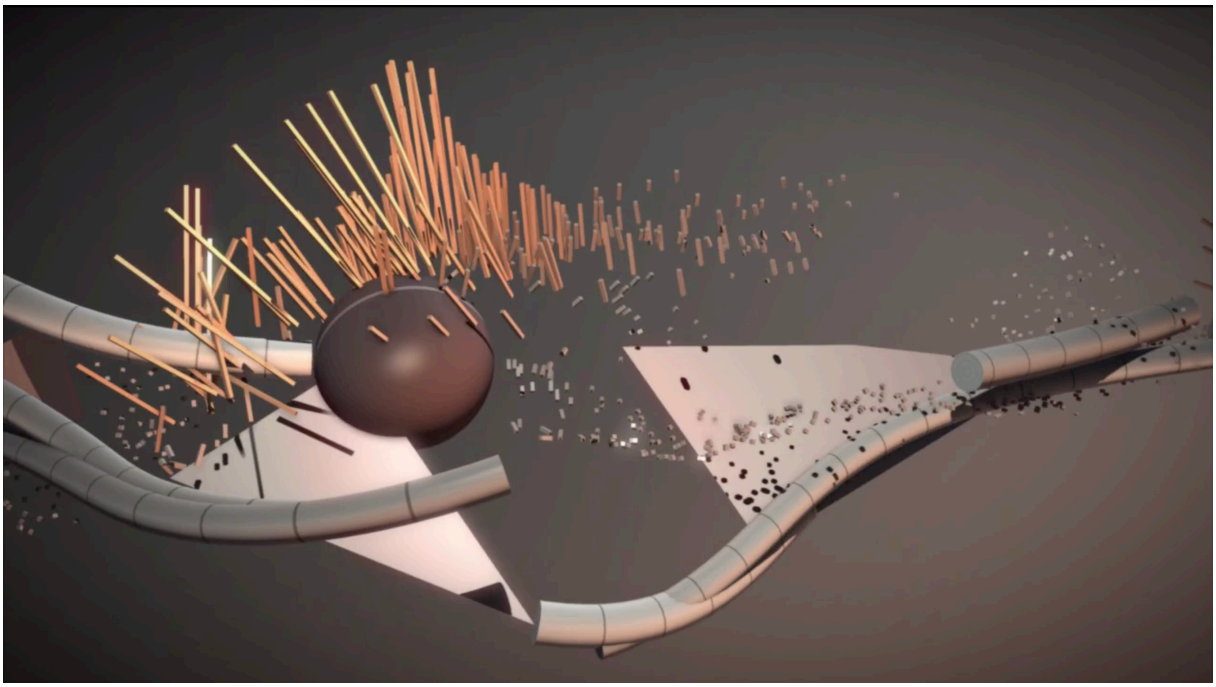


Figure 25 - still of Davide Quayola and Natan Sinigaglia's *Partitura 001* (2011)

In *Partitura 001* (2011), visual artists Davide Quayola and Natan Sinigaglia also use abstract graphics to visualize the sound of Telefon Tel Aviv, by showing geometric shapes and colors which are transmitted through the oscillation of sound waves over time [figure 25] (Carvalho 2018, 13). This work is inspired by studies of artists like Wassily Kandinsky[18] and Fischinger. The main characteristics of the custom software used for *Partitura* is its horizontal linear structure like that of a musical score (Abstract Birds 2012).

2.2.2.2 Camerata de Lausanne

Another possibility to visualize sound is by transforming intangible, invisible audio – from orchestra scores to snipping scissors – into physical objects. An example is Swiss designer Demian Conrad's

[18] Moscow 1866 – Neuilly-sur-Seine 1944

project. Conrad was inspired by the German physicist and musician Ernst Chladni,[19] who is best known for his acoustic work of visualizing the patterns of vibrations (Public Domain Review n.d.). When Conrad created the new identity of Camerata de Lausanne in 2011, he managed to visualize the complex nature of music through the union of graphic design, technology and science. By using a computer program that stimulated Chladni's efforts, Conrad created a series of motifs [figure 26] (Baird 2011).

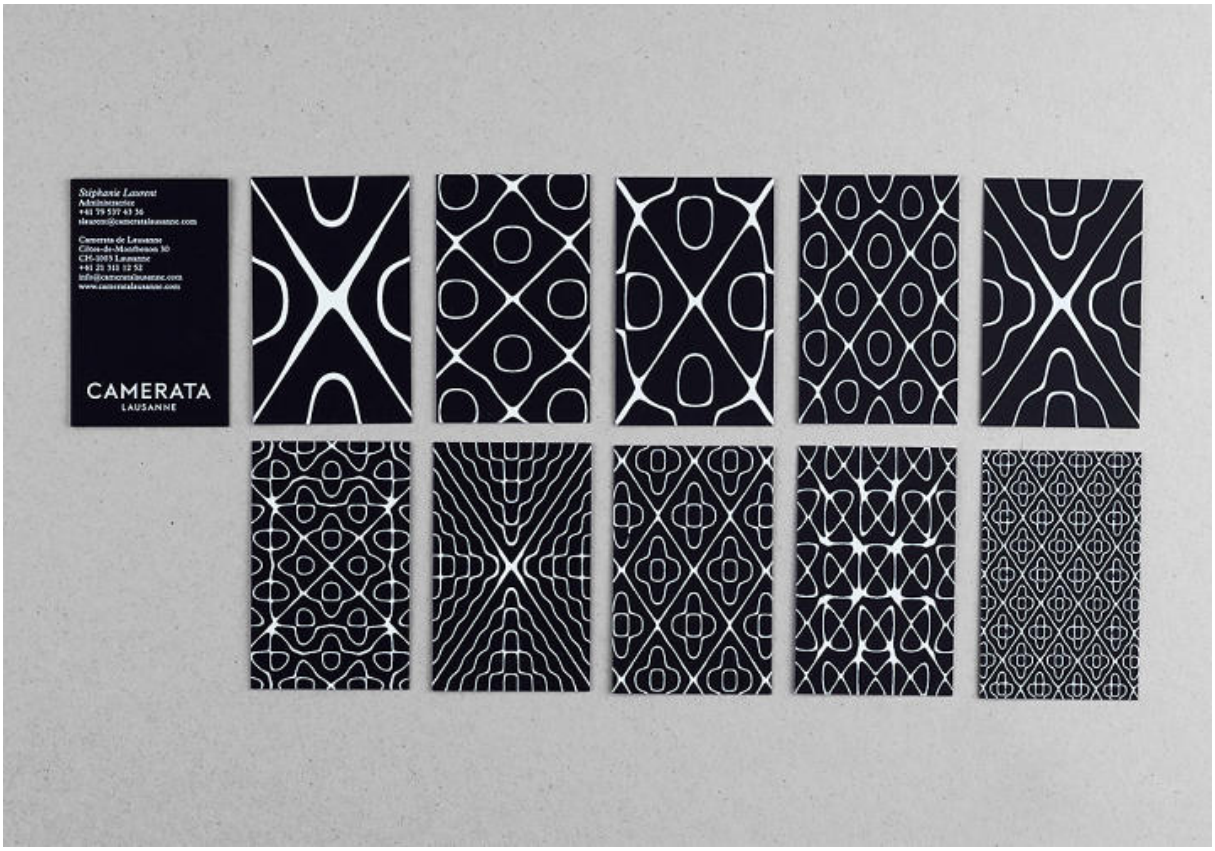


Figure 26 - Damian Conrad's identity design of Camerata de Lausanne (Baird 2011)

2.2.3 SONIFYING VISUALS

During the last centuries visualization was an important topic within science. The other way around, sonifying visuals or Sonification, is defined as "the use of sound to perceptualize data and convey information. It is an alternative and complement to visualization of sound and proved to be particularly useful in the analysis of highly complex and multi-dimensional data sets" (Vogt et al. 2007). It is so inherently interdisciplinary that it is very easy to become disoriented and overwhelmed when confronted with its different aspects, ranging from computer science to psychology and from sound design to data mining (Hermann et al. 2011, 7).

According to *The Sonification Handbook* by Thomas Hermann, Andy Hunt and John G. Neuhoff, the four broad categories that auditory displays might perform are considered: (1) alarms, alerts and warnings; (2) status, process and monitoring messages; (3) data exploration; and (4) art, entertainment,

[19] Wittenberg 1756 – Wrocław 1827

sports and exercise (2011, 32). To maintain the subject of this research, this section focuses on a part of the fourth category: art.

2.2.3.1 The Climate Symphony and Other Sonifications of Ice Core, Radar, DNA, Seismic and Solar Wind Data

Events and data sets can be used as a basis for musical compositions. In here sonification is not for the purpose of information delivery, but in this way the composers often attempt to convey something to the listener (Hermann et al. 2011, 35).

Sonification researcher Marty Quinn is one of the visual artists that creates innovative audio display designs for various types of data (2018). *The Climate Symphony and Other Sonifications of Ice Core, Radar, DNA, Seismic and Solar Wind Data* (2000) is a one-hour presentation of sonification research. By doing this, Quinn has used data sonifications to drive ambitious musical works, and he has produced entire albums of compositions (Hermann et al. 2011, 15).

> The Greenland Ice Sheet Project II (GISP2) completed drilling to bedrock at Summit, Greenland, in 1993 with a 3053-meter ice core. The core contains a record of atmospheric chemistry accumulated by the annual precipitation at Summit for over 200,000 years. The top 2960 meters provides a well-dated climate history for the past 110,000 years and it is this record which has led to the climate symphony. (Quinn 2001, 1)

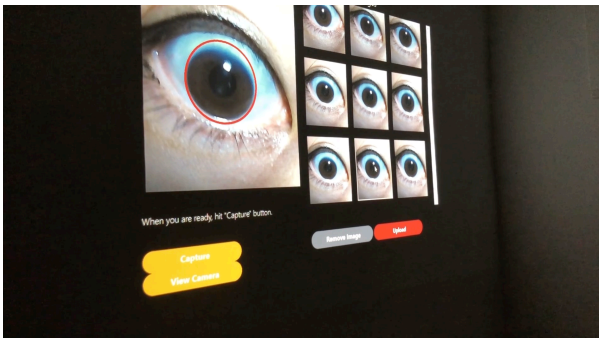
The presentation was designed around the concept of an ice room, with a white floor and walls. The walls served as screens upon which slides and animations were projected, and the stage itself was an electric drum kit containing for mounted drums and a kick drum. All the triggers were funneled to a Roland PM16 pad which was connected to an IBM laptop running the sonification and visualization software (Quinn 2001, 2).

2.2.3.2 Sonified

In 2011 artist Perry Hall created the concept of *Sonified*, an application for iPhone and iPad that "translates what your video camera sees into sound in real time" (2011). This real time instrument uses the video camera of your device to translate qualities of light and color in music, allowing to hear what you are seeing. For the first release of the app Hall recorded the sounds that the camera controls, but anyone could put their own selection of sounds into it and craft their own synesthesia (Leitão 2017).

2.2.3.3 Eyes

As well as Quinn, interaction designer, multimedia artist and researcher Yoon Chung Han conducts researches that include data visualization, biometric data visualization and sonification, new interface for musical expression, and mobile user experience design (Han 2014). One of her newest works called *Eyes* (2018) is an interactive biometric data art that transforms human iris data into musical sound and 3D animated image (Han 2018a). The audience's first step is to capture a photo of their iris and upload it into a customized software. Once the system has analyzed the image and extracted visual features, it transforms it into sound. The dominant colors, brightness and size of the iris are used as parameters in audio synthesis to create a unique and personalized sound (2018b) [figures 27 and 28].





Figures 27 and 28 - *Eyes* by Yoon Chung Han (2018b)



Figure 29 - interactive art installation of *Eyes* by Yoon Chun Han, in the OCI Museum in Seoul, South Korea (2018a)

One of the most important assets of this artwork is that it can create a personalized art experience and multimodal interaction.

> The multi-sensory interpretations of the iris data art can lead a new opportunity to reveal users' narratives and create their own 'sonic signature', which will be able to trigger a new way of interaction in the field of art and science. (Han 2018a)

2.2.4 SYNCHRESIS

French film theorist and composer of experimental music Michel Chion has created the word *synchresis* by combining *synchronism* and *synthesis* to explain "the spontaneous and irresistible weld produced between a particular auditory phenomenon and visual phenomenon when they occur at the same time" (1994, 62).

A point of synchronization or *synch point* is a noticeable moment of an audiovisual sequence during which a sound event and a visual event meet in synchrony. It is a point where the effect of synchresis is a particularly prominent, rather like an accented chord in music (Chion 1994, 58). It can be called the forging between something someone sees, and something someone hears. It is the mental fusion between a sound and a visual when these happen at exactly the same time.

The ability of re-associating image and sound is essential for the making of for example film-sound (Chion 1994, 60). Synchresis is what makes dubbing, post synchronization, and sound-effects mixing possible, and empowers a wide array of choice in these processes (1994, 63).

This symptom of significant synch points generally obey the law of the gestalt psychology, which means the whole is not a small addition of its component parts, but has characteristics of its own (Wertheimer 1924).

Chion explains a synch point sometimes emerges more specially in a sequence:

"• As an unexpected double break in the audiovisual flow, a synchronous cut in both sound and image track. This is characteristic of external logic, frequent in Alien for example;

• As a form of punctuation at the end of a sequence whose tracks seemed separate until they end up together (synch point of convergence);

• Purely by its physical character: for example when the synch point falls on a closeup that creates an effect of visual fortissimo, or when the sound itself is louder than the rest of the soundtrack;

• But also by its affective or semantic character: a word of dialogue that conveys a strong meaning and is spoken in a certain way can be the locus of an important point of synchronization with the image" (1994, 59).

Theorist Sven E. Carlsson explains that sound is for great importance for how we experience moods and narratives, and how the adding of sound to visuals is extremely important for the narration of a film. This is due to the fact that it is a question of movement, and movements are felt as more natural when combined with sound. Humankind is used to the fact that sounds are created by movements, and thus every sound rises from an original score. Like Naumer and Kaiser stated, this conception of the surrounding world can be connected to a pure instinct for survival, for instance learn from sounds about preys or threats (Carlsson 1994).

2.2.4.1 Mon Oncle

A most basic example for synchresis can be setting up the right expectations of the sound (for instance, using walking sounds when you see a character walking), but contrarily it can be interesting to use any other kind of sound effects for these images.

This is exactly what French filmmaker, actor and screenwriter Jacques Tati[20] thought when he directed and played in *Mon Oncle* in 1985, when he used all kinds of special noises for human footsteps, and

[20] Le Pecq 1907 – Paris 1982

other daily activities [figure 30] (Chion 1994, 64).



Figure 30 - film still of *Mon Uncle* (1985), where human footsteps are drawn through all kinds of noises, including glass objects and ping-pong balls (Tati)

In addition to sound with film, synchresis is and can be used in many other occasions. For example, with images and sounds that strictly speaking have nothing to do with each other, which can form weird but interesting and irresistible assemblages in our perception. Another important role in securing the synchresis effect can be the meaning and rhythm of sound and images, or when one sound is way louder than the others it can coagulate with the image it is heard (Chion 1994, 63).

2.2.4.2 Primarily Speaking

Even though the effects of synchresis can be influenced or oriented by cultural habits, American video artist Gary Hill and his video *Primarily Speaking* (1981-1983) have shown that it has a natural basis (Chion 1994, 64). The picture plane of the screen is divided into a left and a right half, a changing background is formed by colorful and highly graphical patterns, and two small rectangles occur on the surface, where two video sequences are playing. These different images show landscapes, objects, graphical images and landscapes, and they are accompanied by Hill's speech. The syllabic sequences of this speech determine the rhythm of the images [figure 31] (Gary Hill Studio 2014).



Figure 31 - film still of Gary Hill's Primarily Speaking (1981-1983) (Gary Hill Studio 2014)

2.2.5 PERCEPTIONS

Because awareness is dependent on someone's attention even though the capacity can be limited, individuals tend to use their resources in the most efficient manner. An individual's limited mental capacities may cause him or her to acknowledge only the more easily processed and affective components of music or visuals. This means these affective and structural aspects (by themselves or in an interactive relationship) do play an important role within every personal exploration, both psychological and practical. However, possibly composers and professional musicians or artists may be an exception to this rule of emotional dominance, since they consciously attend to both of the aspects (Ebendorf 2007, 4).

Before diving into the interaction between the audio and visual elements, the first sections focus on element one: audio.

2.2.5.1 CAUSAL, SEMANTIC, AND REDUCED LISTENING

Chion states there are at least three listening modes: causal listening, semantic listening, and reduced listening (1994, 24).

The most common listening mode, causal listening, consists of listening to a sound in order to gather information about its cause or source. This mode of listening is not only the most common but also the most easily influenced and deceptive. Sometimes we can recognize the precise cause: a person's voice or the sound produced by a specific unique object. However, we rarely recognize a unique source exclusively on the basis of sound we hear when it is out of context. For instance, a human is probably

the only cause that can produce the sound of a speaking voice, but different dogs of the same species have the same bark (or at least we are generally incapable of distinguishing the bark of one bulldog from that of another bulldog).

In another kind of causal listening we do not recognize an individual or a particular item, but instead we hear the category of a human, animal, or mechanical cause (Chion 1994, 26).

Chion refers to semantic listening as "a code or a language to interpret a message: spoken language, of course, as well as Morse and other such codes" (1994, 28). This mode of listening, which is way more complex than the causal listening mode, has been a subject of linguistic research, and the most widely studied.

Clearly someone can listen to a sound sequence that consists of both the causal and semantic modes at once. In other words, causal listening to a voice is to listening to it semantically as perception of the handwriting of a written text is to reading it (Chion 1994, 29).

Reduced listening is the mode of listening that focuses on the traits of the sound itself, independent of its cause or meaning (Chion 1983, 170). He explains: "Reduced listening takes the sound at itself (the sound being verbal, played on an instruments, or just noises etcetera) as an object to be observed instead of as a vehicle for itself" (1994, 29).

And even though it is important to consider these three clear distinctions of modes of listening, these modes overlap and combine in the various and complex contexts of the film-sound aspect. A good reason for that is the question of listening with the ear is in inseparable from that of listening with the mind, just like looking is with seeing. Furthermore we have to take into account that conscious and active perception in only one part of a wider perceptual field (Chion 1994, 33).

2.2.5.2 Affective and Acoustical Component

One of the leading psychologists to examine the relationship between visual and auditory domains, Annabel J. Cohen, suggests that music can be viewed as having two aspects: an affective component and an acoustical component. And even though these components are often examined separately, they steadily work together to produce musical effects (Cohen 2001).

To support this thought, she mentions the Adaptive Resonance Theory (ART) (2000). Stephen Grossberg describes this theory as "a cognitive and neural theory of how the brain autonomously learns to categorize, recognize, and predict objects and events in a changing world. The problem of learning makes the unity of conscious experience hard to understand, if only because humans are able to rapidly learn enormous amounts of new information, on their own, throughout life" (2013, 2), meaning information in short-term memory only becomes conscious if it is consistent with predictions about reality (Ebendorf 2007, 4).

2.2.5.3 Ventriloquist Effect

One example of how the interaction between the stimuli of the two different sensor modalities sound and vision is operating, is the ventriloquist effect (Kohlrausch and Van De Par 2005, 1).

This effect refers to the perception of sound as coming from a direction other than the true direction, due to the influence of visual stimuli (Thurlow and Jack 1973, 1). In other words, it describes a situation where the perceived location of an auditory object is influenced by the presence of a related visual object. In cases this happens, the perceived locus of the auditory stimulus shifts towards the visual stimulus (Kohlrausch and Van De Par 2005, 1).

In a study by Herbert L. Pick Jr, David H. Warren and John C. Hay, inconsistent spatial information is presented through visual and auditory modalities. As a task, participants had to indicate the perceived direction of the auditory and the visual stimuli when they were presented. This was done both in isolation, as well as in simultaneity. It occurred that for the condition in which the elements were presented simultaneously, the perceived auditory location was substantially adjusted towards the location where the visual information came from. On the other hand, the sensed visual location hardly changed by the presence of the auditory information (1969).

Similarly, the perceptual consequences of a mismatch between these modalities has been studied for a difference in the distance (Kohlrausch and Van De Par 2005, 115).

2.2.5.4 Congruence-Associationist Model

Another interesting but complex theme is the interaction between musical and visual components within film. While there are many studies that have explored music's effect on the perception of visuals, the contrary is more challenging to find.

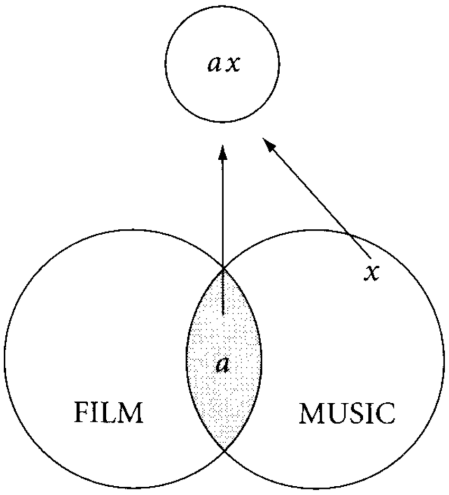


Figure 32 - Annabel Cohen's Congruence-Associationist model of how music alters the meaning of a particular aspect of a film (Cohen 2001, 5)

An example is Cohen's *Music as a Source of Emotion in Film* (2001) where she created the Congruence-Associationist model [figure 32]. This model is based on Marshall and Cohen's (1988) study and shows how music alters the meaning of a particular aspect of a film. In this model the total meaning and structure of the music and film are presented by their respective circles. It explains how the audience comprehends and attaches meaning to what is seen and heard (Moore 2010, 3). The intersection of the circles (a) shows the overlap in music and film, and attention is directed to this area of visual overlap. Other associations of the music (x) are ascribed to this focus of attention (ax) (Cohen 2001, 5).

In addition to Cohen, in *The Cognitive Processing of Film and Musical Soundtracks*, Marilyn Boltz's experiments show that music can impact the knowledge of visual images. He demonstrated that when the music matches the mood of the visual, the intended emotion of the visual was more precisely remembered (2004).

2.2.5.5 Visual Stimuli Effect on Music Perception

As a contrary within this topic and not long after Boltz, Brittany Ebendorf (2007) modified Boltz's experiment to demonstrate that a visual image can as well influence the cognition of musical phenomena.

Just like Ebendorf, in *The Impact of Visual Stimuli on Music Perception,* Ben Field focuses as well on the effects of the visual modality on the affective and acoustical perception of music. He states that the type of visual information (in terms of affect and format) plays a direct role in how music is perceived acoustically and emotionally (2007, 55). Throughout his study participants were asked to rate the musical dimensions of audiovisual stimuli, and the results indicate that visual information does indeed influence the perceived effect of the music (2007, 47). But, according to Field, one may conclude that the visual's affect is not the only manipulation that influences acoustical perception since some of the effects (on flow and volume) of the effective manipulation can be shadowed by the lingering effects of format—montage and video (2007, 49).

In *The Impact of Visual-Music Interaction on Music Perception: The Influence of Agreement and Disagreement* Jordan Moore's subject is "to explore the impact of visuals on the perception of affective and acoustical qualities of music, and to develop a method for discussing the mood interactions of film and music" (2010, 1). He discusses how two types of interactions called *text-music* and *visual-music* (film music) are explored, and how components agree or disagree with the emotion of the other (2010, 10). In contrast with agreement or disagreement, other types of interaction can occur with a musical setting. This can be for the purpose of irony, persona, or other extra-musical reasons (2010, 23).

According to Moore background music in films often presents a mood that represents or enhances the desired emotion presented in a scene. The interaction that takes place between the music and visual elements can be described in terms of congruency when discussing mood (2010, 34). Agreement in mood between these elements can increase the mood of the individual parts, while disagreement can create irony, commentary, of foreshadowing (2010, 46). Foreshadowing occurs when an apparent disagreement is found later to be an agreement (2010, 23). These interactions can cause the audience to perceive the individual elements in an intensified or different way than when they are experienced individually (2010, 46).

Moore's study clarifies that, in film music, the focus is not always on the visual narrative. Thus, in some cases the music draws the attention. When this happens, the mood of the visual image affects the perception of the music through enhancement when in agreement, or reinterpretation when in disagreement (2010, 65).

Even though Boltz, Ebendorf, and Moore's studies focus on visuals in film, the fact that visual information plays a direct role in how music is perceived acoustically and emotionally can as well count

for different audiovisual interactions.

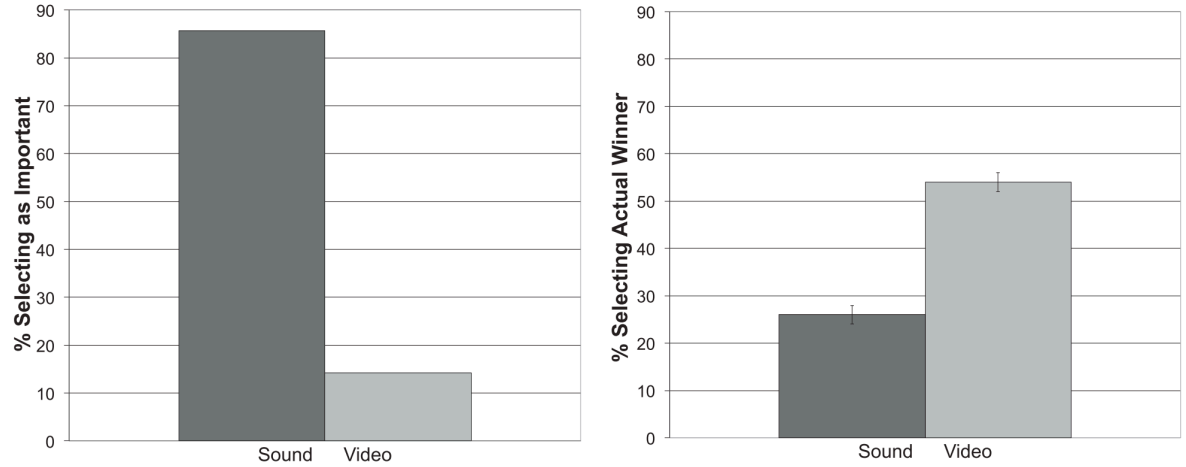
2.2.6 SIGHT OVER SOUND?

Daily life is filled with examples of how visual information can have a powerful effect on our social cognition, ranging from perception to consumer judgment (Tsay 2013, 14583). On top of that, like Field, many researchers concluded that the type of visual information plays a direct role in how music is perceived acoustically and emotionally (2007, 55).

But, does this mean that sight dominates sound? And for which type of interactions between these elements does this count? Only in daily life (judging books by their covers, preferring nicely wrapped gifts, fall in love at first sight, voting for the politician that looks most competent, etc. (Tsay 2013, 14583)), between visual modalities (film or music videos) and sound (music), as well in other interactive audiovisual artworks, or is it like Levin believes, completely up to the arbitrary or personal association of an individual (2000)?

2.2.6.1 MUSICAL PERFORMANCE

Chia-Jung Tsay conducted a set of seven experiments that suggest that both novices and experts make judgments about a music performance quickly and automatically on the basis of visual information (2013, 14583). In experiments 2 to 5, the top three finalists in each of ten international classical music competitions were presented to participants. To do this, in experiment 2, in the first part novice participants were presented with both video-only and sound-only clips of performances during these competitions. And even though 83,3% of the participants reported that the sound mattered most for their evaluation of the music performance, eventually they were significantly more likely to identify the winners when they were presented with only the visual information of the performances [figures 33 and 34] (2013, 14581).



Figures 33 and 34 - table of part of Chia-Jung Tsay's experiments, showing the importance of sound vs. visuals for evaluation (left) and the % of novices identifying actual competition outcomes when given sound-only vs. video-only stimuli (2013, 14581)

Samuel A. Mehr, Daniel A. Scannell and Ellen Winner conducted the same kind of experiment. They presented short videos of performers of a music competition, and while the video was muted, participants accurately had to guess who were the winners (2018, 1). They found out that both novice and expert musicians correctly identified the winners of the competitions by only watching muted videos, but not when they heard audio-only pieces, or viewed and heard audiovisual versions (2018, 6).

Another example is how since the 1970s and 1980s, orchestras started using blind auditions. During these, candidates are located behind curtains so the jury cannot be influenced by someone's looks, gender or ethnicity. Researchers have determined that even if these auditions are used for only the preliminary step, it is 50% more likely that women will advance to the finals. These auditions help in knowing what to focus on, instead of being biased by the visual information received (Rice 2013).

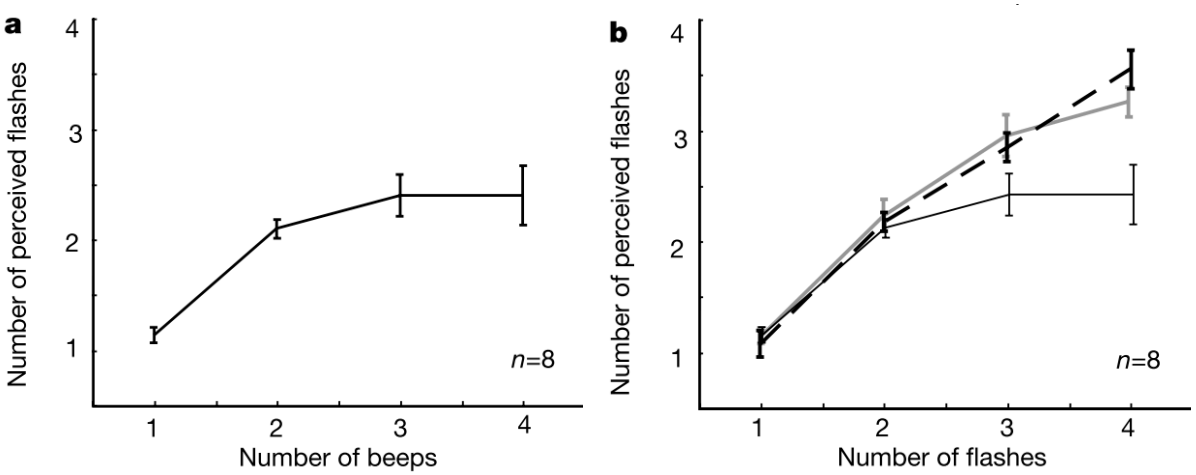
Although these examples show quite clear how in these specific situations sight overruled sound, vision's perception can also be altered by other modalities, for instance during the *sound-induced flash illusion* experiment.

2.2.6.2 What You See Is What You Hear

According to Philip Auslander, the relationships between audio and visual elements can be configured as the power relationship (where one component is thought to dominate and set the context for the other) or stay in the traditionalist position, which entails a complex relationship between these components. For instance, during a performance the sound is thought to be more important because the goal of the performance is to play the music. On the other hand sound alone is incapable of providing the audience with all of the information needed to assess the musician's skill and effort, and so it depends as well on the visual element for verification (2013, 12).

In *What you see is what you hear* (2000)*,* Ladan Shams, Yuki Kamitani and Shinsuke Shimojo state that vision is believed to dominate our multi-sensory perception of the world, but they overturn the established view. According to them, auditory information can qualitatively alter the perception of an unambiguous visual stimulus, to create an interesting visual illusion.

They have discovered a visual illusion that is elicited by sound. "When a single visual flash is accompanied by multiple auditory beeps, the single flash is incorrectly perceived as multiple flashes" (Shams et al. 2000). Observers were asked to judge how many visual flashes were presented, and surprisingly, all the time observers reported incorrectly multiple flashes whenever a single flash came with more than one beep (2000).



Figures 35 and 36 - Ladan Shams, Yuki Kamitani and Shinsuke Shimojo's experiment, (a) is the perceived number of visual flashes by eight observers plotted as a function of the number of auditory beeps for a single flash, and (b) the next experiment, is the perceived number of flashes by eight observers plotted as a function of the actual number of flashes presented without sound (dashed line), and trials with single beeps (grey line) (2000)

Figures 35 and 36 show that observers performed the assignment very well in the absence of sound (dashed line), but the result of the catch trials (grey line) support that the responses were not determined by their auditory perceptions.

And so, Shams, Kamitani and Shimojo's results point out that this illusory flashing is actually caused by a modification of visual perception, by auditory stimuli. They suggest that the direction of cross-modal interactions is somewhat dependent on the type of stimulus (2000).

This influence of auditory cues on visual perception has also been experimented before and within other settings, for example the one from Robert and Allison B. Sekuler, and Renee Lau. *Sound alters visual motion perception* reveals that sound can alter the visual perception of motion. They investigated this by conducting experiments which determined whether the introduction of sounds would promote the perception of bouncing from two identical objects on a computer screen, that move steadily towards each other, coincide, and move apart again (1997).

2.2.6.3 Modality Appropriateness

While Shimojo and Shams wrote *Sensory modalities are not separate modalities: plasticity and interactions*, they explicated a variety of different experiments by stating that while effects of visual signals on other modalities contribute the belief that humans are vision dominated, sound also alters temporal and other aspects of vision (2001, 508). This means sound signals can influence the perceived duration of visual stimuli, while sound influences the perceived intensity of a visual stimulus (2001, 506).

Robert B. Welch and David H. Warren speculated that "the great body of behavioral findings on cross-modal interactions has been accounted for in a modality appropriateness" (1980). This means that the modality that fits the best with respect to a given task, dominates the perception in the context of this given task. In fact, vision has a higher spatial resolution and therefore dominates spatial tasks (like the ventriloquist effect, explained in section 2.2.5.3), while audio has a higher temporal resolution, and thus dominates more temporal tasks (Shimojo and Shams 2001).

According to experimental psychologist Charles Spence, “the binding versus segregation of unimodal stimuli depends on both low-level structural factors such as spatial and temporal ‘co-occurrence’, temporal correlation between the signals, and the relative strength of intramodal versus cross modal perceptual grouping” (2007, 61). On top of this, he states that the binding or separation of stimuli also depends on other factors. For instance whether the stimuli are congruent or not, and if the personal perception of the individual or ‘observer’ assumes that the stimuli go together (2007, 61).

As such, like Chion explains, audio-visual arts can infuse sound with visuality or add a sense of the auditory to an image, which means they can create sensations that “address the ear that is in the eye” (1994, 134).

2.2.6.4 Assessment of Quality

According to Marie-Neige Garcia, Robert Schleicher and Alexander Raake, “the balance between audio quality and video quality depends on the content, video format, and the audio degradation type”. They believe the perceived quality can be estimated both in the planning phase and as part of the service monitoring. This can be assessed using audiovisual subjective tests, or by instrumental methods. If these are properly conducted, quality tests with human subjects are most valid since it is all about human perception (2011, 1).

In conclusion, to achieve the aimed balance between audio and visual elements it depends on multiple and complex details concerning the type and form of audiovisual interaction. Not only it relies on the situation this interaction takes place, but as well the duration, location, engaging observers with their own perception, and of course the intention of the type of interaction.

2.3 PERFORMANCE ART

Since sound-image relations are such a broad subject and a complex field to investigate and for instance synchronized music and imagery within a film or music video is different from an audiovisual artwork or performance, the next section continues with audiovisual performances (Ritter 1993). Because the main research goal of this study is to find a way to create a balance between the audio and visual elements during such a performance, this section will focus on the different aspects of audiovisual performances, and a variety of artists that have fabricated such a performance (or artwork) before. *Performance art* is a very loaded and complicated term, and it is just as confusing as it is fascinating. On its foundations, performance art refers to an artwork dependent on the presence of the artist itself, instead of an artwork made by him or her (Eisinger 2013).

According to Ana Carvalho and Cornelia Lund, “live audiovisual performance defines a group of practices that require analogical as well as digital technology as mediation to express aesthetically a dialogue between sound and image” (2015, 1). So visual elements during a musical performance are not only digital components but also the artist itself, the location, the light, the movement of the objects/individuals, the instruments, and much more. The auditory elements in that case, can vary from voices talking or singing, the use of classical or digital musical instruments, the use of any other object

that fabricates sound, etcetera.

The next sections are centered around classical performances (specifically ballet and opera, theater and musical performances), and digital performances.

2.3.1 CLASSICAL PERFORMANCE

Some historical artworks are standing out in a sense of the artist's autonomy in composition and endurance in performance, the difficulty to replicate, and the work's social critique (Eisinger 2013). Some of these artworks will be discussed, as well as the focus on sound-image relations within these areas.

During musical performances, the acoustics of the room or hall are important to create the sound elements. To quantify subjective impressions of room acoustics, many objective parameters have been introduced. These quantities can be measured by a variety of powerful tools and equipment. On top of that the results also rely on measurement positions and the condition of the hall (full, empty, etc.) (Fausti and Farina 2000, 213).

One of the most traditional and important components that influences the visual aspect of acoustical musical performances, opera or theatre, is stage design, which includes production design, scenic design, and scenography. It is the process of planning and creating the scenery, the lightning, costumes, set construction and set placement for each location during the performance (Moulton 2015).

2.3.1.1 THEATER

The *9 Evenings: Theatre & Engineering* series from 1966 is a good example of an important collaboration between artists and engineers that produced innovative works using emerging technologies (Digicult 2005).

2.3.1.1.1 Open Score

These evenings consisting of early experiments fusing art and technology were organized by Robert Rauschenberg,[21] alongside a forum called *E.A.T.* (*Experiments in Art and Technology*). *Open Score*, which was the first of the nine evenings in 1966, is one of Rauschenberg's best-known works. It consisted of three parts: a tennis match between painter Mark Stella and Mimi Kanarek, a projection of footage of 500 people walking through the darkness, and an addition to the projection, where a spotlight illuminated a girl in a cloth sack singing a Tuscan folk song.

During the tennis match a FM transmitter was assembled on each tennis racket to transmit acoustic transmissions, so a loud 'bong' was heard throughout the space and a light turned off [figure 37] (Eisinger 2013).

[21] Port Arthur 1925 – Captiva 2008



Figure 37 - Robert Rauschenberg, *Open Score. 9 Evenings: Theatre & Engineering* in 1966. Overview of the tennis game, played by Frank Stella and Mimi Kanarek (Eisinger 2013)

2.3.1.1.2 America I-IV

Another innovative multimedia performance called *America I-IV* was done by Laurie Anderson in 1984. Anderson composed eight hours of music, including compositions for instruments of her own invention, animations, and spoken word [figure 38]. For decades she was one of the most accessible and highly regarded figures in the artistic vanguard, and she was able to speak about the United States' conditions, without being too punctuated or cause a scene (Eisinger 2013).



Figure 38 - Laurie Anderson performing *America I-IV* in 1984 (Eisinger 2013)

Both *Open Score* and *America I-IV* show the influence the applied stage design can have.

2.3.1.2 Opera and Ballet



Figure 39 - Reconstruction of the ballet *Parade* (1917) by the trope of Teatro dell'Opera de Rome. Set design and costumes by Pablo Picasso, choreography Léonide Massine (Korchina 2017)

2.3.1.2.1 Parade

In 1917 a handful of Europe's leading avant-garde artists, Pablo Picasso,[22] Erik Satie,[23] Jean Cocteau[24] and Sergei Diaghilev[25] with his dance company, collaborated on a project called *Parade* (Jones 2017). This performance made the art of ballet one of the popular amusements, while they made use of early sound effects, and employed a number of revolutionary instruments for a culturally disruptive spectacle of modern art [figure 39] (Eisinger 2013).

2.3.1.2.2 The Joy of Life

The ballet created by interdisciplinary group Jikken Kobo (founded in Tokyo in 1951) called *The Joy of Life*, was the strongest incarnation of their presentations. The group Kobo created everything, from the music to the backdrops to the lightning. The event is seen as a performative manifesto of the group's ideas, and as a necessary revitalization of the art culture during that time (Eisinger 2013).

2.3.1.2.3 Einstein on The Beach

Einstein on The Beach (1976) is widely credited as one of the greatest artistic achievements of the 20th

[22] Málaga 1881 – Mougins 1973
[23] Honfleur 1866 – Arcueil 1925
[24] Maisons-Laffitte 1889 – Milly-la-Forêt 1963
[25] Chudovsky District 1872 – Venice 1929

century. This first of three operas in the Portrait Trilogy was first produced in Avignon, France, by director Robert Wilson and composer Philip Glass. This opera piece breaks all of the rules of conventional opera: instead of a traditional orchestral arrangement, glass chose to compose the work for the synthesizers, woodwinds, and voices of the Philip Glass Ensemble. Overall the full production takes five hours, and there are no traditional intermissions, but the audience can wander in and out of the performance when they want to [figure 40] (Wilson 2015).



Figure 40 - *Einstein on The Beach* by Robert Wilson and Philip Glass in New York's Metropolitan Area in 1976, photo by Byrd Hoffman Foundation (Wilson 2015)

2.3.1.3 MUSICAL

In Western music, the performance is normally viewed as an interpretive art, even though it is not always like that. "Performers to some degree determine aspects of any music they play. Issues of tempo, phrasing, dynamics, and in some types of music pitches and instrumentation are a subject to a performer's discretion" (Foss et al. 2011).

The mediums for musical performances are extraordinarily various. It may be vocal, instrumental or electronic, and the Western technology has had a big impact on the development of musical instruments or stage design. Vocal performance is the oldest and primary influence for the development of later musical gestures and materials (Foss et al. 2011).

Apart from the stage design (lights, colors, objects, visuals, etcetera) during a performance, there is another trait that many artists share: the visual representation to add further dimensions to their musical delivery. For instance the way they dress, move, and look at the audience (Liverpool Museums 2019).

According to Wing Yi Chan Huamin Qu and Wai Ho Mak (2010), a key obstacle in the appreciation of classical music is that for some individuals training is essential to understand the musical structure and compositional techniques, to understand the thoughts behind the musical work. To help the people

understanding this structure, visualization is an option.

2.3.1.3.1 Visualizing music

The majority of computer visuals and interfaces for the representation and control of sound have been graphical objects into the space of the computer screen. According to Levin, "three principal metaphors for sound-image relationships have come to dominate the field of visually orchestrated computer music: scores, control panels, and what he calls interactive widgets" (2000, 34). Paul Haeberli's *DynaDraw* (1989) and Scott Snibbe's *Gravilux* (1998) and *Motion Phone* (1991-1995) are examples of artists who developed systems for visual performances on the computer (2000, 34).

Chan, Qu and Mak explain that there are four principles for the visualization of the semantic structure in music:

> (1) consistent, the encoding scheme should be consistent in all visualization prototypes such that users would not be confused or misled; (2) intuitive, novice users should be able to comprehend the visual displays rapidly without much training; (3) effective, the underlying musical structure should be shown effectively for novice users to gain insights into the structural features; and (4) aesthetic, being a visual representation of beautiful and sophisticated musical compositions, the display should be of high aesthetic to reflect both the artistry and complexity of music (2010, 3).

Just like these principles, they explain that the correlation between music and color is important. This means the (1) tone color, which in music, also known as timbre, refers to the quality of a sound; (2) how colors are related to music, especially when emotions are evoked; and (3) physics, when sound pitch can be encoded by a physical mapping between sound and color spectrum. For example when the color of the noise is loosely determined by mapping sound frequencies identical to light-wave frequencies (Chan et al. 2010, 4).

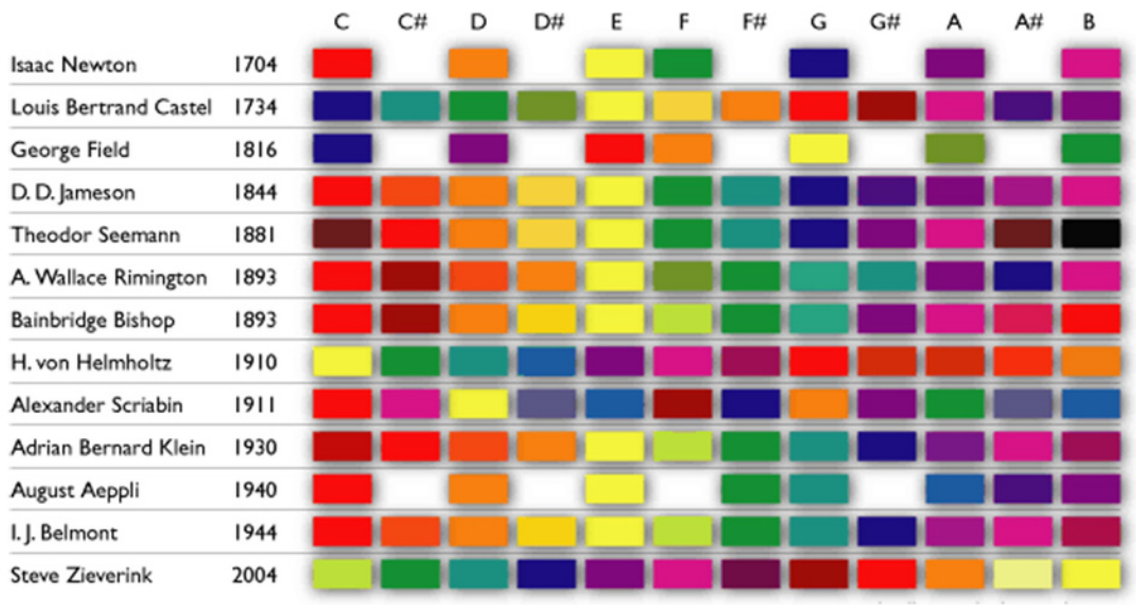


Figure 41 - correspondences between music and color (Antunes 1982, 29)

The most common proposal of the possible correspondences between music and color was the mapping of musical notes or heights to color tonalities [figure 41]. André Rangel Macedo explains that these

color scales often make correspond colors from the visible spectrum to the twelve half tones that constitute an octave of the diatonic scale (2009, 3).

Apart from Chan, Qu and Mak's insight about visualizing music, there are many more ways to explore this field.

Scientist Evan Sinar (2016) states that "unique data visualizations are more memorable, and add variety for the audience—even the most clear and straightforward visualization types lose their appeal when repeated over and over again". Another way to visualize music is by analyzing the data behind the sound, finding ways to measure different qualities, and assigning a visual component to them (Ellison 2014). The music that can be visualized with these digital systems can be both acoustic or electronic. Some unique and innovative examples are Franke's *Artist and Computer* (1976), Malinowski's *Music Animation Machine* (1982-2001), and *The Shape of Song* (2001) visualizations by Wattenberg.

2.3.2 DIGITAL PERFORMANCE

In the late 1999s there was a broad range of schools and styles offered by a new generation of performers, but the laptop-concert quickly became a regular way to perform (Akiyama 2007). Electronic music revolutionized by involving the reproduction of traditional performance through electronic means, while also evolving composition and performance on its own. It started with reproduction of natural sounds by electronic means, but later composers and technicians began to invent electronic sounds and discover new sound relationships (Foss et al. 2011).

According to Masato Kakinoki (2017) one of digital music's strengths is its non-visibility. The entity of digital music is merely the combination of digits, and thus freed from physical and visible instruments in the material world. However, when it comes to its performance, it is different. If there is a need to perform digital music, this lack of visibility needs to be tackled. And so, as well as in acoustical performances, a digital music performance is technically audiovisual. We see something, regardless of whether it is darkness, a laptop or speakers, a projection, on so on.

Apart from Walter Giers who specialized in electronic arts and audiovisual constructions, Robert Henke and Max Hattler are examples of artists that create work concerning audiovisual performances.

2.3.2.1 LUMIÈRE I, II & III

German composer, artist and software developer Robert Henke works in the field of audiovisual installations, music, and performance. Henke is mainly known for his contributions to contemporary electronic music, and for his laser works (Henke 2019).

One of his best-known audiovisual laser performance works is *Lumière* [figure 42]. *Lumière* is a series of concerts, exploring the artistic dialogue between high precision lasers and percussive sounds. Since 2010 Henke has developed a unique vector graphics software, which the Lumière series are based on. This software allows to generate rapid successions of visual shapes and associated sonic events (Henke 2013).

Since *Lumière*'s premiere in 2013, it has got three fundamental revisions, and countless minor updates.

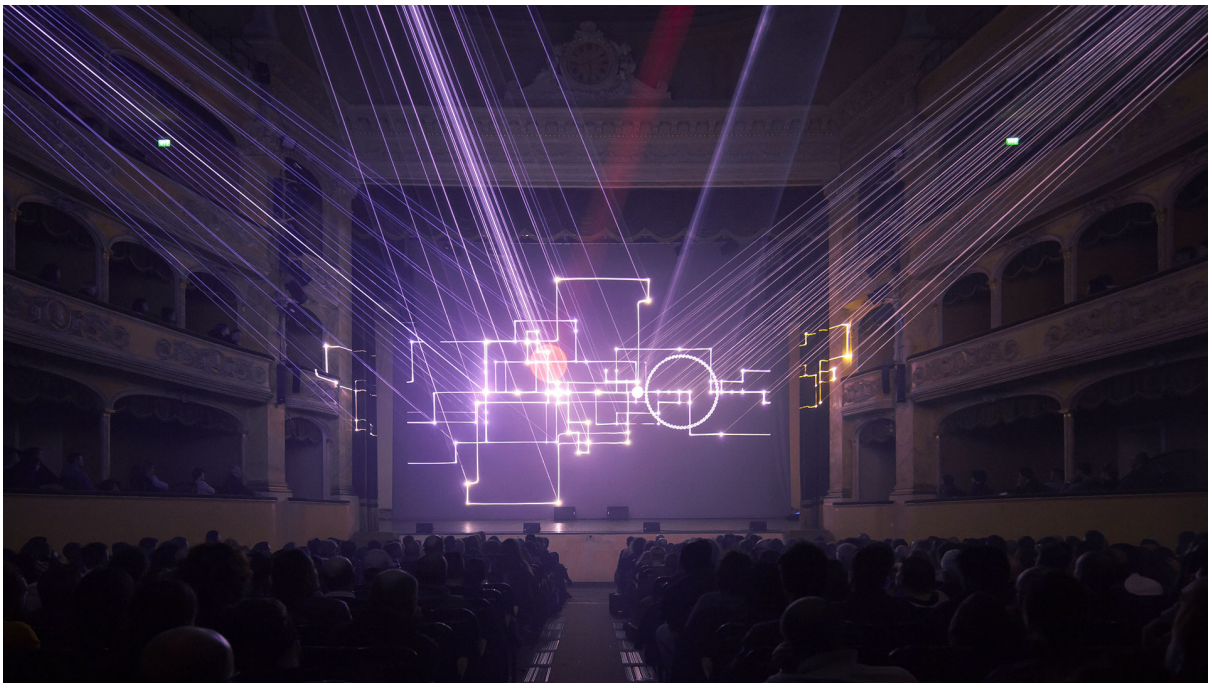


Figure 42 - Robert Henke's *Lumière II* at Modena (Henke 2015)

> Composing for Lumière means composing both in the auditive and visual domain. Bigger conflicts happen with the large scale" and, "Every few shows I make a slight update of Lumière, as a result of my experience when performing it with an audience. That's always different from the rehearsals. (Henke in Whight 2015)

2.3.2.2 HATTLERIZER

German media artist and experimental filmmaker Max Hattler works primarily with animation, and as an extension of his film and video work he performs live audiovisual works during festivals, exhibitions, and in clubs (Hattler 2019). His work explores the relationships between abstraction and figuration, sound and image, precision and improvisation, and aesthetics and politics (City University of Hong Kong 2015).

Some examples of his live audiovisual performances are *Hattlerized Motorsaw* with Motorsaw and Schmid at ISFF Detmold in 2012, *Hattler VS. Hattler* at Sonic Visions in 2012, *Hattlerizer 2.0* at Schaustelle in 2013, and during the *Audiovisual Spectacular* in 2015 at the Seoul Museum of Art where he collaborated with South Korean electronic music band Idiotape [figure 43] (Hattler 2019).

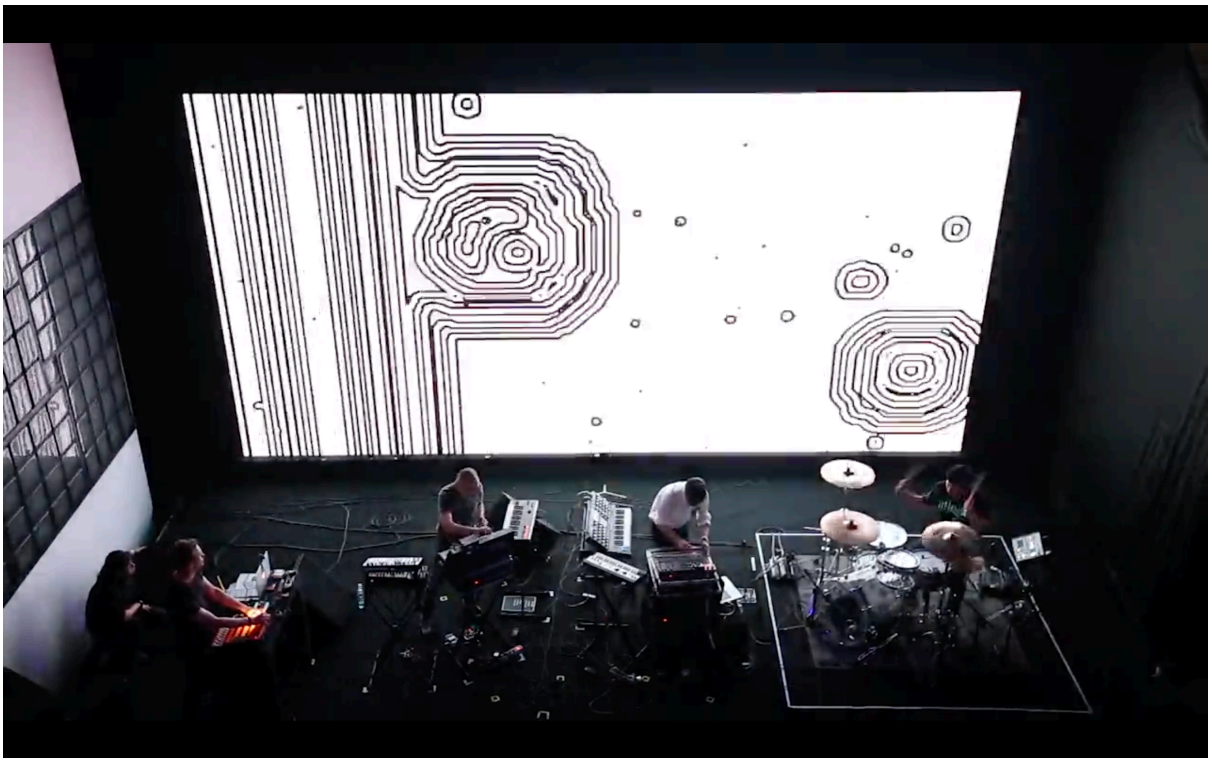


Figure 43 - Idiotape and Max Hattler at Seoul Museum of Art, Seoul, Korea, 2015 (Hattler)

As well as Henke and Hattler, examples of innovative audiovisual performances are: *Imposition* from 2012 by Edisonnoside and Daniel Schwarz, they created video clips that are projected onto a field of rods (Schwarz); *DROMOS* in 2013 created by the duo Mathieu Le Sourd (MAOTIK) and Eric Raynaud (FRACTION), which was a 360-degree immersive universe where minimal and experimental sound textures correspond and synchronize with shiny and dynamic visuals evoking the aesthetics of speed [figure 44] (Maotic & Fraction 2013); and the visual installation *LEVEL* from 2015 made for the fifth anniversary celebration of a nightclub, by Paris-based design studio IF. In this installation displays project a fast-paced series of optical mind tricks and dizzying distortions set to the tracks of artist Trespur (Emory 2015).



Figure 44 - *DROMOS* by Mathieu Le Sourd and Eric Raynaud (Maotic & Fraction 2013)

Apart from constructing the many audiovisual performances that center around digital media or music,

Christian Marclay and Björk are examples of artists who created innovative performances by making use of other attributes.

2.3.2.3 Berlin Mix

In 2009, visual artist and composer Christian Marclay organized an innovative live simultaneous concert called *Berlin Mix,* featuring 180 musicians, varying from hip hop DJs to opera singers to an accordion orchestra (Huffpost 2014). Marclay acted as the conductor from a podium in the center of a Berlin formed train shed, and they created an illuminating and fascinating pastiche or contemporary music. By doing this, he had accomplished live what in the past had been achieved with tape loops and turntablist techniques (Eisinger 2013).

2.3.2.4 Biophilia

Icelandic artist Björk implemented science and technology together during the live performance tour of her album *Biophilia* from 2011. Apart from this album being the world's first app album (Binder 2011), where each track was released with a different app, these performances included workshops, a mixture of traditional and electronic instruments, a female choir, a light show, and interwoven footage of astral bodies, dancing microbes and pulsing starfish (Felperin 2014).

As well as Marclay and Björk, there are many more artists who make use of live/acoustic features together with electronic elements during their performance. For instance musician and DJ Bonobo and Floating Points with a live band, or drum and bass producer Netsky, who toured with a drum and bass ensemble (Jones 2016).

2.3.2.5 Color-Music

A feature of a successful performance instrument or any other instrument is that when a system's possibilities are easily or quickly exhausted by the user, the user loses interest. In the field of color-music instruments, the use of canned audiovisual materials (like pre-prepared audio loops, cardboard templates or bitmapped spires), is one of the most predictable indications that the system's expressivity is very limited.

However, unfortunately it is not enough to design a system with a variety of possibilities, if those results are difficult or impossible to control. This means that for a system's infinity it is needed to be balanced by a deep malleability, to match the number of degrees of freedom closely to the number of controls or expressive handles (Levin 2000, 54).

On top of that, most of the systems which use image and sound together have focused on only one of these elements, to the drawback of the other. Although some of the earlier keyboard-systems like Castel's *Clavelin Oculaire* and its many developments provided an acceptable control of colored lights, the results of this imagery were clearly overthrown in comparison to the highly evolved musical structures that could be played on the keyboard's strings or pipes. Thus, the problem with these systems is that the expressive capabilities of their aural and visual elements are unequal and balanced. According to Levin "It is straightforward to imagine even more systems which control sound from a GUI, or which have visuals which react to sound. It is more challenging, however, to propose that a successful audiovisual instrument ought to yield equally expressive performances in the image and sound domains"

(2000, 55).

Furthermore, when using visual elements in a live performance it is essential to be conscious about what kind of meaning will be added to the total experience. Sometimes, the performance may perhaps be more effective without any visual elements (including even the presence of the performer) (Kakinoki 2017, 8).

Simon Emmerson writes that "the acousmatic condition, in depriving us of what we have been told is the dominant sense perception of the late twentieth century media, and has engaged and encouraged that most essential faculty, the imagination" (2007, 34).

Composer Karlheinz Stockhausen was also more of a supporter of the acousmatic condition: "The present fashion to add visual effects to almost all the music performed should diminish. Listening to music in the dark will become much more important in the future than today" (in D'Escriván 2017).

Finally, according to Emmerson, "In an ideal performance, the audience should be able to sense a performer's physical actions which change the real sounding nature of the music, strongly enough to believe the relation between the actions and related sounds during the performance (2007, 90).

2.4 AUDIENCE EXPERIENCE

How do listeners use this auditory and visual information to judge performance quality? When considering how someone engages with audiovisual events, Chion's listening modes come to mind. Apart from physically omnipresent sound called passive perception, there is active perception which he divided in three listening modes: causal, semantic and reduced (1994, 24).

2.4.1 TYPES OF AUDIENCE

Sociologists Nicholas Abercrombie and Brian Longhurst (1998) proposed three types of audience that have important distinctions: (1) simple; (2) mass; and (3) diffused. A simple audience event often takes place in a public space, and performers and the audience communicate directly in a performance setting which involves strong ritual elements (for example a concert or football match audience).

Contrarily, mass audiences usually exist in private rather than public spaces, the performance generally needs less focused audience attention, and the communication between the audience and a performer is not as direct (for example a television or radio audience).

Finally, the diffused audience experience refers to the way in which "in contemporary society, everyone becomes an audience all the time. Being a member of an audience is no longer an exceptional event, nor even an everyday event. Rather, it is constitutive of everyday life" (Abercrombie and Longhurst 1998, 68).

Because the audience of audiovisual performances can vary depending on the type of elements, this

section will be narrowed down to the ‘simple’ audience which takes place with ritual elements (public space, etcetera).

Apart from the type of audience, there is a fundamental difference between the audiovisual economy of the performance. For instance, audiences at musical performances where they use traditional instruments are assumed to understand the underlying cause-and-effect relationship between what they see and what they hear. While on the other hand, audiences of a performance where music is made by relatively unfamiliar digital devices (MIDI interfaces, laptops and computers as instruments) cannot be assumed to understand this relationship between the performers’ actions and the resulting sounds (unless the audience is familiar with those technologies) (Auslander 2013, 2).

2.4.2 AUDIOVISUAL PERFORMANCE MODES

Influenced by Chion’s listening modes, PhD researcher Léon McCarthy isolates three modes of audiovisual engagement and accompanying keywords that would suggest the presence of these modes in the audience’s comments (2013, 309).

Chion’s causal mode of listening has to do with cause and effect, and observation and sensation. For this listening mode McCarthy proposed a perceptive mode in which audience members were observing and reacting purely to the content within the performance. Chion’s semantic mode calls for more of the rational faculties of the listener as they see for meaning from the sounds, and McCarthy’s proposed mode is called interpretive. It is a mode in which audience members seek out connections and meanings from the events in the performance.

Finally, for Chion’s third reduced mode of listening in which he believes the listener can focus on the physical traits, McCarthy proposed a reflective mode of engagement. Even though it was difficult to link this mode exactly to the physical traits, McCarthy noted many comments that were reflecting on the nature of the performance; the stage setup; and the memories that were being triggered [figure 45] (2013, 310).

Chion’s listening modes	Audiovisual Performance Modes
Causal	Perceptive
Semantic	Interpretive
Reduced	Reflective

Figure 45 - modes of engagement (McCarthy 2013, 310)

Perceptive	Interpretive	Reflective
I like...	I do not understand the...	What if he changed the...
The... appeals to me	That means...	The aesthetic is...
That is an interesting...	It suits the mood of...	I would like more...
The... was triggering...	The plot is...	This could also be...
The... was repetitive	The narrative is...	That reminds me of...
It has a... aesthetic	The symbolism is...	It would not be... if...

Figure 46 - typical phrases that tended to reveal which of the three modes of engagement a participant was revealing (McCarthy 2013, 310)

Another way to gather quantitative feedback from the audience is a questionnaire or interview. But McCarthy explains that even though he analyzed these post-performance questionnaires, they had given him general insights on the audience's experience but nothing about how specific this audio-visual happening had steered their engagement (2016, 44).

However, what contributes to shaping the audience's experience of a performance? A possibility is the audience's curiosity that drives them to seek meaning from a performance, with their quest for meaning then shaping their experience. Sometimes the importance is their impression or vision of the meaning shown during the performance, influencing their search through audiovisual elements (McCarthy 2016, 23).

2.5 RESEARCH QUESTIONS

When returning to the objectives of this research there are still some questions left unanswered, which depend on the components of Marinho's performance.

Will sight oversee sound? Will the audience still listen to the music if they look at the visuals? And what would be the best way to combine these two elements together?

This problem statement is translated into a research question which will be used by conducting further research:

How to create visuals for a baroque music recital, where the visual component supports the auditory component instead of overwhelming the audience, and influencing their awareness too much?

The following sub-questions are set-up to help answering the research question:

1 How does the audience describe the recital after their first experience, and how do they feel about it?

2 What is the first element that grabbed their attention, and did this change after a while?
3 What are the main factors the audience focusses on during an audiovisual performance, and what comes to mind when they think about it?

The next section will explain how the answers to these questions are being developed through conducting qualitative research.

3 DESIGN EXPERIMENTS

3.1 METHODOLOGY AND OPERATIONALISATION

On top of secondary data, primary data will be collected to answer the research question and its sub-questions. We will use two different types of qualitative data (Kumar 1999, 103).

Experiment

The experiments will be conducted by developing rehearsals, some of which will be open to the public. This will be executed in different ways: through an audience being present at the moment, and through video documentation of the auditory combined with visual elements during the rehearsals. The audience visiting or seeing these rehearsals (both in real-life and by watching the video), will be the participants for the interviews.

These experiments are used to capture the production and creation of this recital from both visual and auditory aspects, and to grow and learn from the feedback given by the participants (Kumar 1999, 335).

In-depth interview

The in-depth interviews' themes will be the focus, the feeling, and the combination of the components the participants make after seeing the rehearsals. On top of that they will explain what they feel about the attention the visuals and/or audio need during an audiovisual performance, and what first comes to mind when they remember it later on.

To be able to answer the research question it is important to capture the first thoughts and feelings about what they saw, and to make sure they are not biased by the point of view they have or way they see the recital. If they are, this can and will affect the answers given and data collected and have impact on answering the research question of this study (Kumar 1999, 131).

3.1.2 SAMPLE

The sample size representing this study will be a mixture of the Purposeful Sample and the Judgement sample. Most of the participants will be rich cases for the in-depth interviews and have a background related to a variety of audio, visual or design, so their answers can be an addition to the data received (Education Centre n.d.).

Participants who have visited different types of musical audiovisual performances before will be useful, since they might have insights and experience that can interestingly fulfil the gaps of data needed to

answer this research question. Specific information about the participants brought together is shown in APPENDIX 5 (Kumar 1999, 193).

3.1.3 LIMITATIONS

Limitations that can occur during this research may have to do with the sample size chosen and the subjective answers that can be given. Because the research question and sub-questions also have to do with opinions, personal experience and background, the results can vary when different participants are chosen. This means a sampling error can take place, because there is no guarantee that any sample will be representative of the population (Education Centre n.d.).

3.2 AUDITORY AND VISUAL COMPONENTS

In this section both of the main elements used within the audiovisual performance will be described and explained. The auditory elements are the musical pieces which a variety of musicians will perform together. Because other elements created or decided are inspired by these auditory elements and because these elements are fixed, they will be identified first.

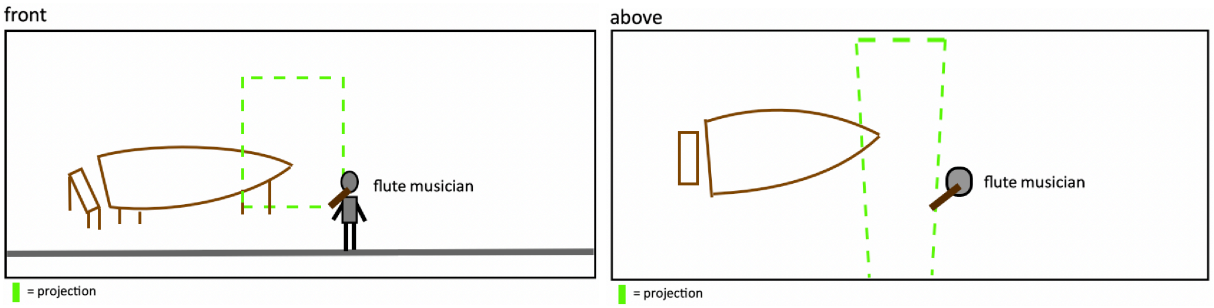
3.2.1 BAROQUE FLUTE

The performance will consist of 19 pieces of music, centered around Liliana Marinho playing a baroque flute. The recital is divided into three sections. Within these sections, the concept *happiness is bigger when we share* will be displayed. All musical pieces together will take around 52 minutes.

The first part contains of four pieces composed by Johann Sebastian Bach.[26] The four pieces are:

Partita for Flute (A minor), BWV 1013

1 *Allemande*
2 *Courante*
3 *Sarabande*
4 *Bourrée Anglaise*



Figures 47 and 48 - musician on stage during the first part, view from up front (left) and above (right)

[26] Eisenach 1685 – Leipzig 1750

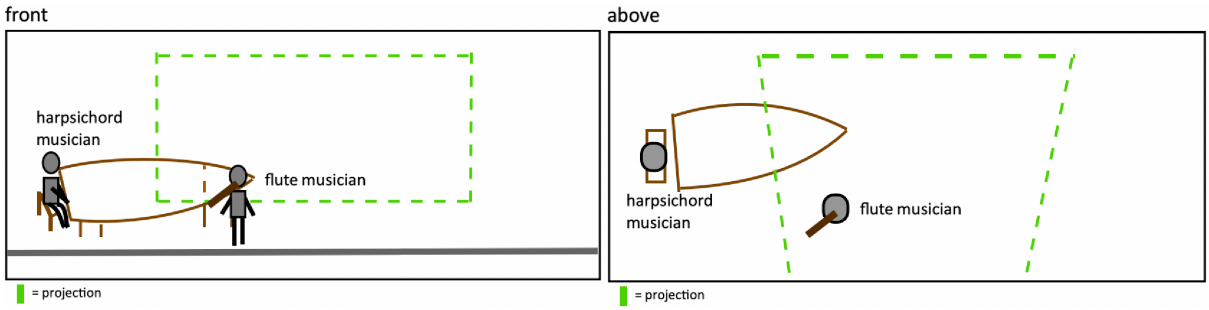
Figures 47 and 48 show the location of the flute musician on stage during the first part.

Within section two a musician playing the harpsichord will join on stage. Together with the flute they will play 9 pieces composed by Jacques Hotteterre.[27]

Pieces Pour la Flûte-traversiere, Op. 2, Quatriéme Suite

I. *Prelude. Lentement*
II. *Allemande. La Fontainebleau. Gravement*
III. *Sarabande. Le Depart. Doulouresement*
IV. *Air. Le fleuri. Gayement*
V. *Gavotte. La Mitilde. Tendrement*
VI. *Branle de Village. L'Auteüi*
VII. *Menuet. Le Beaulieu*
VIII. *2e. Menuet*
IX. *On Reprend le Menuet Precedent*

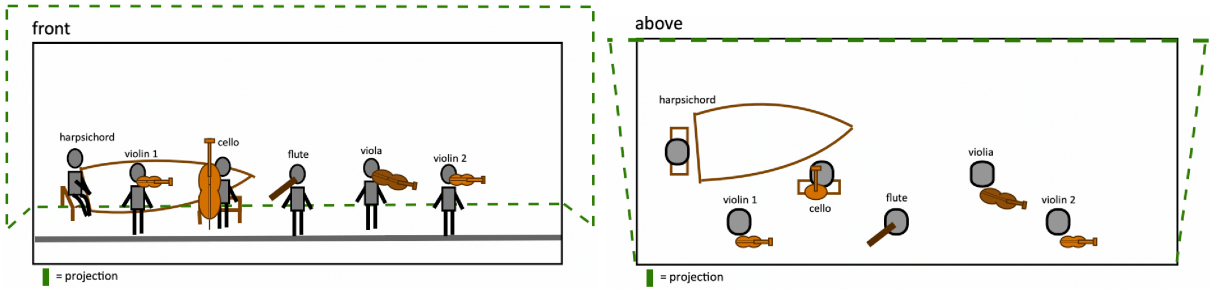
Figures 49 and 50 show the location of the musicians on stage.



Figures 49 and 50 - musicians on stage during the second part, view from up front (left) and above (right)

For the third and last section, four other musicians will enter upon stage. These musicians play cello, violins and a viola. The three pieces played in this part are composed by Carl Philipp Emanuel Bach.[28]

Concerto in D Minor, Wq. 22
I. *Allegro*
II. *Un Poco Andante*
III. *Allegro di Molto*



Figures 51 and 52 - musicians on stage during the third part, view from up front (left) and above (right)

[27] Paris 1647 – Paris 1763
[28] Weimar 1714 – Hamburg 1788

Figures 51 and 52 show the location of the musicians on stage, but eventually this has changed during the final performance. This is clarified within the conclusions. The three sizes of projection are explained in the next section.

3.2.2 VEGETATION

The visual theme chosen for the visuals of the performance is vegetation. This theme is inspired by three main reasons: (1) the type of music; the general characteristics of baroque music are melody, texture and timbre. When listening to these pieces it is possible to imagine birds chirping, river water rushing, or any other natural sounds around you. Showing plants and trees through video images keeps the visual element close to the feeling the music gives, and reduces the gap between the who elements. (2) The baroque flute; the main instrument in the performance connects as well with natural sounds, for instance like birds chirping. Furthermore, it can (as shown in the results) easily give a feeling of being in a natural or green environment (for instance with Peter Pan, who plays the pan flute).

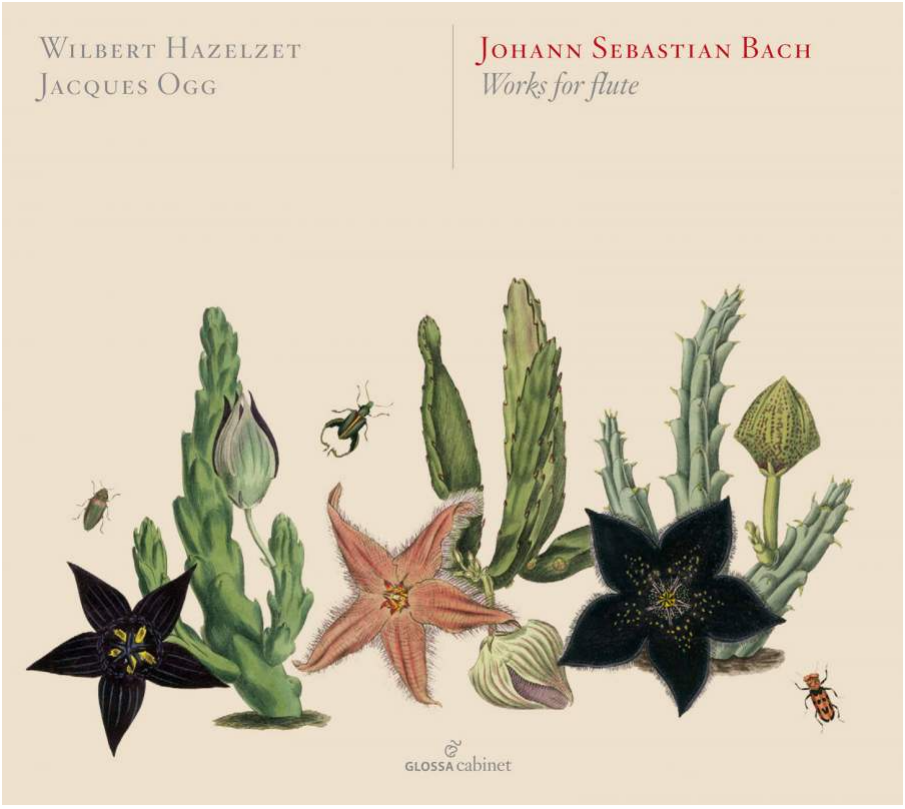


Figure 53 - Bach: Works for flute album cover (Hazelzet and Ogg 2017)[29]

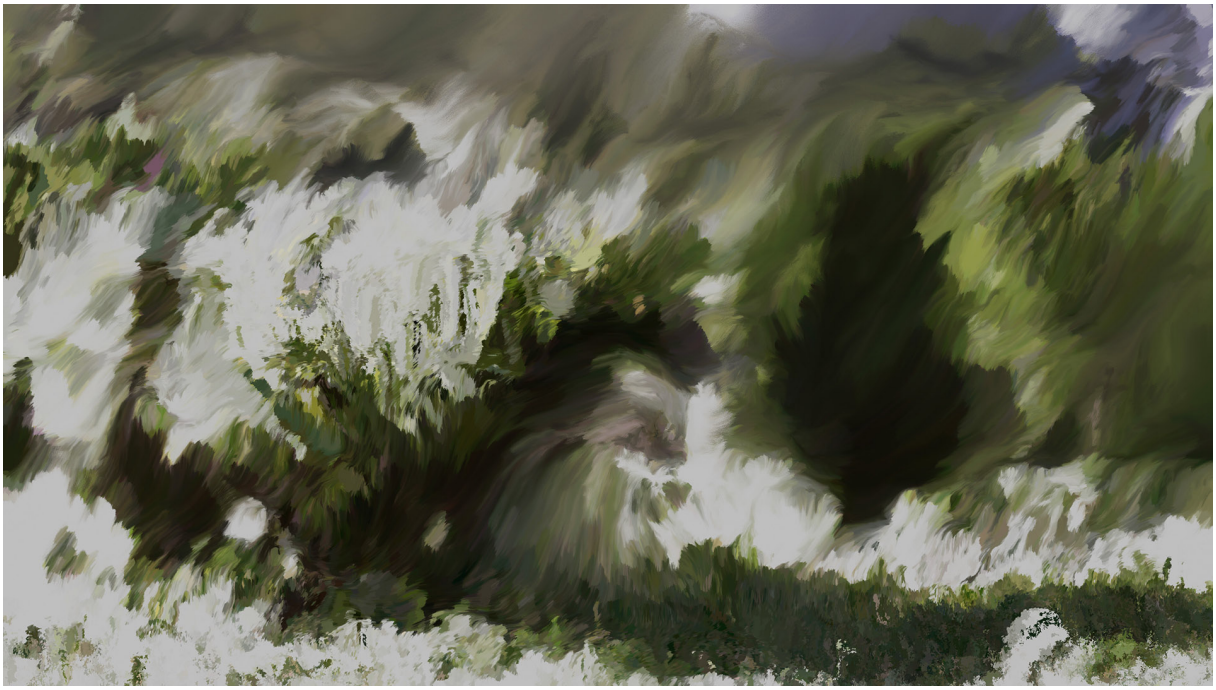
The third reason (3) is the acoustic performance; the music is acoustic and does not need any amplification. This made it interesting to choose something that is a mixture of analog and digital.

Apart from the auditory reasons, artist Quayola has given an inspiration with his works *Pleasant Places* and *Jardins d'Été*.[30]

[29] The illustration on the album of Johann Sebastian Bach called Bach: Works for flute, connected as well with the chosen theme
[30] Summer Gardens

3.2.2.1 Pleasant Places

Pleasant Places are a series of digital paintings made by Quayola, in 2015. Inspired by the work of Vincent van Gogh[31] and titled like the first series of landscape prints that were produced in The Netherlands in the seventeenth century. Digital videos of landscapes are manipulated, and the photographic image is being challenged through proposing alternative types of vision and synthesis. Pleasant Places explores the boundaries between representation and abstraction, while the nature becomes dense and almost impenetrable [figures 54 and 55] (Quayola 2015).



Figures 54 - still of *Pleasant Places* (Quayola 2015)



Figure 55 - still of *Pleasant Places* (Quayola 2015)

[31] Zundert 1853 - Auvers-sur-Oise 1890

3.2.2.2 JARDINS D'ÉTÉ

Jardins d'Été was made in 2016 and consists of a series of high-resolution digital video paintings. These video paintings are inspired by the French impressionism and works of Claude Monet,[32] and show classical landscape paintings. Quayola filmed the landscapes and nature at night with the use of artificial light, and manipulated the videos through computational analysis of motion, composition and color schemes [figures 56 and 57] (Quayola 2016a).



Figure 56 - still of *Jardins d'Été* (Quayola 2016b)



Figure 57 - still of *Jardins d'Été* (Quayola 2016b)

[32] Paris 1840 – Giverny 1926

3.2.2.3 Botanical Garden

To create visuals connecting to vegetation and with Quayola's artworks in mind, an accumulation of videos was shot in a variety of locations. Some examples are Jardim Botânico do Porto,[33] Parque do Horto das Virtudes[34] and Sever do Vouga. These videos contain different aspects of vegetation, in order to connect them to the three different sections of the auditory part.

For the first section, where the flute musician plays solo, simple and zoomed in videos were made mainly from flowers. Videos for the second musical section are a more zoomed out and contain moving nature, and the third musical section with six musicians on stage will be performed with videos from even further away [figures 58 until 63]. Apart from the distance and frames, the videos are connected to the musical pieces by rhythm and melody. Gradually the melody and the rhythm become different since additional instruments join, which asks for moving images of vegetation that connect to this.



Figures 58, 59, 60, 61, 62 and 63 - stills of videos made for the visuals

[33] Porto Botanical Garden
[34] Garden Park of Virtues

3.3 SOFTWARE

The software used to process the prerecorded videos in real-time was developed in the programming environment Max 8.[35] The patch[36] created contains computational objects that process the digital video signal and is controlled – via MIDI protocol – by an Evolution UC-33 Controller.

The patch deals with prerecorded videos, in 50 frames per second. These videos are operated through different matrices [figure 64].[37]

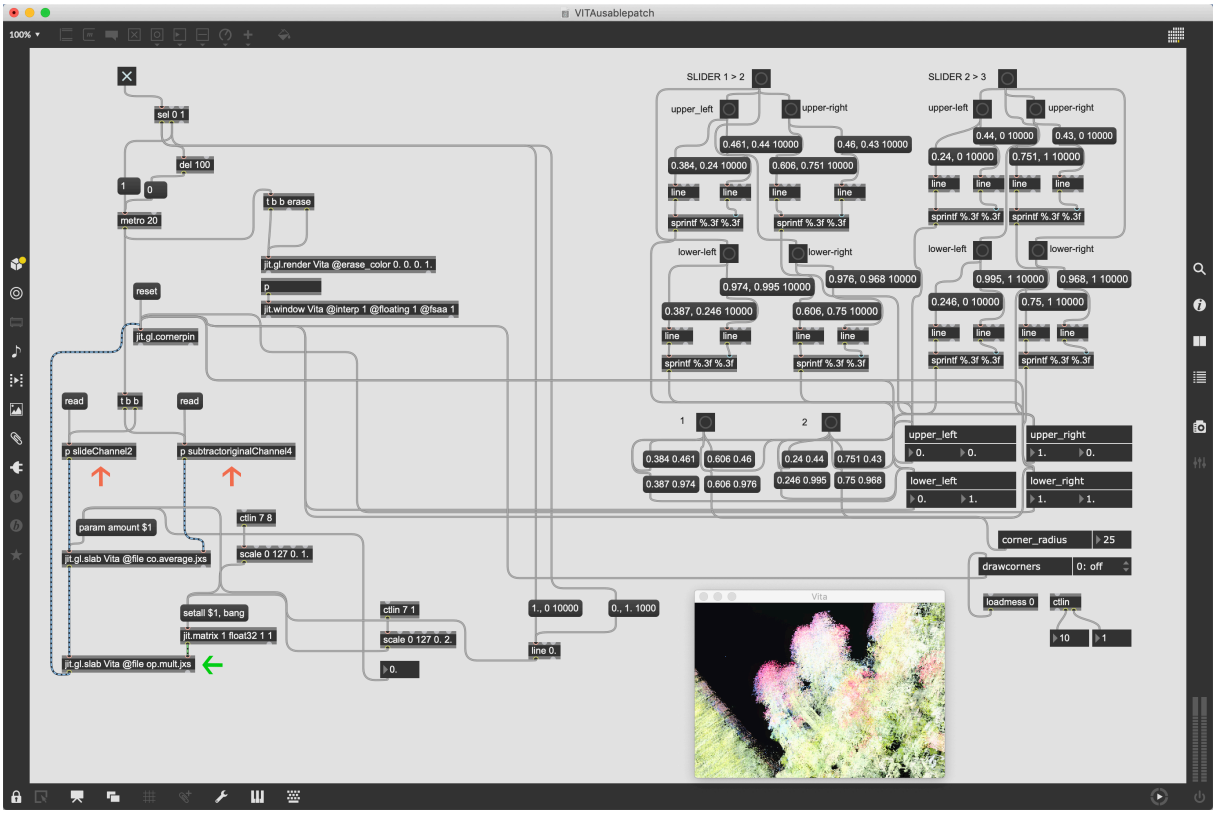


Figure 64 - screenshot of *VITAusablepatch*

3.3.1 SLIDECHANNEL2

Within sub-patch slideChannel2 [figure 65] a video is loaded through object *jit.movie*, with attribute *@engine hap @output_texture 1*. Thereafter the values of the matrix of the video stream are multiplied by an empty black matrix, through object *jit.gl.slab Vita @file op.mult.jxs*. Message *setall $1, bang* changes the data from this multiplied matrix to the value provided by the MIDI Controller. Through the controller the values from 0 to 127 can be mapped to values from 0.6 to 1. This means the brightness of the video changes to dark or light, but it never gets completely black.

[35] https://cycling74.com/
[36] Patches are Max programs made by connecting and arranging building-blocks of objects within a patcher
[37] For more detailed information about Max objects used consult Max Documentation Online https://cycling74.com/support/documentation

The object *jit.gl.slab Vita @file tp.slide.jxs* is a cellwise temporal envelope follower. It makes a temporal following of the changes of the pixels in the matrix, in a way that if a current frame has a white pixel while in the next frame that pixel is black, there is no radical change visible. Just like the object before, this is controlled by the MIDI controller, from 0.5 to 500.

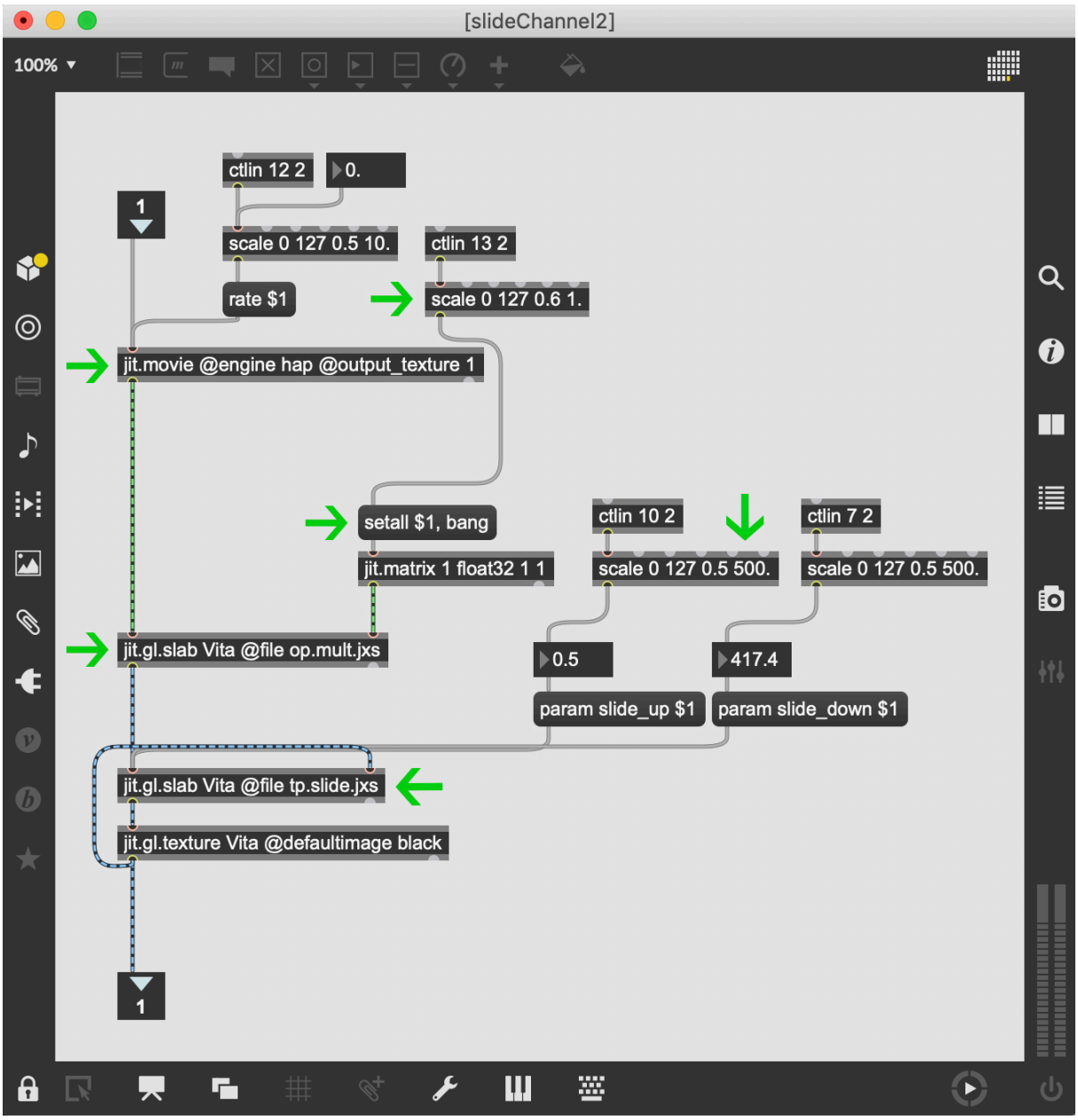


Figure 65 - screenshot of sub-patch *sideChannel2* within VITAusablepatch

3.3.2 SUBTRACTORIGINALCHANNEL4

Within sub-patch subtractoriginalChannel4 [figure 66], another prerecorded video is loaded through object *jit.movie* with attribute *@engine hap @output_texture 1*. The next object called *jit.gl.slab Vita @file cc.saturate.ip.jxs* desaturates the video image, and converts it into a single luminance matrix instead of a RGB matrix.

The object *jit.gl.slab Vita @file op.absdiff.jxs* works as a movement tracker, it calculates the difference of brightness between a current pixel and the previous pixel within the matrix. Like said before this happens 50 times per second for every pixel, so for a matrix resolution of 1920 x 1080 pixels there is a total of 2.073.600. This means it calculates the difference between around two million pixels, 50 times per second.

Thereafter the white pixels within the video image are the pixels that changed brightness (compared to the pixel before), and black pixels are the pixels that did not change from the previous frame to the current frame. For instance, if the video shows a blue sky which is not moving, it gets black because there is no change in the pixels. If there are leaves in the wind moving, those pixels will get white.

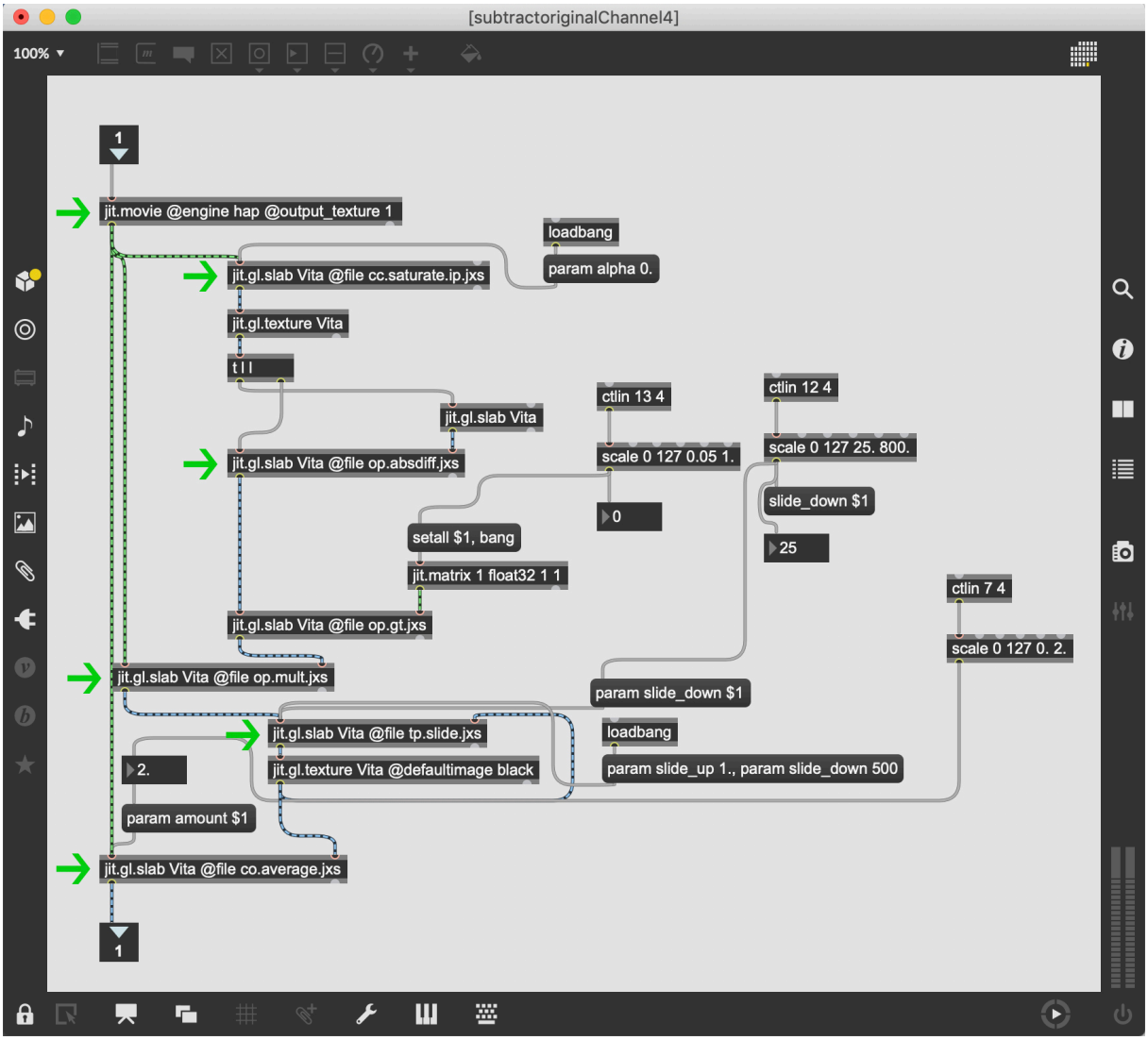


Figure 66 - screenshot of sub-patch *subtractoriginalChannel4* from VITAusablepatch

Object *jit.gl.slab Vita @file op.mult.jxs* multiplies the original video matrix with the processed video matrix resulted from the subtraction process described before. This processed video contains only black and white images (black from the unchanged pixels and white from the changed ones), while the original video is an RGB file. When these matrices are multiplied by each other all the pixels from the original video matrix that do not change over time become black, because black correspond to 0 and times any

number equals 0. This means that after the multiplication the unmoved and black pixels stay like a black background, while moving pixels end up in the original color.

This multiplied video matrix continues into object *jit.gl.slab Vita @file tp.slide.jxs*. This object makes the same temporal following of the changes of the pixels in the matrix, just like in the other sub-patch, which smoothens the changes in pixels brightness along time.

The bottom object called *jit.gl.slab Vita @file co.average.jxs* located right before the outlet, mixes again the original video stored in the hard disc with the processed video with the black background and colored movements. Eventually when turning back to the main patch, the process of the two sub-patches are mixed together.

Back in the main patch both processed videos matrices can be processed at the same time, or separately. Finally the object *jit.gl.slab Vita @file op.mult.jxs* controls the final fade, which is the master fade that allows the screen to turn all black any time wanted [figure 64].

3.3.3 CORNERPINS

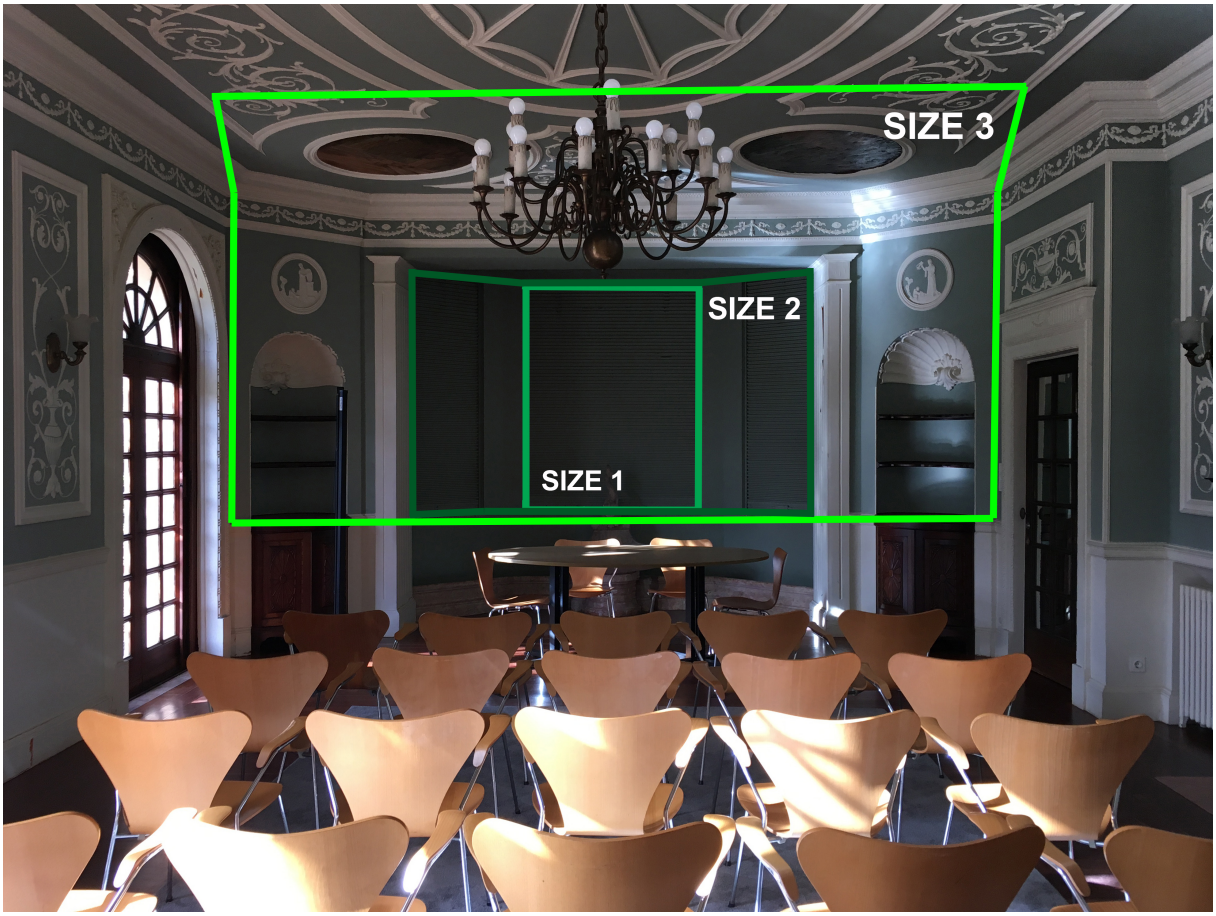


Figure 67 - three sizes of the video layer

A corner-pin provides controls for mapping matrices to an output window, by repositioning the image corners. The right part of the main patch controls the coordinates of these corner-pin of the video layer in the projection, which is used in combination with the three musical sections [figure 68]. The

projection for the first musical section will be smallest, the projection for the second musical section is a bit bigger, and the projection for the third musical section is the biggest. The patch contains buttons for size one and two, the third section is the maximal size the projection can be [figure 67]. During the final performance the location of the projection has changed. This is explained in the conclusions.

Within the patch the buttons number 1 and 2 linked to the messages, contain different coordinates for the corners of the video projection. For example 0.384 0.461, which are the x and y coordinates in the screen.

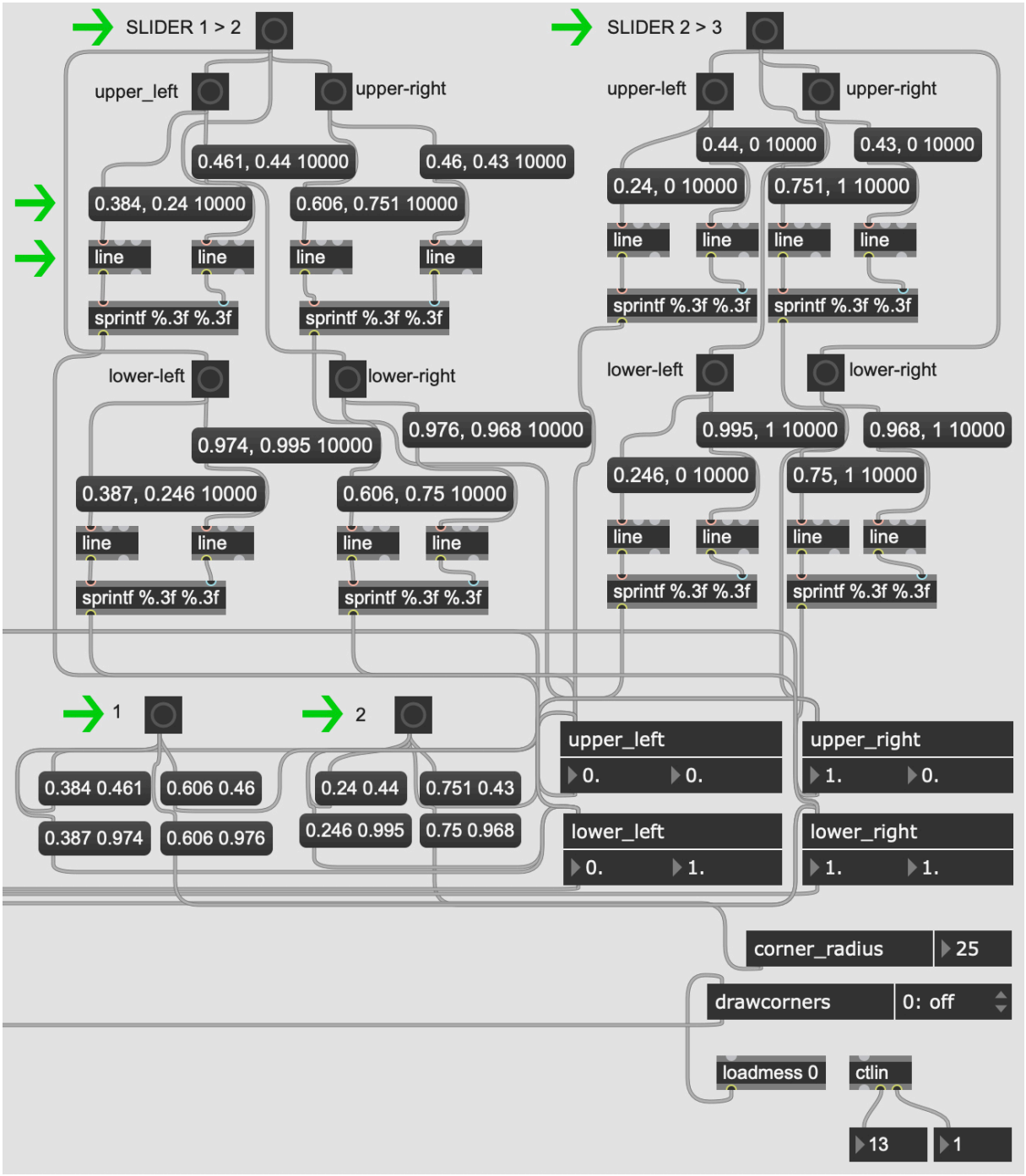


Figure 68 - screenshots of coordinates for jit.gl.cornerpin objects on the main patch of VITAusablepatch

Buttons *SLIDER 1 > 2* and *SLIDER 2 > 3* are created to change the projection size from one to another. By clicking these buttons, the visibility of the visuals expands from size 1 to size 2 and size 2 to size 3, each transition lasting 10 seconds. The transitions are achieved with the object *line*.

The object *line* generates a ramp of numbers in a certain amount of time. For instance, within *SLIDER 1 > 2* and the *upper_left* corner, the object *line* receives the message with the numbers 0.384, 0.24 10000. This message is telling the line that the x coordinate of the upper left part of the video rectangle needs to go from 0.384 to 0.24, in 10 seconds (in this case the y coordinate needs to go from 0.461 to 0.44, also in 10 seconds). This means the first number shows the starting coordinate of the corner, the second number shows the end coordinate of the corner, and the third number shows in how many milliseconds this movement needs to be completed.

If the message only contains one single number, the object line outputs that number immediately. This is shown within the messages containing only the x and y coordinates of the corners, linked to button 1 and 2.

3.3.4 IMPROVEMENTS WITHIN PATCH

One of the improvements made during the development of this patch are the changes from only green patch-chords to blue and green patch-chords. The green patch-chords are processes happening in the processor of the computer, while the blue patch-chords makes sure the videos are being processed by the graphics card of the computer. The graphics card of the computer is much more powerful than the processor of the computer.

First all the processes were done with the CPU, the processor of the computer, but because of the need for fluence and speed of calculation during these processes this improvement has been made.

In the main patch as well as the sub-patches this is shown as objects *jit.gl*, and they are based on *OpenGL*. *OpenGL* is the cross-language, cross-platform application programming interface that deals directly with a graphics processing unit (the graphics card) on the computer (The Khronos® Group Inc n.d.).

Another improvement is the compression of the prerecorded videos into HAP. HAP is a very specific low compressor for real-time video processing (HAP Codecs). It is the fastest and easiest compressor to access the data of the pixels from video stream (in this case 50 images per second). This works within Max with the extra plugin called HAP and when the attribute *@engine hap @output_texture 1* is added to the objects *jit.movie*.

3.3.5 VISUALIZING MUSIC

During the development of the patches, the musical pieces are visualized on paper. The aim was to understand and get to know the auditory element of the performance better, by visualizing the compositions in three ways: melody, instruments, and rhythm. This is done by listening to it piece by piece, and while doing that illustrating what is being perceived.

A big reason why it is important knowing the musical element thorough, is because the MIDI-controller will be controlling the values of the video images in a variety of ways (tempo/brightness/darkness/cellwise temporal envelope follower/color subtraction), live and connected to the music during the performance.

Photos of the illustrations are shown in APPENDIX 1.

4 OPEN REHEARSALS

The experiments – open rehearsals – are conducted and documented in three different stages. Within the first rehearsal the visuals that were shown focused on the brightness vs. darkness. Within the second rehearsal the visuals focused on being filled (and therefore more chaotic) with movements, and within the third rehearsal the visuals focused on the type and size of visuals connected to the three musical sections that will be played.

4.1 ROOM 210

The first experiment was conducted in ESMAE (Escola Superior de Música e Artes do Espectáculo), in room 210. The auditory component consisted of Marinho the flute musician, who rehearsed the first four pieces of the *Partita for Flute (A minor)* from Johann Sebastian Bach. This rehearsal took place at 22:00 ‘o clock and so the room was completely dark, apart from the small light shining to make the musical notes visible.

Behind Marinho videos of vegetation were manipulated and projected on the wall, by a ViewSonic PJD78220HD projector. The visuals shown varied in content and in brightness. A small audience has participated in this open rehearsal, and the rehearsal (visuals combined with the musical pieces and location) has been filmed. The floorplan and stills of this video are shown in APPENDIX 2.

4.2 ROOM 209

The second experiment was as well conducted in ESMAE, but in room 209. The auditory component consisted of Marinho together with the harpsichord player. They rehearsed the second section of music, *Pieces Pour la Flûte-traversiere, Op. 2, Quatriéme Suite* by Jacques Hotteterre. Because the rehearsal took place in the day, the room was partly illuminated.

Behind the musicians the manipulated videos of vegetation were projected on the wall, by the ViewSonic PJD78220HD projector. This time the visuals that were shown were fuller and contained more chaotic and moving images of vegetation. A reason for this was the room being illuminated, and the visuals were harder to see. Another reason was to experiment with these kinds of visuals, and to see how the audience would respond to it. A small audience has participated in this open rehearsal, and the rehearsal (visuals combined with the musical pieces and location) has been filmed. The floorplan and stills of this video can be found in APPENDIX 3.

4.3 CASA DE ALLEN

The third and last experiment was held in Casa de Allen. Casa de Allen is currently allocated to the Northern Regional Direction of Cultural Extension, and apart from the Archive and Library it also provides rooms for cultural and social activities (Casa de Allen n.d.). Because one of those rooms is chosen to be the location for our final performance, the third experiment was located there [figures 69 and 70].



Figure 69 - Casa de Allen

This open rehearsal consisted of Marinho rehearsing different pieces from all three musical sections. The visuals shown through the ViewSonic PJD78220HD projector collaborated with these three sections. The first section started with a small projection square as big as the middle window next to the musician, showing flowers. The second section contained a wider square covering all back windows, showing zoomed out plants and trees. Within the third section the projection covered the whole backwall and a part of the ceiling, showing plants and trees further away and/or with more movement. The windows and doors were blinded so the room was completely dark, apart from the small light shining to make the musical notes visible.

A small audience has participated in this open rehearsal, and the rehearsal (visuals combined with the musical pieces and location) has been filmed. The floorplan and stills of this video can be found in APPENDIX 4.

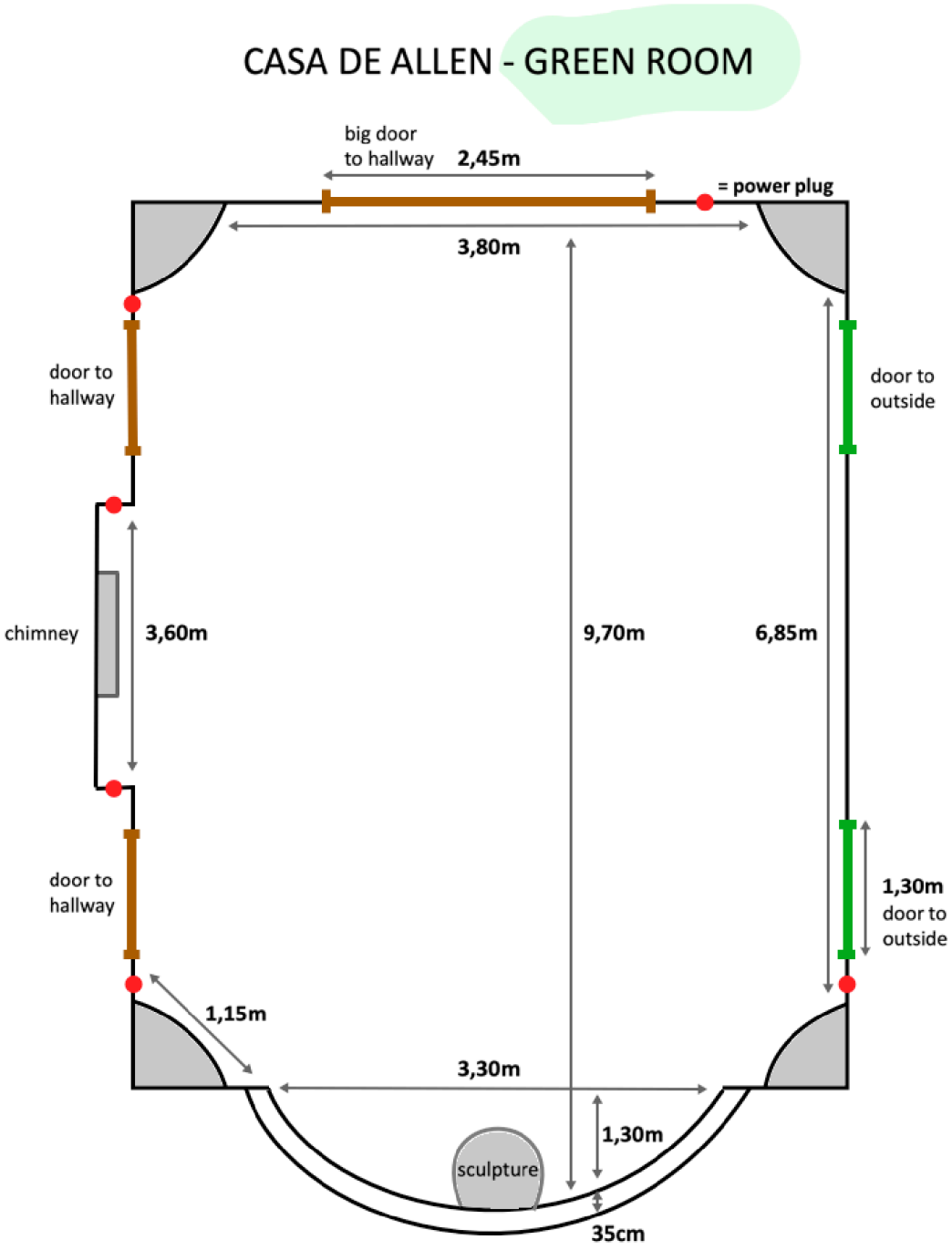


Figure 70 - floorplan of the green room in Casa de Allen

After and during the conduction of the experiments a variety of respondents were interviewed about their opinions, ideas and thoughts.

4.4 RESULTS

The in-depth interviews were divided in three different sections. The first part focused on the first impressions, feelings, and focus points the respondents had by seeing the open rehearsals, without the respondents knowing about the aim of the visuals. The second part was centered around all kind of audiovisual performances, and their thoughts about the focus they normally have and what they remember thinking about it. The third section focused on this specific audiovisual performance and the aim to not overwhelm the other elements or dominate the performance. The first two sections are connected to the sub-questions of this study.

The interview questions, the extended analysis and code generation are shown in APPENDIX 5.

Sub-question 1. How does the audience describe the recital after their first experience, and how do they feel about it?

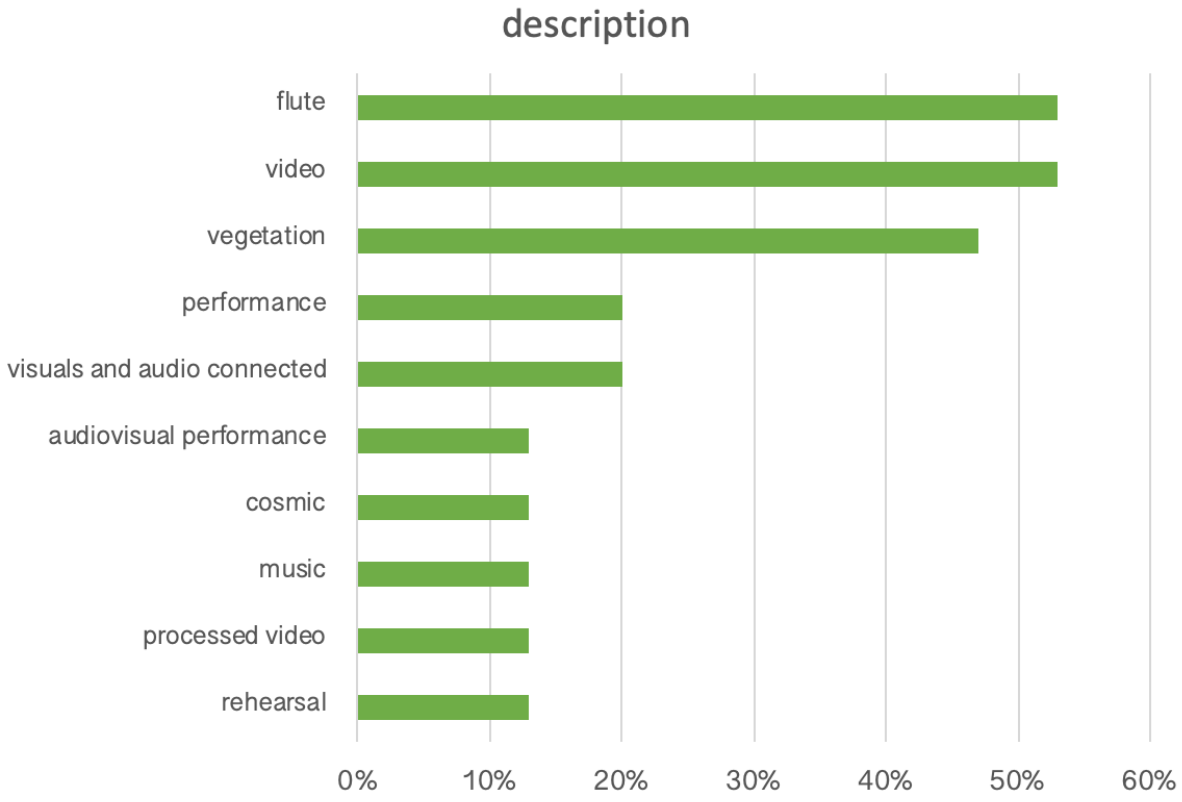


Figure 71 - respondents describing open rehearsals 1, 2 and 3

The collected interview data shows that 53% of the respondents mentioned they saw a flute and a video. 47% mentioned vegetation, 20% mentioned a performance, and that the visuals and audio were connected to each other. 13% called it an audiovisual performance, something cosmic, music, processed video, and a rehearsal [figure 71]. An example of other answers mentioned once were baroque, exhibition, musician, visuals and a story.

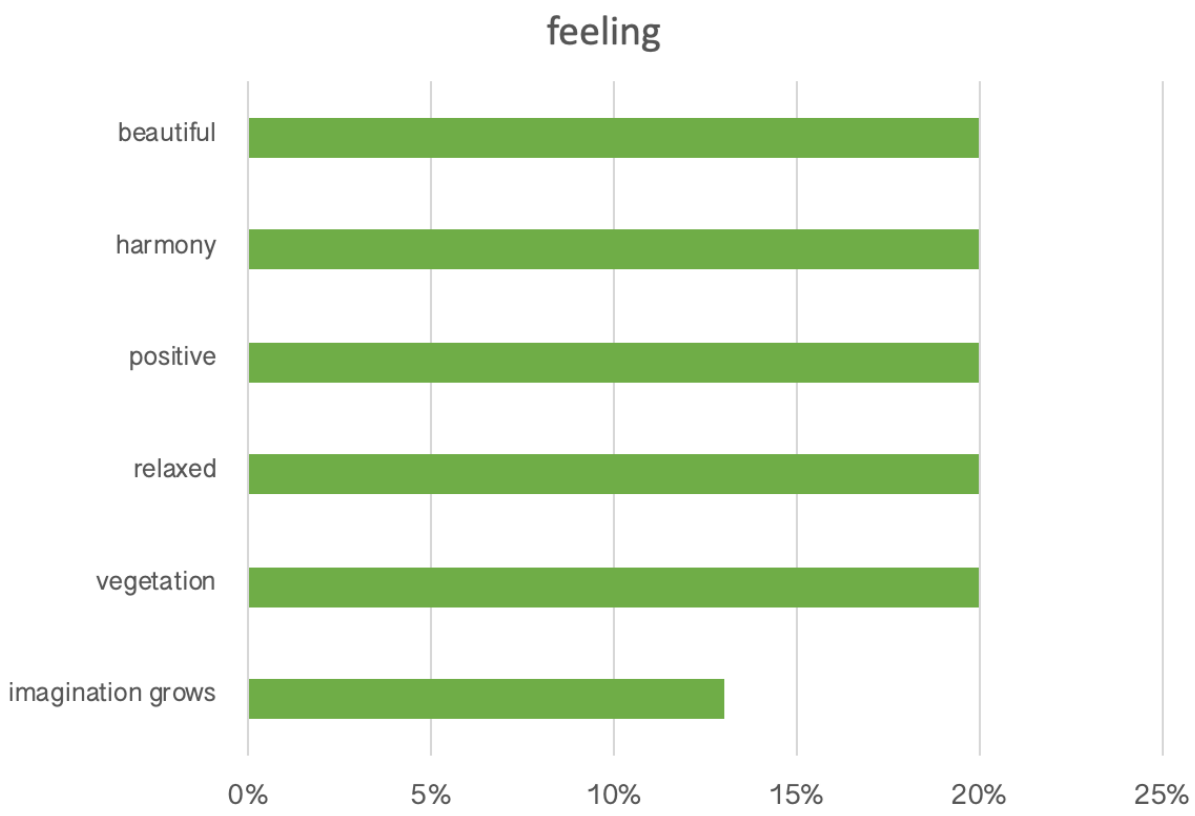


Figure 72 - feeling respondents got seeing open rehearsals 1, 2 and 3

When the respondents were asked what they felt about the rehearsal they saw, a lot of different answers were given. 20% of the respondents said beautiful, harmony, positive, relaxed and vegetation. Another 13% of the respondent answers that their imagination grows, for example “like I was standing outside– with some music”, “a sunny fresh day during spring”, or “I saw myself in a field with flowers with the music in the background” [figure 72]. Examples of other answers given once were calm, depressing, joy, uplifting, and vivid.

Sub-question 2. What is the first element that caught their attention, and did this change after a while?

The collected interview data showed that 40% of the respondents first focused on the video, 33% focused on the music, 27% on the musician and on understanding what they were watching, and 13% on the building-up from music playing and visuals appearing, on noticing light was needed, on the movements, and on the room itself [figure 73]. An example of other answers given once were colors, flute and vegetation.

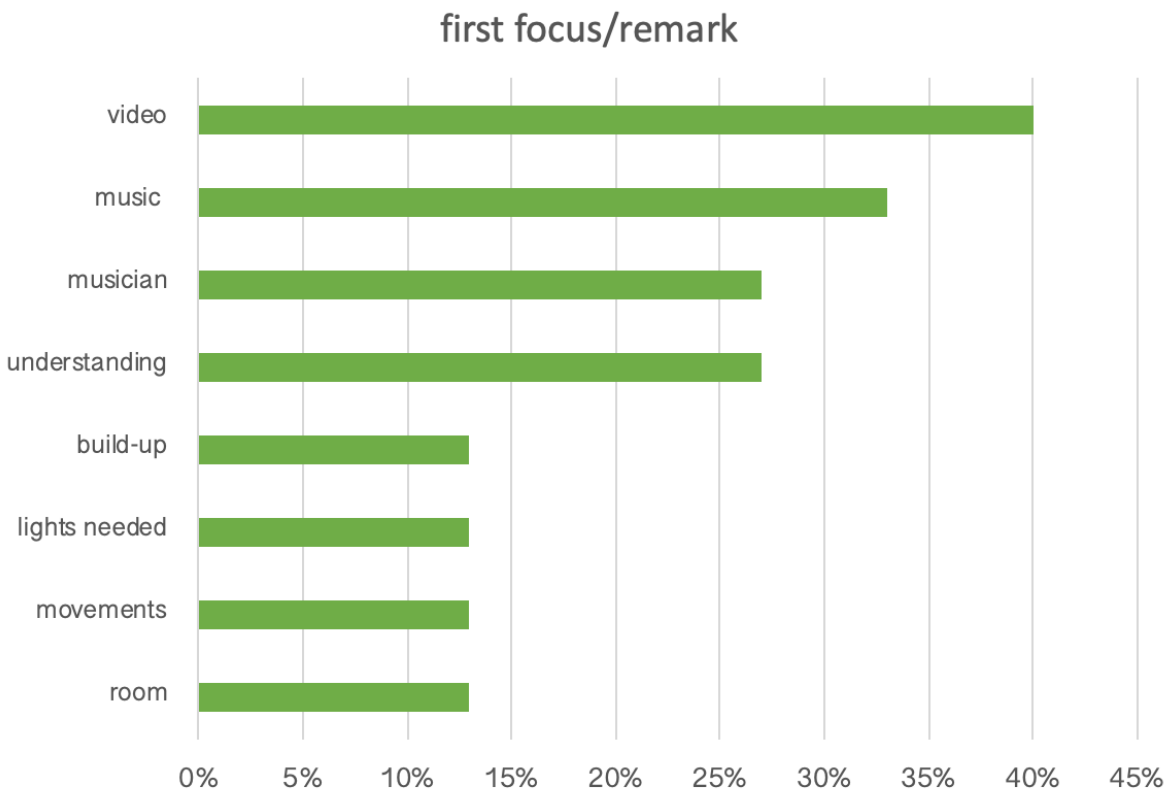


Figure 73 - first focus or remark of respondents watching open rehearsals 1, 2 and 3

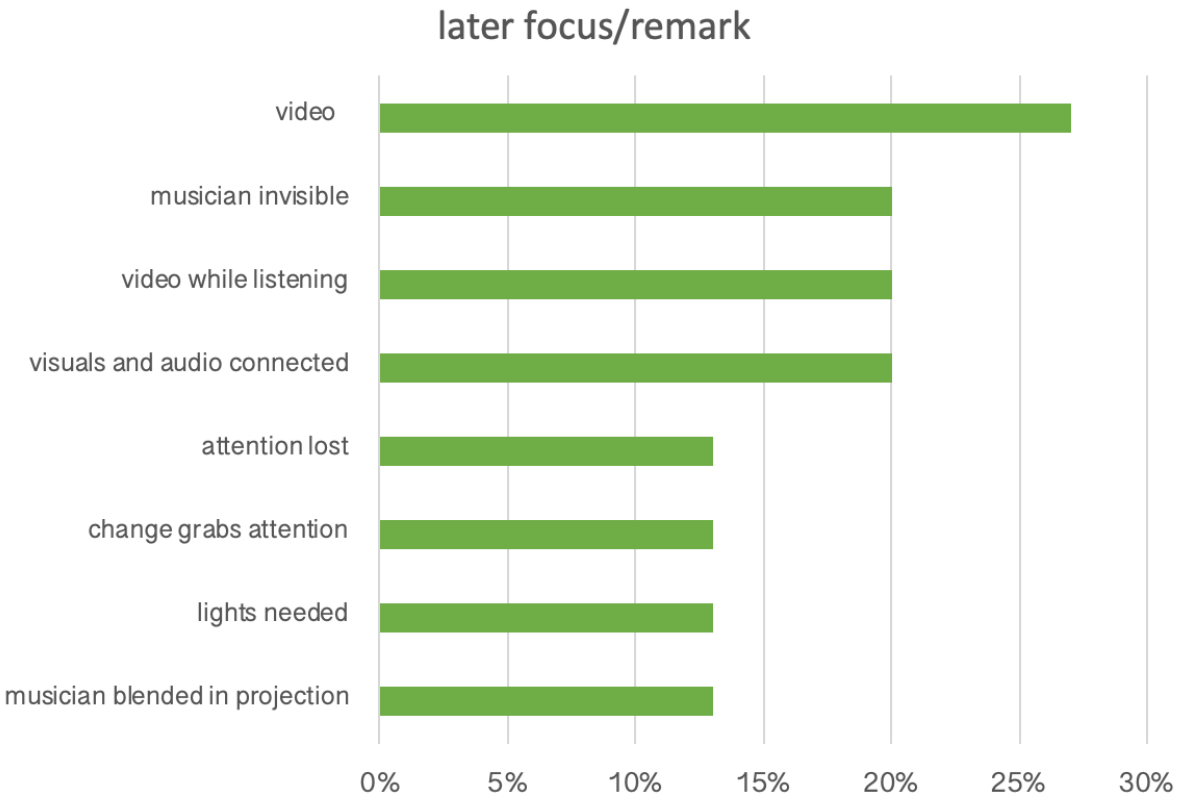


Figure 74 - later focus or remark of respondents watching open rehearsals 1, 2 and 3

Later the focus changed for most a part of the respondents. Figure 74 shows that still 27% is focused on the video, 20% noticed that the musician is invisible (because of the dark), or that they watched the video while listening to the music, and that the visuals and audio were connected. 13% of the respondents noticed that their concentration was gone for some moments, that changes within the visuals or music caught their attention, that lights were needed, and that the musician was blended in the projection. This last comment was meant positive, the respondent says that "the second type of projection made me look more at her, because she had the projection on her."

Some other answers given once were music, musician, video without listening, and exciting.

Sub-question 3: What are the main factors the audience focusses on during an audiovisual performance, and what comes to mind when they think about it?

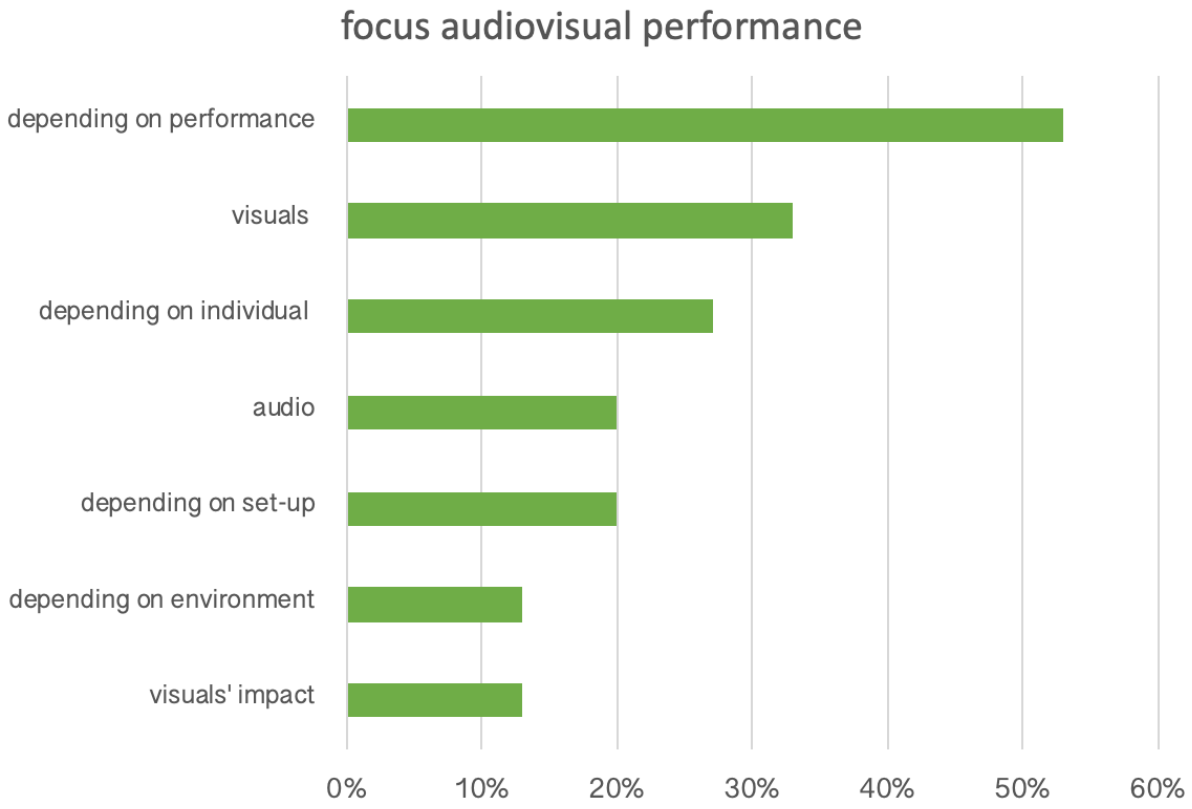


Figure 75 - general focus respondents have watching an audiovisual performance

When the respondent thought about their main focus during any audiovisual performance, 53% said that it depended a lot on the performance they attended. 33% said they focus mainly on the visuals, and 27% said it depended a lot on the individual watching the performance ("it depends on the cultural background of the individual watching"). 20% said they focus on the audio, or that it depends on the set-up of the performance, and 13% said it depends on environments or location ("for example I feel different if it is in a church or something"), and on the impact the visuals have [figure 75].

Some other answers given once were that they normally search for a relationship between the visuals and audio, the instruments, that it depends on the connection they have with the music or artist, the personal feelings someone has ("it depends on how I am feeling"), or the quality of the performance.

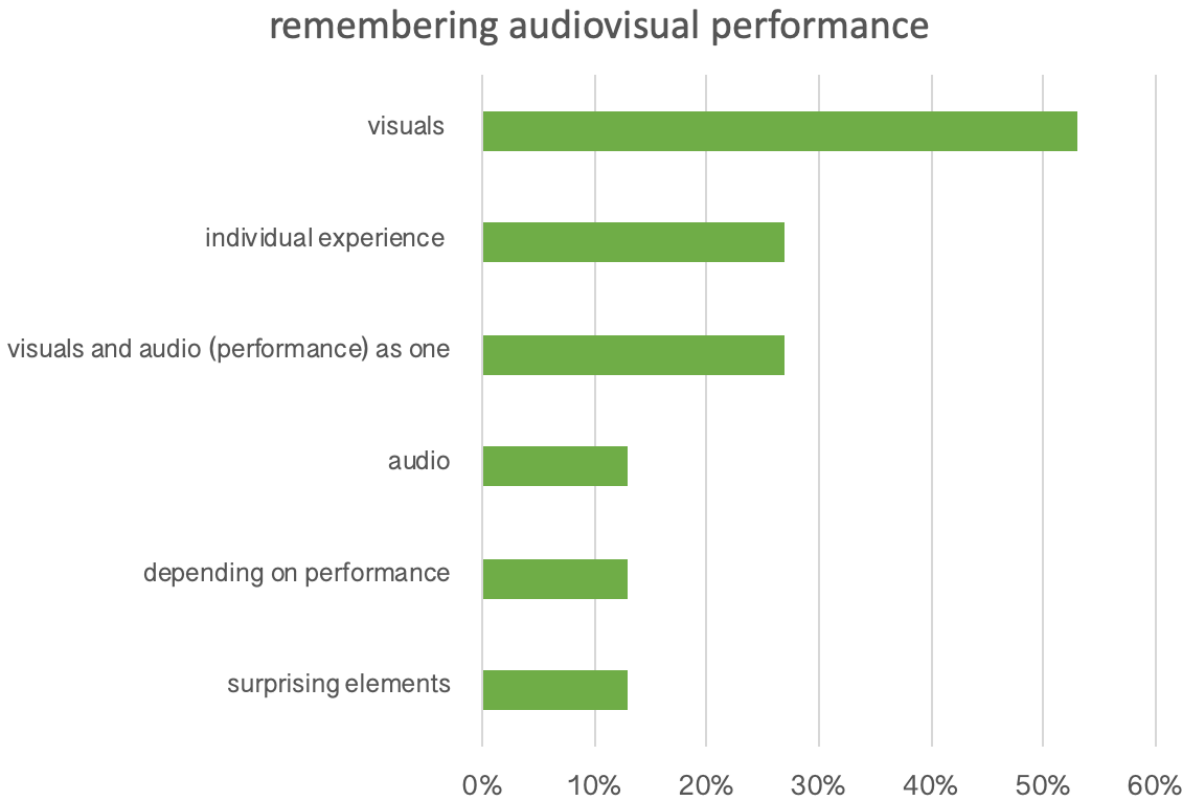


Figure 76 - what respondents remember first from an audiovisual performance

The data also shows that when respondents remember the first thing about an audiovisual performance they went to, 53% answered visuals. 27% said it is an individual experience, or they remember visuals and audio (the whole performance) as one. 13% answered they remember the audio, that it depends on the performance, and that they remember mainly the surprising elements [figure 76]. Another answer given once was the visual's prominence.

After the idea of the performance and the aim of the visuals were explained, the respondents gave their answer about what they think are the most important parts in that case, and what can be improved or changed.

Figure 77 shows that the biggest part of the respondents, 53%, thinks that it is most important to have a connection between the visuals and the audio. This connection between the elements "will lift the musician, and put the focus on her as well". According to 33% of the respondents, the second most important point is to make the visuals and audio (the whole performance) as one. It is "the whole that matters, not the elements on itself". 27% of the respondents answered that it is important to keep an eye on the impact the visuals have, and 20% said it is good to think about the brightness and darkness of the visuals and the location of the projection/projector, and that some lights on the musicians are needed.

The projection square did not grow or change in the first and second rehearsals in ESMAE in room 210 and 209, and a respondent commented “increase or expand the projection sometimes, play with it, or cover half of the room”. In the third rehearsal this was carried out, and respondents commented positively, saying “I found the big visualization interesting because it felt like a whole”, “the three different sections are well defined, and it makes sense when projection grows while the musicians and the music grows as well”, and “it makes perfect sense that the visuals grow”.

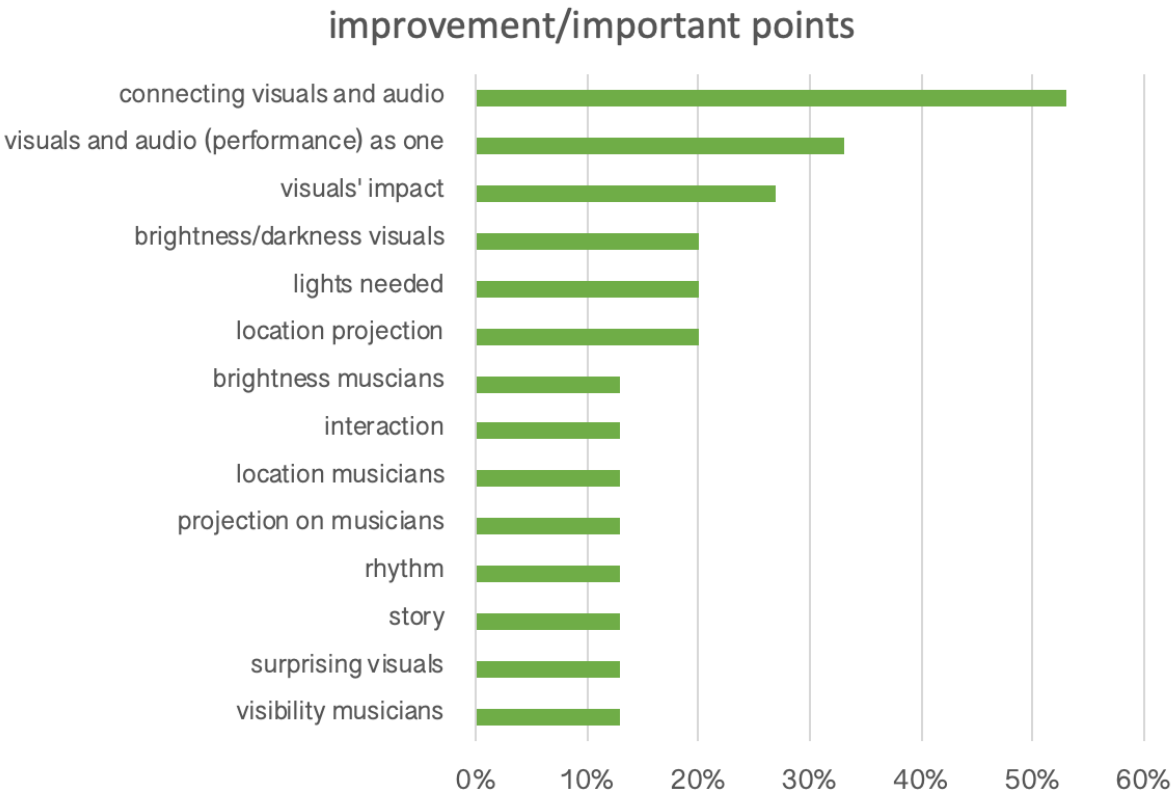


Figure 77 - what respondents think is most important and what can be improved

The other 13% of the respondents answered that it is important to think about the brightness and visibility of the musicians (“she was too hidden” and “she needs light”), the location of the musicians (“put the musician in the middle, with the projection not on her but behind her”), the projection on the musicians or not (“distinguish the projection from the musicians”), the rhythm (“it is good to focus on the rhythm of the music, and sequence the visuals on time”), the story of the performance (“I was searching for the story” and “it is good to build a story, starting small and quiet”), the surprising visuals (“it is good to keep the curiosity”). Sometimes they also noticed that there is interaction needed between the musician and the visuals (“it is good if she is interacting with the visuals, it makes it more dynamic”).

An example of some other answers given once were colors, no lights needed, play with the sound, and continuity.

When the respondents were asked about their opinion of the vegetation theme chosen for the visuals, 53% of the respondents expressed their positivity in a different way (“I like it”, “the theme works well”, “it is nice”). 20% said they noticed that their imagination grows, for example “I saw a painting being

created" or "it is a bit like looking at the stars". 13% called it beautiful, that it supports the music and said it linked to the music and the flute instrument [figure 78].

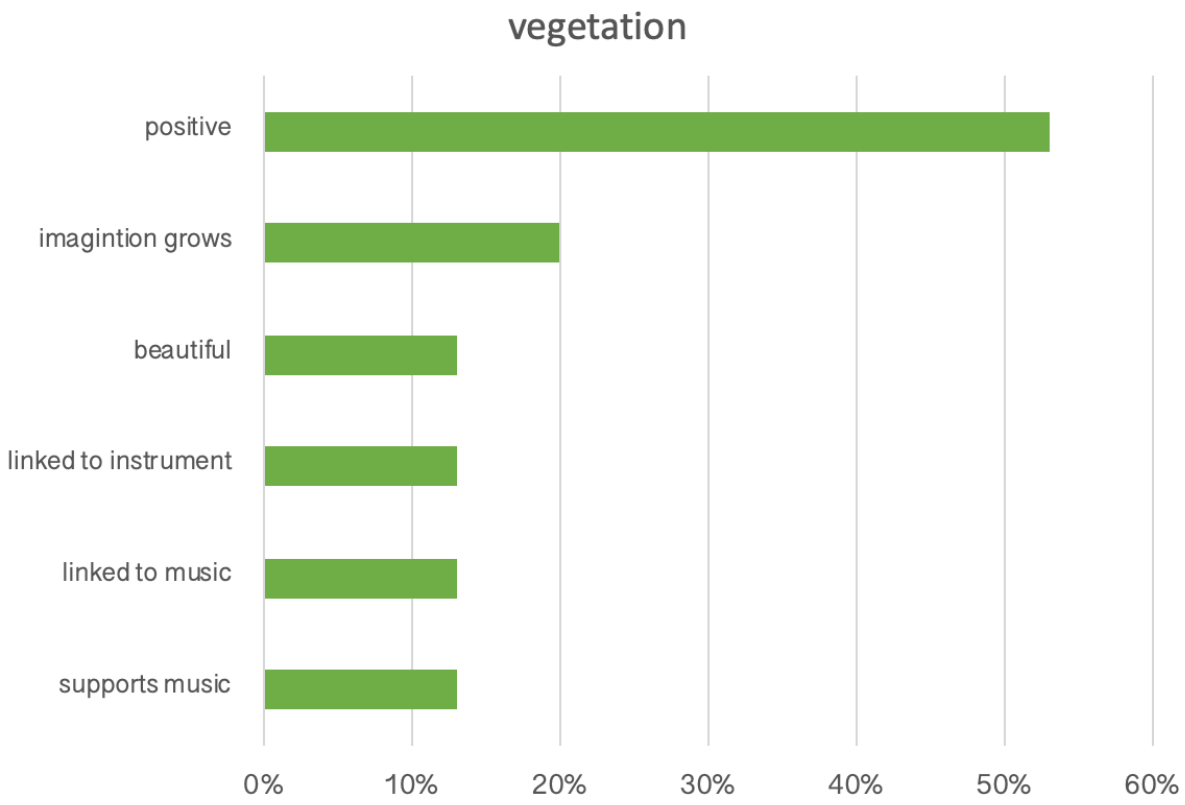


Figure 78 - respondents' opinion about the vegetation theme

It was clear that some respondents who watched the video, said that they felt their experience and responses could have been different if they were present at the rehearsal.

5 CONCLUSIONS

This dissertation followed the evolution of visuals created for the musical performance of Liliana Marinho, visuals that do not overwhelm the performance and take the audience's focus away from the music. It questions if sight overrules sound, and if it is, how this can be modified into a collaboration, or if it completely depends on the individual receiving it.

The primary data collected the experiences and knowledge of respondents, about audiovisual performances in different types of situations. It centers around an individual's focus, notification, recollection and feeling.

5.1 SUMMARY

It is almost impossible to describe the relation of sound and image when they become means and responses of interaction, since this relation is way more than a translation of sound frequencies to colors and shapes. It is about expressivity, rhythm, dynamics, motion and time. On top of that there is a possible intended or unintended competition for the audience's attention, which can influence the understanding of the project or the performance.

Because awareness is dependent on someone's attention, an individual's limited mental capacities may cause him or her to acknowledge only the more easily processed and affective components of music or visuals. For instance, it is a fact that composers, professional musicians, or video artists receive the elements with a different personal exploration (both psychical and practical) than another individual.

Another influencing factor is the effect and format of the visual information. But not only the manipulation of the visuals affects the acoustical perception, since some of the effects can be shadowed by the lingering effects or format, montage and video.

Within different types of interactions components can agree or disagree with the emotion of the other. Agreement in mood between these elements can increase the mood of the individual parts, while disagreement can create irony, commentary of foreshadowing. These interactions can cause the audience to perceive the individual elements in an intensified or different way than wanted, or than when experienced individually.

Music can have an impact on the knowledge of visual images. When the music matches the mood of the visuals, the intended emotion of this visual is more precisely remembered.

The primary data shows that the type of visual information plays a direct role on the perception of the receiver, but that it is also very dependent on the personal culture of the individual receiving it. Responses are always subjective and rely on an individual's association, background and mood.

In case both elements need to be in a balanced relation and need to be conceived in a way that program, sound and image are equal partners, the most important factor is harmony. Harmony in a way that what the audience sees and hears needs to be connected, and that the performance is conceived as one. This does not mean the visuals need to exactly draw or visualize the musical notes, it can be done through many other movements or shapes.

Because the respondents responded positively about the chosen theme, the visuals will be real-time processed videos of vegetation. There will be different lights placed next to the musicians, to make them visible and so they visibly can interact with each other and the visuals. Because the number of musicians will grow on stage, the projection square grows during the recital. The imagery of the video content expands as well, from close-up flowers to further away branches and trees. And finally, but not unimportantly, the natural but purposely created movements of this nature will be connected to the auditory element: the music.

5.2 FUTURE RESEARCH

The relation between sound and image will always be a complex subject to understand. Because this study focused mainly on one role, supportive, only one type of concept is being experimented with. It could be interesting to experiment within different classes of sound-image relations, containing a variety of situations and interactions between elements. Where sound is at the service of image or where image is at the service of sound, for instance when used as a means to navigate or manipulate sound. Another possibility could be experimenting with the same type of interactions but a bigger sample of different audiences, to find out about the impact of the individual association.

Because the relation between sound and image is such a broad concept, there are a lot of possibilities in which further research can make an attempt finding out more about this. If this study could be expanded in time and possibilities, an interesting idea could be creating a variety of visuals together with a bigger sample of a varying audience, to end up with a fairer and more unbiased conclusion.

5.3 ENVISIONING NATURE

5.3.1 PRE-PRODUCTION

Some last adjustments were made for the final performance. The main adjustments were (1) the location of the projection on the wall, (2) the location of the musicians on stage during the third musical section, and (3) the light during the performance.

5.3.1.1 LOCATION OF THE PROJECTION

After conducting research and rehearsing with all musicians together, we decided to change the location of the projection on the wall. Figure 67 shows what we had in mind first, figure 79 shows the final location and size of all three musical sections. The two main reasons for this adjustment are the

musicians and the light. The musicians were not used to the projection light shining on them, and they were insecure about the effect it would have on their performance. This led to heightening the sizes 2 (for musical section 2) and 3 (for musical section 3), so they would start above the heads of the musicians. Size 1 stayed on the same location, because during the first musical section Liliana played alone and the projection would be located next to her.

The second reason, the light, also had to do with the third adjustment made before the performance and is explained in section 5.3.1.3.

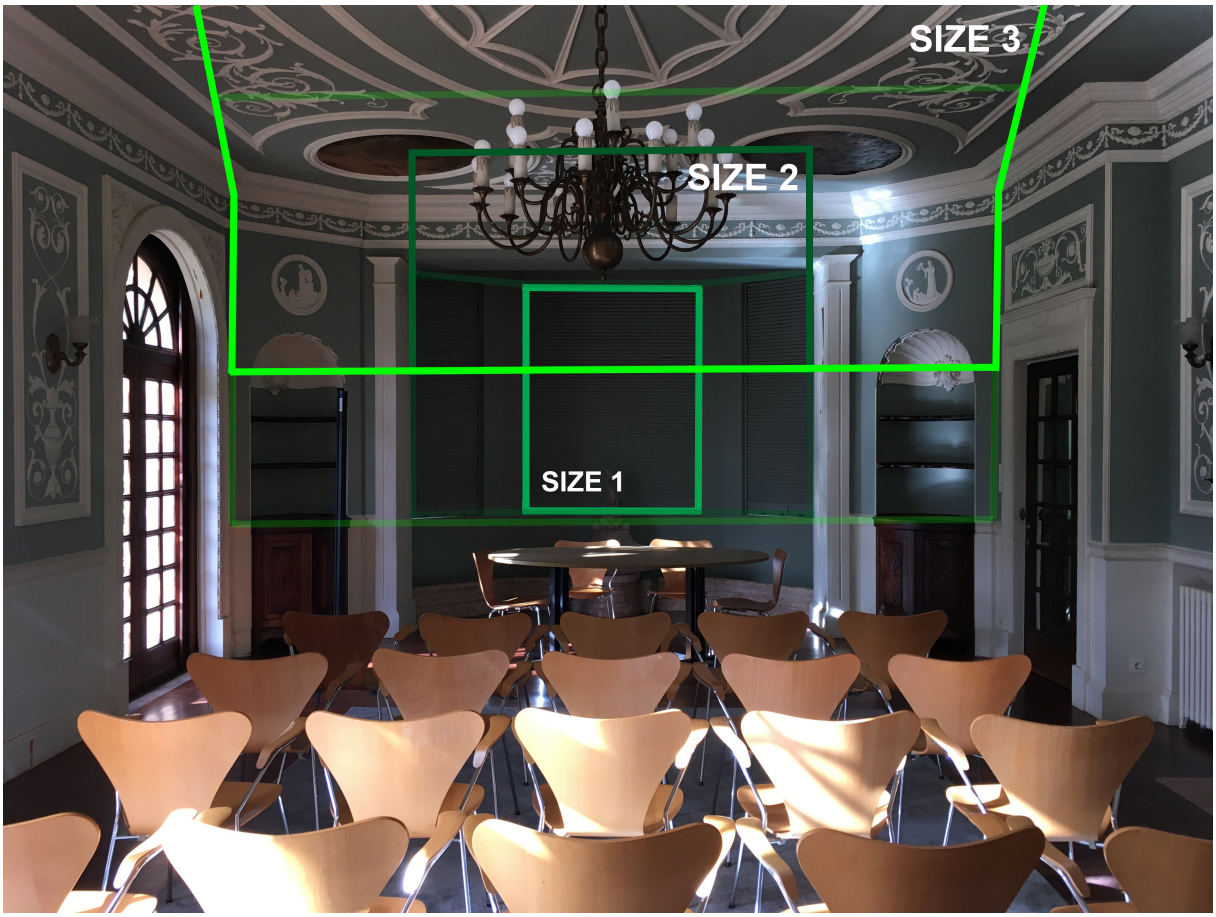


Figure 79 - sizes and location of the projection during the final performance

A positive addition to the projection located higher was that during musical section 2 and 3 a big part of the visuals were shown on the ceiling (a lot of times with the shadow of the chandelier through it), and thus came closer to the audience.

5.3.1.2 Location of the Musicians

The location of the musicians during the third musical section has changed right before the final performance as well, and the reason for this is the acoustics of the music. Figures 51 and 52 show the stage-setting from before, and figures 80 and 81 show the final one.

Figures 80 and 81 also show the new location of the projection in combination with the musicians during the final performance.

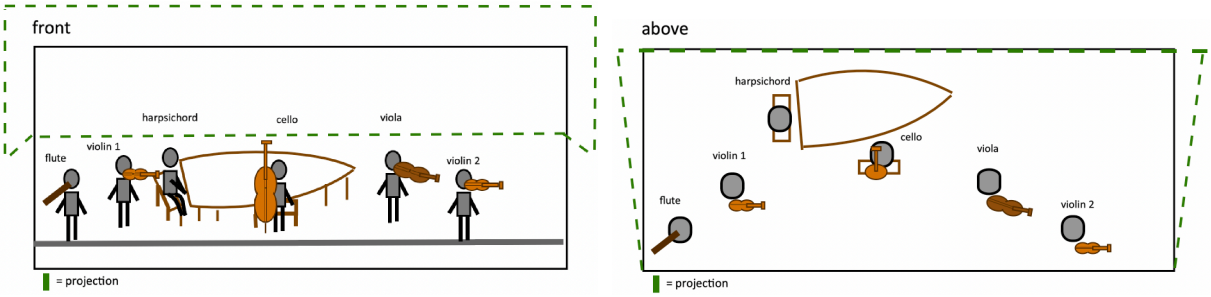


Figure 80 and 81 - musicians on stage while playing the third part, during the final performance. view from up front (left) and above (right)

5.3.1.3 LIGHT DURING PERFORMANCE

The third adjustment that was made was the addition of artificial light during the final performance, which is done because of several reasons. Firstly, it is important to see the musicians play because they are an important element during this audiovisual performance. The participants of the in-depth interviews also mentioned that it was difficult to see the musicians and that this made it harder to focus on them or their instruments.

Secondly, the musicians itself need to read the musical notes, and see each other to interact and play as an orchestra.

However, it could be possible that the addition of the artificial lights would decrease the quality and contrast of the projection, if the projection would be close to the musicians. So eventually the combination of a bit of lights and the location change of the projection turned out positively.

Figure 82 shows the floorplan of the final performance. The main artificial light added is a 30-centimeter (from bottom to top) 15 watt lamp from IKEA, placed on the ground. From here it illuminated the musicians. On top of that every musician had its own lamp to illuminate the notes in front of them. The windows and doors were all closed which meant there was no natural light entering the room.

The ViewSonic projector, MacBook Pro laptop and Evolution UC-33 Controller were placed in between the hallway and the room. The harpsichord was placed in the back of the room, and stayed there during the entire performance.

The number of musicians, instruments and locations varied during the three musical sections.

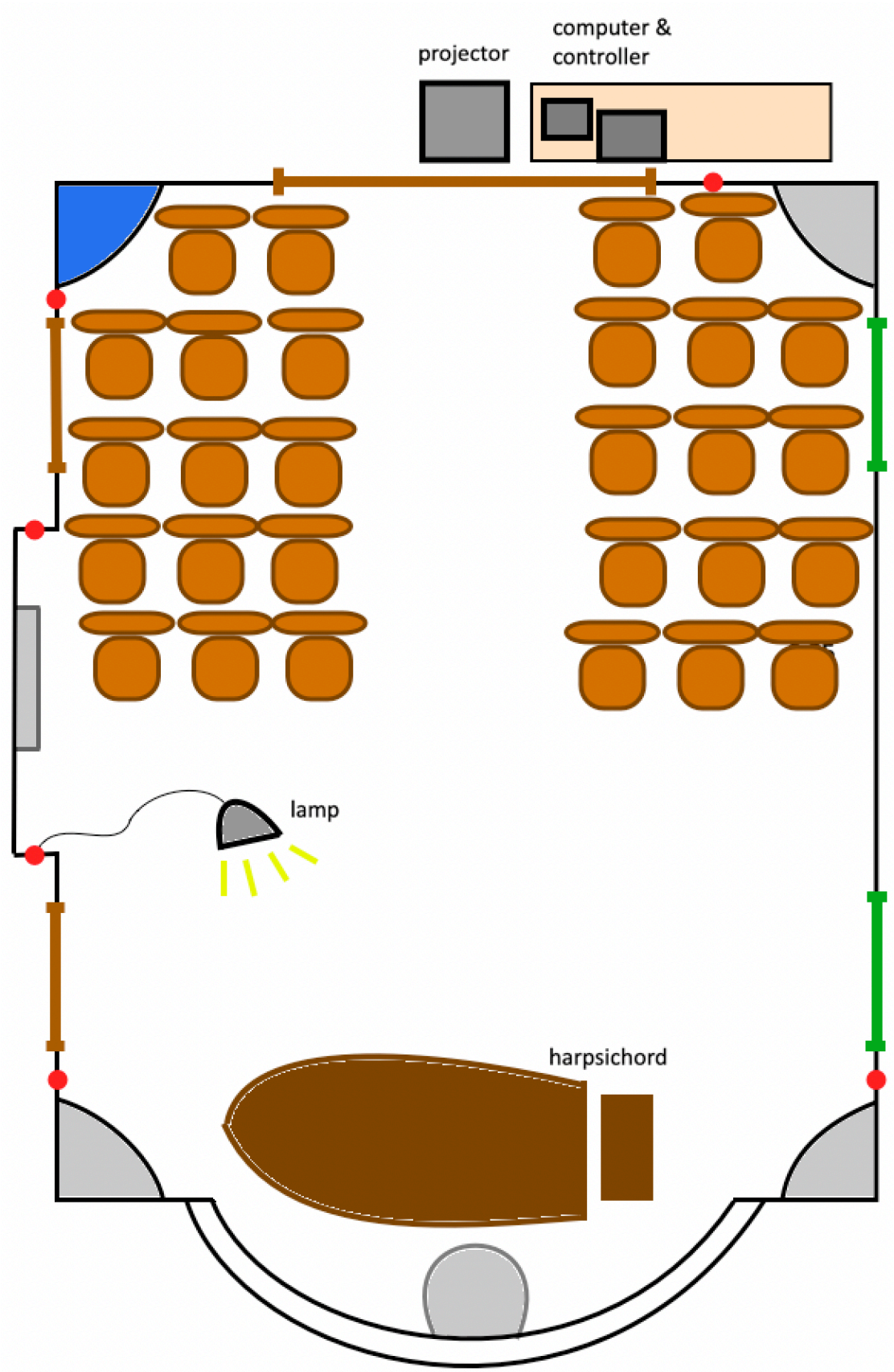


Figure 82 - floorplan from final performance

5.3.2 FEEDBACK

All feedback concerning the final performance was positive. The audience had a great experience listening to the music while seeing the visuals. Some participants asked if the visuals were responding to the music, which was a big compliment. The changes of the projection's location turned out good as well, the audience liked that the visuals came very close to them on the ceiling.

It felt good that the months of research, preparation, adjustments, improvements, and hard work payed off for both me and Liliana Marinho, and we are looking forward to our next collaboration.



Figure 83 - third musical section during the final performance

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APPENDICES

APPENDIX 1

VISUALIZING MUSIC

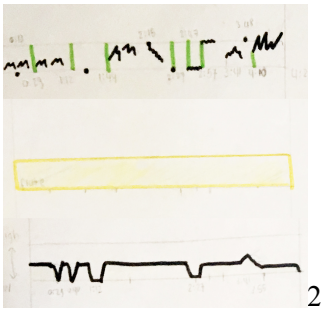
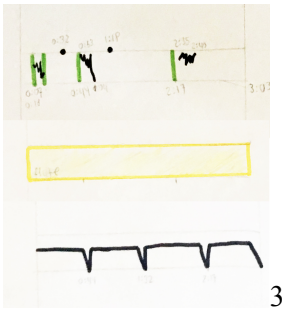
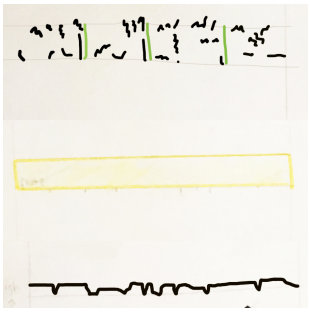
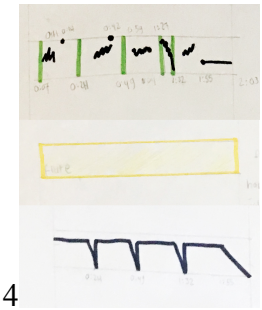
The upper bar shows the melody or special high notes, low notes, or specific tunes. The middle bar shows the instrument(s) heard, and the third bar shows the rhythm and break parts.

Within the melody-bar the black lines present the melody and notes and the green lines the break, or when the tune repeats.

In the instrument-bar the yellow presents the flute, red the harpsichord, dark blue the viola, light blue the violins, and purple the cello.

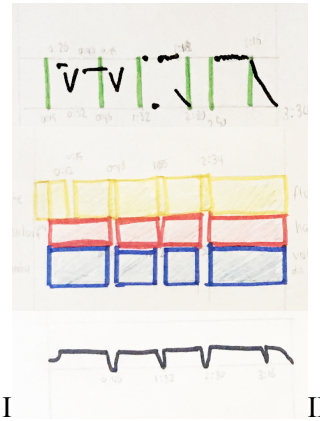
Section one:

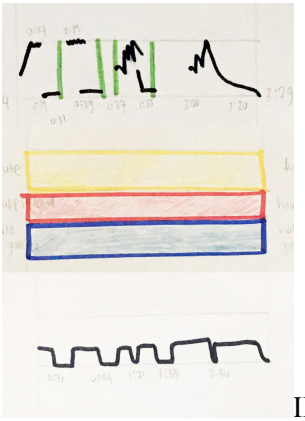
Partita for Flute (A minor), BWV 1013
1 Allemande
2 Courante
3 Sarabande
4 Bourrée Anglaise

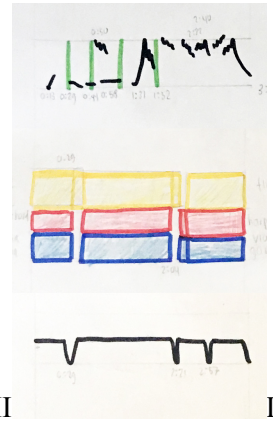
1  2  3  4 

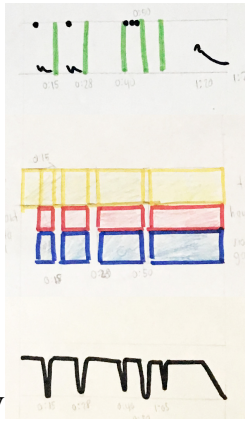
Section two:

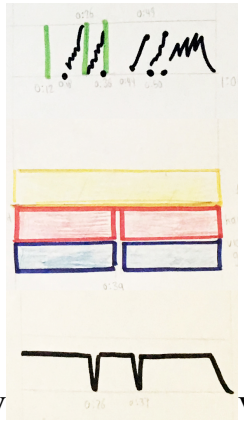
Pieces Pour la Flûte-traversiere, Op. 2, Quatriéme Suite
I. Prelude. Lentement
II. Allemande. La Fontainebleau. Gravement
III. Sarabande. Le Depart. Doulouresement
IV. Air. Le fleuri. Gayement
V. Gavotte. La Mitilde. Tendrement
VI. Branle de Village. L'Auteüi
VII. Menuet. Le Beaulieu
VIII. 2e. Menuet
IX. On Reprend le Menuet Precedent

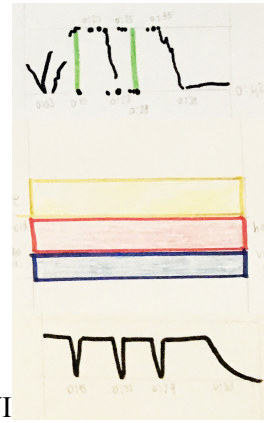

I

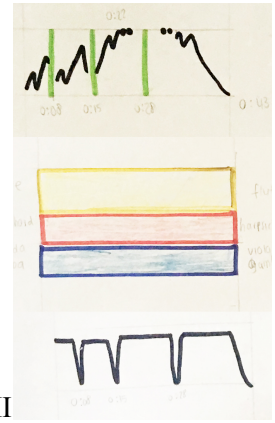

II

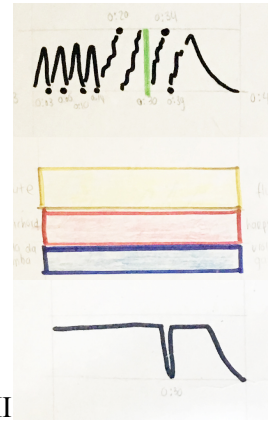

III

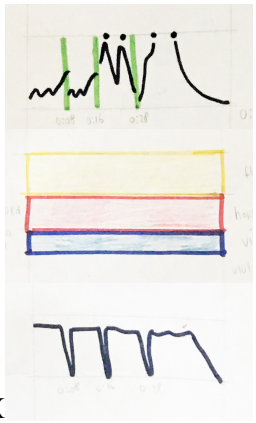

IV


V


VI

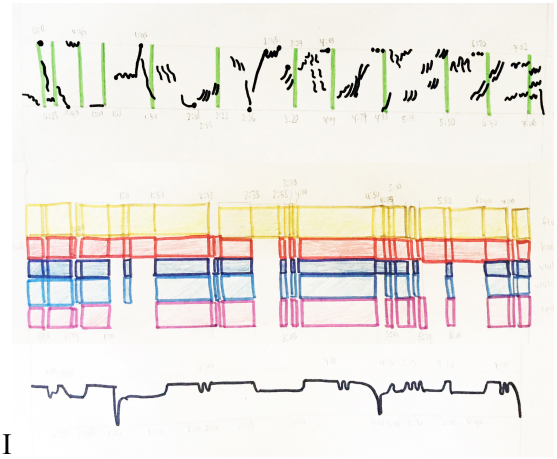

VII


VIII

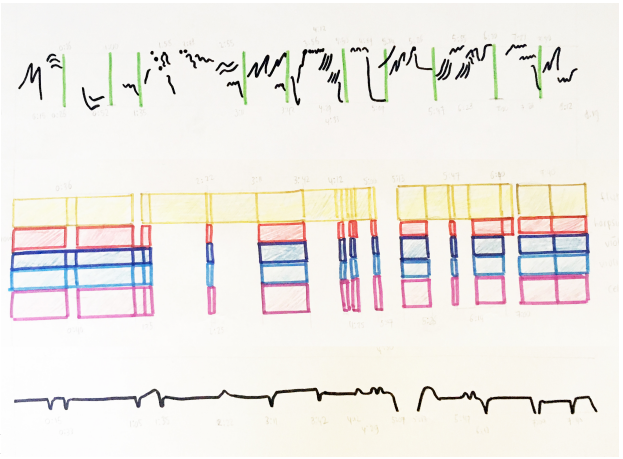

IX

Section three:

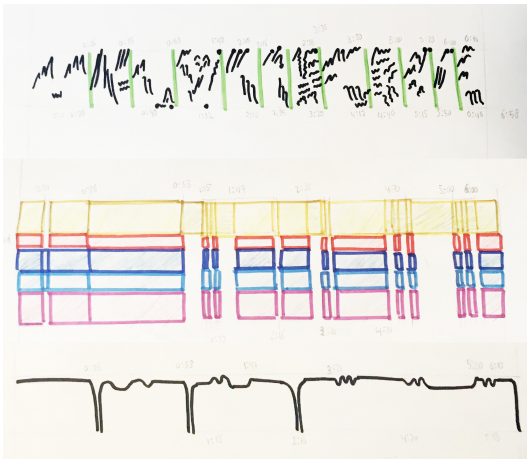
Concerto in D Minor, Wq. 22
I. Allegro
II. Un Poco Andante
III. Allegro di Molto



I



II



III

APPENDIX 2

OPEN REHEARSAL ROOM 210

The first open rehearsal has taken place in room 210, in Escola Superior de Música e Artes do Espectáculo (ESMAE).

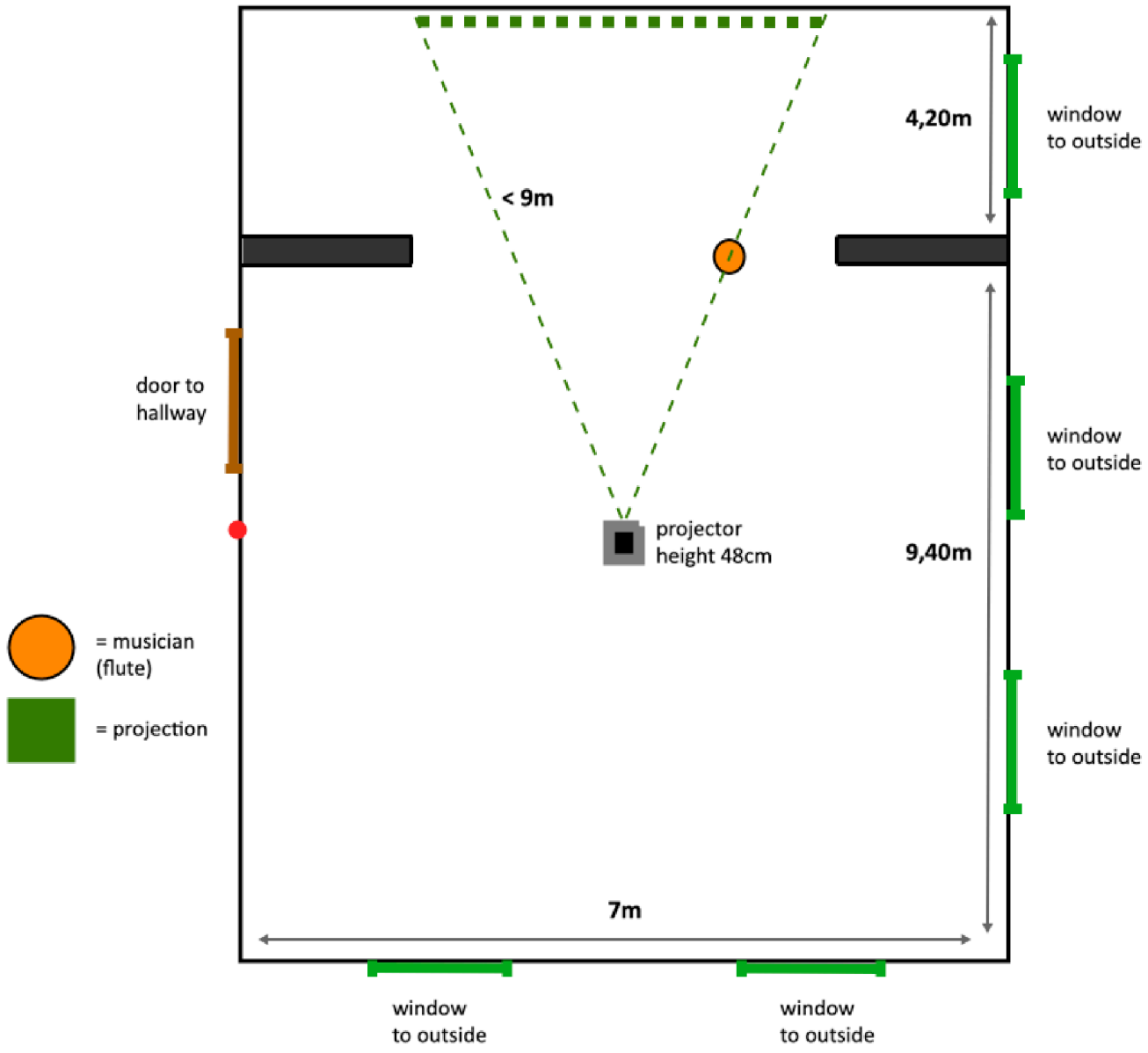


Figure 84 - floorplan open rehearsal in room 210

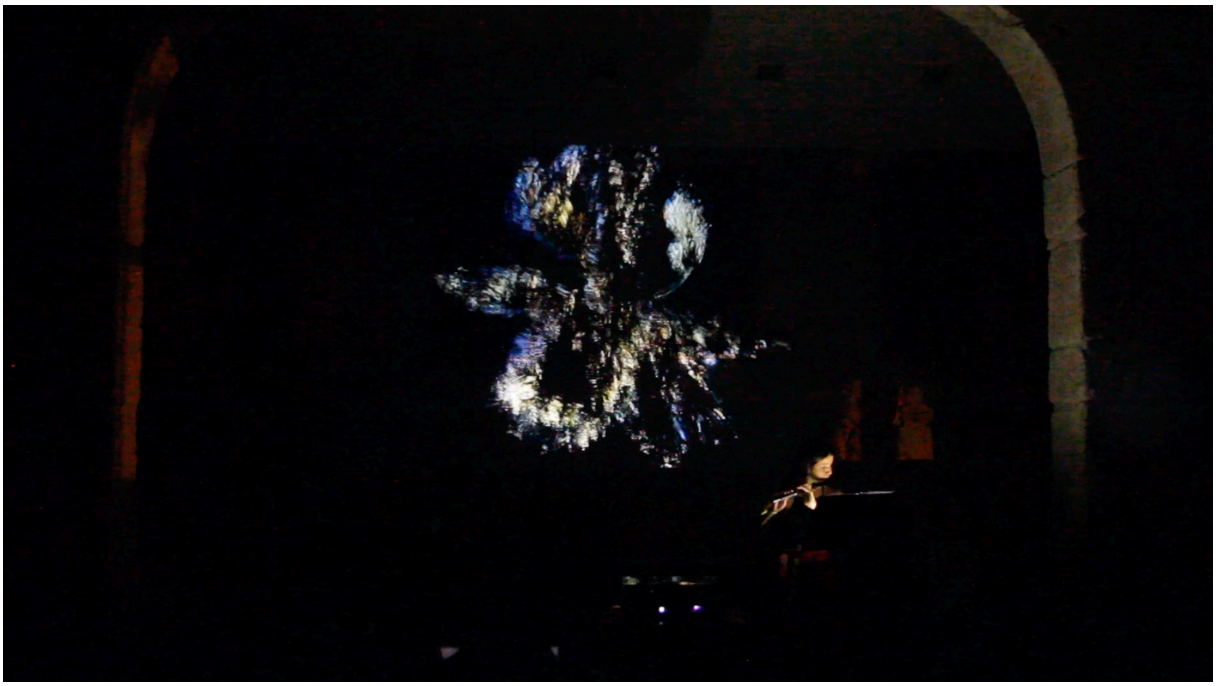


Figure 85 - still of documentation video of open rehearsal room 210



Figure 86 - still of documentation video of open rehearsal room 210

APPENDIX 3

OPEN REHEARSAL ROOM 209

The second open rehearsal has taken place in room 209, in Escola Superior de Música e Artes do Espectáculo (ESMAE).

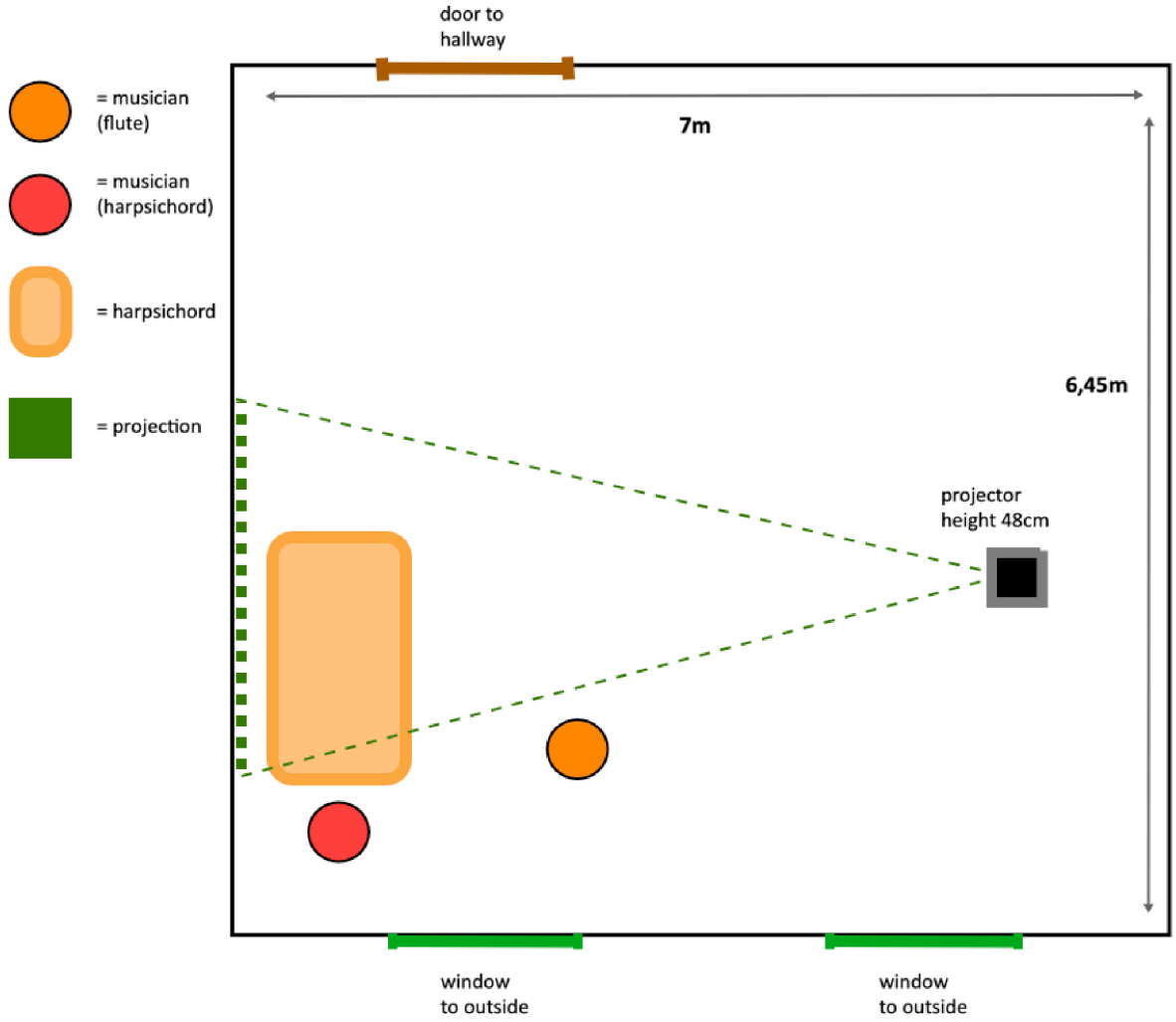


Figure 87 - floorplan open rehearsal in room 210



Figure 88 - still of documentation video of open rehearsal room 209



Figure 89 - still of documentation video of open rehearsal room 209

APPENDIX 4

OPEN REHEARSAL CASA DE ALLEN

The third open rehearsal has taken place in Casa de Allen, in the green room.

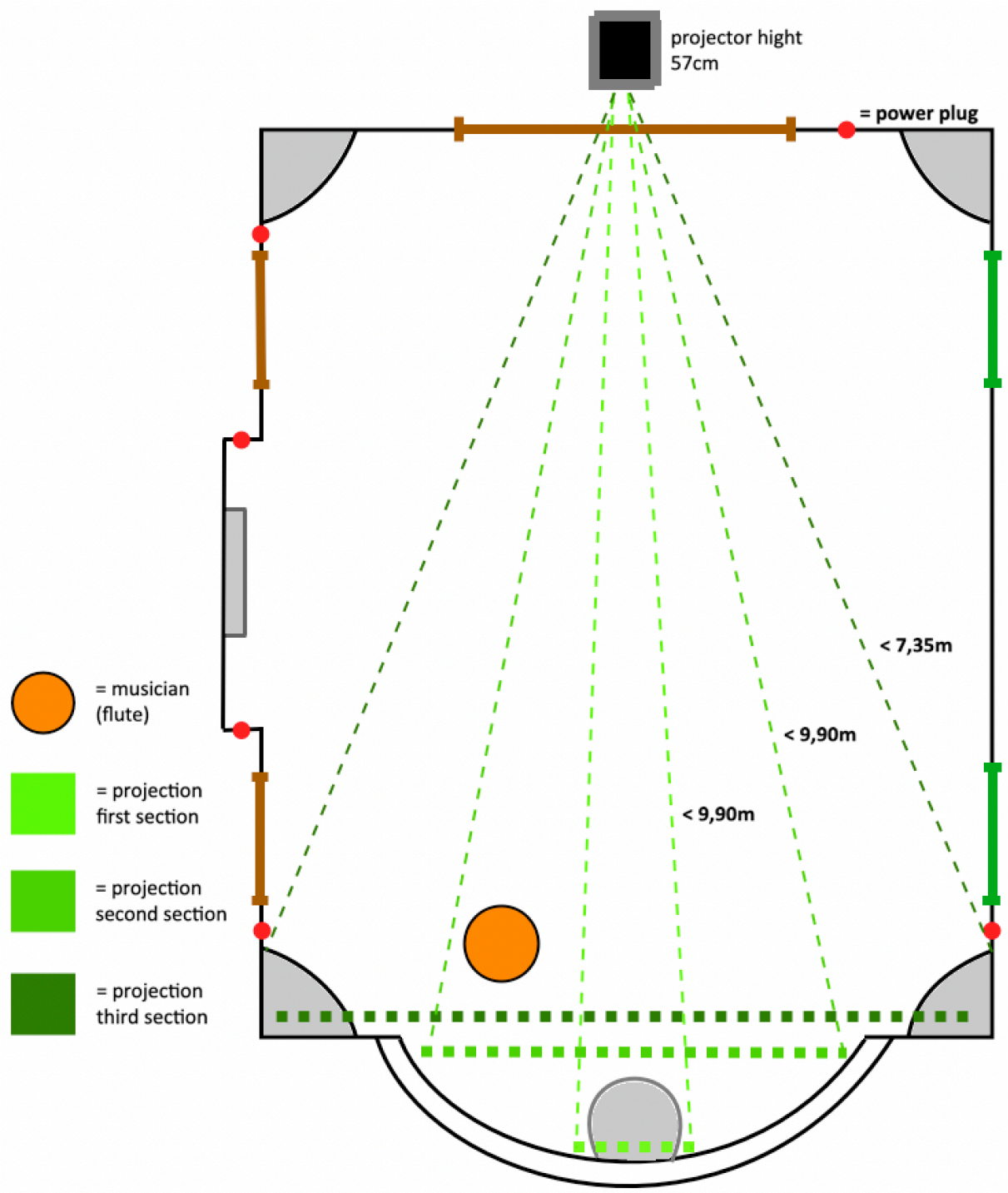


Figure 90 - floorplan open rehearsal in Casa de Allen's green room



Figure 91 - still of documentation video of open rehearsal Casa de Allen



Figure 92 - still of documentation video of open rehearsal Casa de Allen



Figure 93 - still of documentation video of open rehearsal Casa de Allen

APPENDIX 5

ANALYSIS UNSTRUCTURED IN-DEPTH INTERVIEWS

Respondents

Respondents chosen for this interview are 60% male and 40% female. Their age is between 20 and 40. The backgrounds vary, and are stated behind the name of each respondent.

R1 = Luis Arandas – sound design/interactive music and sound design
R2 = Marcelo Sousa – audiovisual communication/interactive music and sound design
R3 = Ana Lourenco – psychology/multimedia, culture and arts
R4 = Vital Erlich – direction/writing/video-edit
R5 = Omer Katanov – musician (guitar/rapper)/songwriter/psychology
R6 = Mees Visser – fashion design
R7 = Hannah Meijer – graphic design
R8 = Tim Reijling – graphic design
R9 = Stanislav Solonenco – documentary film, photography and directing/multimedia, culture and arts
R10 = Joana Rodrigues – music production and technologies/interactive music and sound design
R11 = Raquel Rodrigues – information science/multimedia, culture and arts
R12 = Pedro Fernandes – engineering
R13 = Miguel Monteiro – engineering
R14 = Ana Ferreira – nutritional sciences/literatures and cultures, Portuguese and English/ballet
R15 = Tomaz Silva – social communications, audiovisual/education

Green = positive response/reaction
Yellow = negative response/reaction (or need for improvement)
Blue = idea/idea for improvement

Questions and answers

1. What did you just see in the rehearsal/video of the rehearsal?

REHEARSAL 1 & 2

Open coding	**Themes**	**Selective coding**
R1: an audiovisual display; some rehearsals; projections of plants; a flute player; filmed in two different places; the video and the performer; light can evade the room	audiovisual display as a whole; rehearsal; plants projections; flute; focus lays on video and performer	visuals and audio as one; video; musician; vegetation; flute
R2: processed images and video; nature and leaves; video pops up the most, especially in a darker setting; I enjoyed the first and third videos of the video projections, they are really cool	processed images; video; nature; video clear in dark setting	processed video; video; vegetation; video in darkness
R4: a flute concert with video behind it	flute concert; video	flute; video
R5: flute concert; she is practicing; musician is not really connected to the music she plays when solo; second part is more confident with	flute concert; rehearsal; no connection of musician with music; video vegetation;	flute; video; vegetation; visuals and audio unconnected; rehearsal

harpsichord; negative video of trees and plants, not connected to music	visuals not connected to the music	

REHEARSAL 3

R3: performance with a flute; visual performance representing her music; music, sound, visual art; audiovisual performance	flute concert; visual performance presenting the music; music; visual art; audiovisual performance	flute; audiovisual performance; visuals and audio connected; music
R6: rehearsal of an audio and visual performance; Western concert flute; screening of digital visuals	Rehearsal; audiovisual performance; western concert flute; digital visuals	rehearsal; audiovisual performance; flute; processed video
R7: girl performing in a small salon with four types of projected visuals; first visual is more quiet/mindful; second part looks like the milky way; I like it when you suddenly see the flowers appear; it feels like a story; it feels like I am standing in that room; it feels like I am in the middle of the music and everything; a lot of green I find interesting, because there's happening a lot; it feels like she is painting the music with the sounds	performance in small room, 4 different types of visuals; story; surrounded by music; painting the music; visuals and audio connected	performance; variety of visuals; story; surrounding performance; painting; visuals and audio connected
R8: rhythmic performance of nature images, very flowery just like music	performance of vegetation; flowers	performance; vegetation
R9: reactive video with footage of leaves; responsive to the sounds of flute; some parts looked like nature and some more cosmic; use of colors; sometimes musician was in the background and sometimes in the front	reactive video of vegetation; visuals and audio responsive; vegetation; cosmic; colours	vegetation; visuals and audio connected; cosmic; colours
R10: baroque music; two elements that complement each other, but not made at the same time; painting; visuals are relatable to the era of music	baroque music; elements complementing each other; visuals relate to era of music	music; baroque; connected elements
R11: girl playing a flute, with visuals	girl with a flute; visuals	flute; video
R12: exhibition; video projection	exhibition; video projection	exhibition; video
R14: performance with a flutist, with some projections of flowers and the universe; projection was moving according to the music	performance with flute; projections of vegetation and universe; visuals and audio connected	performance; flute; vegetation; video; cosmic; visuals and audio connected
R15: girl playing the flute while there was a projection of flowers and leaves and trees	Girl playing flute; projection of vegetation	flute; video; vegetation

2. Which feeling did you get seeing this?

REHEARSAL 1 & 2

R1: a lot of things happening; beautiful, both the graphical presentation and music; I try to find patterns; sometimes the absence of patterns is a good thing; this is a subjective answer; I would respond negative if I do not like it	lot of things happening; beautiful videos and music; looking for patterns; absence of patterns is positive; subjective answer	vivid; beautiful videos; beautiful music; absence of patterns is good; subjective answer
R2: super positive feeling; reminds me of my home	positive feeling	positive
R4: sometimes a positive connection; sometimes waiting for movements or visuals to move more connected to the music	positive feeling; waiting for movements of visuals for more connection	positive; visual and audio connection needed
R5: bit depressing; something was missing; rehearsing needed	depressing; something missing	depressing

REHEARSAL 3

R3: I enjoyed it; liked uplifting music; pretty songs; harmony between audio and visuals, especially in the first section *(smaller visuals, clear image of flower)*; story going on	joy; uplifting music; pretty music; harmony between visuals and audio; story	joy; uplifting; pretty music; harmony; story
R6: room is nice as it has a classical aesthetic which is contrasting in an interesting way with the visuals; not a big fan of the instrument; the visuals seem nice and go well with the music; not sure whether it was interacting live with the music or not, it was a little bit hard to tell at times	classical and nice room; room contrasting positively with the visuals; visuals go well with music	beautiful room; contrast between room and visuals; harmony
R7: I have looked at the nature; felt like standing outside with music; a sunny fresh day during spring; green colors and the type of music give a calm feeling; wanting to know more; what is the story; what kind of visualization comes up next?; will there be clear pictures of the flowers; the space contributes the 'dreamy' and 'fairy-tale' feeling	imagination visuals with music; calm feeling; wanting to know more; dreamy room; nature	imagination; calm; dreamy room; vegetation
R8: music and visuals are beautiful	beautiful	beautiful

R9: positive; some tunes are more positive; tunes related to medieval times, paintings, flowers, because of the flute; forest nymph	positive feeling; medieval tunes; paintings; vegetation	positive; medieval; painting; vegetation
R10: they complement each other; visuals did not overcome audio part; they worked as a whole	visuals and audio complement each other; visuals do not overwhelm; visuals and audio as one	no overwhelming visuals; visuals and audio as one; complementation
R11: flute is related to nature; vegetation is showing what the music is saying	flute related to nature; vegetation show what music says	flute relates to vegetation; visuals show musical story
R12: relaxing; beautiful; colors; whole scenario is really nice; if music was different it might not be so nice; happy harmony	relaxing; beautiful; colours; music fits; happy harmony	relaxed; beautiful; colours; harmony
R13: relaxing; beautiful; mix of nature related video and detailed room	detailed room; relaxing; beautiful; video nature	detailed room; relaxed; beautiful; vegetation; video
R14: happiness; beautiful to mix image and sound; makes sense to mix nature and colors with the music; makes sense with sound and type of music; saw myself in a field with flowers with music in the background; felt more connected with the projection if she was not in it	happiness; visuals fit with the music; imagination	happiness; vegetation fits music; imagination
R15: relaxed feeling; flute gives a relaxing sound just like nature shows	relaxing	relaxed

3. What was the first thing that caught your attention? Did this change?

REHEARSAL 1 & 2

R1: video visuals which is most moving; temporal scale is big, it progresses really slow (Robert Henke or Quayola); start minimal and progress to seeing the projection-square; waiting for another color to come; musician does not move much; idea can change if it is lighter outside; it changed after watching longer; change of focus depends on who is watching, on the background and interest	video visuals; progress to a bigger and fuller screen; wait for more colour; musician does not move; subjective focus	FIRST: video; screen progress; colour LATER: subjective focus
R2: try to understand video and patterns; music helps immerse in video; musician is not disruptive which helps; later I tried to understand what happened in the whole performance, which is good; performance is about a whole, not just one element	understand patterns; understand video; the music immerses you in the video; performance is one	understanding; immersed in video; visuals and audio as one
R4: first focus on musician; then stopped looking at her and watched the video	musician; video	musician; video
R5: the video; musician in the corner, without any light	video; musician in corner; no light	video; light needed

REHEARSAL 3

R3: first note musician played; while the song played I stopped looking at the artist but focused on the visuals; the lights were not focusing on her and the visuals were moving; she was present because of the sound not because of her looks; if she dressed different or moved more it could change; the first part focused at visuals and listening to music; halfway I only focused on visuals (no listening); maybe because it is not my type of music, or visuals were more abstract	music; visuals; no lights on her; visuals were moving; musician not present; visuals while listening to music; visuals without music; visuals too abstract	music; light needed; musician; video; video while listening; video without listening; visuals too abstract
R6: projection was cropped into frame of the window blinds which was cool and nice to adapt to the room; later it is bigger, covering the ceiling and the performer as well (unfortunately); visuals covered the whole screen, seemed more colorful/busy than other ones, I liked that one, but seemed out of place/different than the rest; attention stayed more or less the same because of development of visuals and music; a good build-up and then and with a calmer atmosphere again; not boring to watch but exciting	positive mapping; projection on musician is negative; visuals too much varying; visuals and audio developed; positive build-up; exciting	positive mapping; musician without projection needed; development; build-up; exciting
R7: first the girl and the sound; it is smart to start with music without visuals because the attention goes to the musician/music, to build a story, and visualization gives extra layer to music; focus changed after 50 sec, I thought the part was a bit long and the visualization was a bit small; not very exciting; my attention came back, the visualization and music changed; the big projection is more exciting, more into music, more into the performance	musician; sound; story; build-up; attention went away; grabbing attention with change; big projection exciting	musician; music attention lost; change grabs attention; positive mapping; exciting

R8: first visual with the music; trying to figure out what I was watching; my attention went a bit away, I got bored	visuals with music; understanding; attention went away; bored	video; music; understanding attention lost; bored
R9: saw the fountain, cool idea the flower immerses from there; a nice room, fits with the music; mixing old and new together; attention was more on video, apart from when the music changed, or special tunes	fountain; video; changing of music grabs attention; special tunes grabs attention	fountain; video video; change grabs attention
R10: first music because it started; fading it with visuals worked well; visuals grow like music grows, which matches; focused more on visuals; easier for people to actively see than actively listen, so logical if they watch visuals; still listened, hearing audio while visuals are linked to it; reactive to the sound, helps to focus on the sound	music; build-up; visuals while listening to music; reactive; visuals and sound connected	music; build-up video while listening; visuals and audio connected; reactive
R11: things moving; later trying to figure out movements and projection; later it changed, expected for movements to go one way but it went the other; never focused on the musician, only on music would go with visuals; if music goes faster checking if visuals also go faster; also focus on audio like a videoclip; she would blend in if the projection was on her	movements; understanding movements; no focus on musician; audio; videoclip; musician blends with projection;	movements; understanding music; videoclip; musician blended in projection; musician invisible; lights needed
R12: understanding where music came from; then the girl playing; then the room; then the visuals; focused 80% on video, music was decoration; music was making the image happy; did not look at her because there was no light; nothing was moving on her; if there would be light on her I would focus on her; if she was dressed in color also focus more on her	understanding; girl playing flute; room; visuals; music being decoration; music made visuals happy; no light on musician; musician not moving	understanding; flute; musician; room video; music is decoration; musician invisible; musician without movement
R13: music; then video; when the screen got bigger focused more on video; music stayed in same style; did not look at musician but watching video and listening to music; everything was connected; attention was in 3: music, visuals, room; did not look at musician there was no light on her; she was secondary and static playing flute; looked more to things moving and changing; if there is light on her it is different but not very because she does not move	Music; video; room; visuals and listening to music; connection; no no light on musician; musician secondary; changes grab attention	music; video; room musician invisible; lights needed; video while listening; visuals and audio connected
R14: the movement when it started moving more; did not expect movements, sometimes it got more unnatural; my focus changed, first wow it is pretty, later thinking what does this make me feel; feeling more, being more connected with it; second type of projection made me look at musician, she had projection on her	Movement of visuals; thoughts; beautiful; connected; musician blends with projection	movements thoughts; imagination; visuals and audio connected; musician blended in projection
R15: image of the flower and sound were sync; brighter with a higher note and darker with lower sound; saw things of the room, looked like a part of the projection when it became bigger/lighter; sometimes saw musician in front of projection; she was not interacting; tried to listen while watching, but they were not in sync so checked apart from each other	vegetation and music synchronized; room is one with projection; musician; interaction musician and visuals needed;	vegetation; visuals and audio connected; visuals and room connected; musician; interaction musician visuals needed

4. What do you focus on during an audiovisual performance?

R1: depends on set-up, I can feel different about what you showed me if it was in a church, or if I am immersed in speakers or in full dome projection, or if the room is black and I lay down and sound is all around me; I am sound designer, image has more impact on me than sound; depends on the environment or feelings	depends on performance; depends on set-up; image has more impact than sound; how I am feeling	depending on performance; depending on set-up; visuals' impact; depending on personal feelings; depending on environment
R2: depends on the cultural background of individual and environment; stage step-up is the factor that differentiates experience	Depends on individual; depends on cultural background; depends on environment; depends on set-up	depending on performance; depending on individual; depending on environment; depending on set-up
R5: depends on the quality, if it is a good performer I look at the performer, the same with visuals	depends on quality; depends on performance	depending on quality; depending on performance
R3: depends on connection I have with music; when I know the music, I look at visuals more complementary; when I do not know the songs, I get lost on stage visuals; easier to process what I am seeing than what I am listening, especially difficult to engage if it is instrumental or if I do not know lyrics	depends on connection with music; no connection with music means more visuals	depending on connection
R6: more easily drawn to visuals and sometimes think about how it is made or the idea behind it, then I am distracted from music; if visuals and music are in sync and both equally interesting this should not happen; I go to audiovisual performances more for music than for visuals	visuals can distract; both interesting	visuals are distracting
R7: depends on the artist; with a DJ I prefer good visuals, it contributes to the vibes	depends on performance	depending on performance

R8: equally; try to find relationship between music and visuals; the music needs to strengthen the visuals and the other way around	equally; searching relationship; music needs to strengthen visuals; visuals need to strengthen music	visuals; audio; searching relationship
R9: visuals; depends on the situation; depends on what I look for; I work with visuals so I look more at that usually	visuals; depends on individual	visuals; depending on individual
R10: depends if you make it together, or making visuals focused on something already made; depends on the place set-up (visuals big/sound system present etc.); mostly visuals have more impact	depends on performance; depends on set-up; visuals have impact	depending on performance; depending on set-up; visuals' impact
R11: depends; sometimes focus is on band or more visuals; depends on experience I want to have in that moment	depends on performance; depends on aim for focus; depends on individual;	depending on performance; depending on focus; depending on individual
R12: mainly on music; curious about the instruments; when there is no movement or nothing to watch visually	music; instrument; especially without movement or story	audio; instrument
R13: both together; depends on the performance	equally; depends on the performance	visuals; audio; depending on performance
R14: visuals; I have a hearing problem, sometimes music is too loud so I focus on visuals	visuals; depends on individual	visuals; depending on individual
R15: usually more video; if video is nice music makes more sense; like a music video where you associate music with visuals; also depends on type of performance; whenever audio and visuals are put together you try to make them fit	visuals; connection between audio and visuals; depends on performance	visuals; visuals and audio connection; depending on performance

5. What is the first thing that comes to mind when you think about an audiovisual performance you went to? Why?

R1: what changed me most on that moment; what I liked best; what surprised me most; normally mostly visuals	what surprised me; visual; individual experience	REMEMBERING surprising elements; visuals; individual experience
R2: both equally; best experience of the performance; I saw one where the image was horrible with the audio, and so meaning got lost	equally; individual experience	visuals; audio; individual experience
R3: equally	equally	visuals and audio (performance) as one
R4: visuals, but also the whole picture	visuals; both together	visuals; visuals and audio (performance) as one
R5: the whole thing, like one picture for me	both together	visuals and audio (performance) as one
R6: music; usually I come for the music so that is what I remember best; sometimes the visuals are more prominent and/or out there than music, then I clearly remember visuals; also on big and nice festival stage designs, visuals are remembered better than music played	audio; individual experience; prominent visuals; visuals	audio; individual experience; visuals; visuals' prominence
R9: image; saved in my brain is image	visuals	visuals
R11: mainly visuals; I remember seeing the images	visuals	visuals
R12: on the image, graphics, visuals; coming back after a night out, I don't remember music but only some visuals	visuals	visuals
R13: visuals are more inside my memory than music; I enjoy music in the moment but remember better visuals	visuals	visuals
R14: depends on the performance; depends on my mood; if I am in a bad mood I don't pay attention to music; music is the first thing I remember and focus on; also if I see or hear something unexpected, I will remember it	depends on performance; individual experience; what surprised me	depending on performance; individual experience; surprising elements
R15: both as one; I remember the setting, everything related to the performance	equally; depends on the set-up; depends on the performance;	visuals and audio (performance) as one; visuals; audio; depending on performance

This performance

6. What do you think about the objective of the audiovisual performance through the rehearsal/video you saw now?

REHEARSAL 1 & 2

R1: the thing that mostly got my attention was screen of the projection, having the exact square of projection non-projection which might be a problem because images are restricted to that area; idea to increase/expand the projection sometimes, play with it, cover half of the room; think about performance as a whole, as one experience; play with sound; I do not think it is possible to make audience focus 50% on visuals and 50% on audio, I also do not think you should want that; look for making it one whole performance/experience; everyone's mind is different and everyone looks at it different, you can never focus on everything exactly balanced; it is good to focus on rhythm, sequence on time; better if you do not exaggerate with changing from bright to dark	square of projection; play with sound; performance as a whole; rhythm; brightness/darkness visuals	projection square; play with sound; connecting visuals and audio; visuals and audio (performance) as one; rhythm; brightness/darkness visuals
R2: depends on set-up, where will the musicians be, the audience, the projection, etc.; to expand projection the projector should be high enough; if you expand it as big as you can in Casa de Allen at the end, it will be very cool; it is probably something you should discuss with musician, in balance or focus it claims; also good to focus on the piece she plays, if its subtle go subtle, more intense, try to stimulate that feeling; it is the whole that matters, not the elements on itself	location of projector; attention the projection asks; focus on music; performance as a whole	location projector; visuals' impact; focus on music; visuals and audio (performance) as one
R4: sometimes video is disturbing what she is playing, and sometimes the other way around; sometimes they are harmonized, but sometimes she is in another rhythm than the video; it is good to match rhythm of video more to what she is playing, connect more; the video works but with different music; music and video should be one piece; it would be good to be with rhythm and colors of what is happening during music; express the feeling music gives; I liked the different layers in the video, and when the screen is dark; I like it when it is dark and not clearly a square of projection; I want the video to surprise me; good if she has a connection to video; this connection will lift her, and put focus on her as well	connection visuals and audio; rhythm; visuals and audio as one; surprising visuals; express feelings music gives	connecting visuals and audio; rhythm; visuals and audio (performance) as one; expressing musical feeling
R5: in the beginning there was a connection, but later on it was not so connected which was disturbing; musician was just there, it was hard to focus on her; searching for story, something to connect me to what I see; rhythm of music was different than video, so hard to connect to it; I like it when it is dark and not clearly a square of projection; sometimes I saw a face, stretching, I like that; it is good to connect it to each other	connection visuals and audio; story; rhythm; brightness/darkness	connecting visuals and audio; story; rhythm; brightness/darkness visuals

REHEARSAL 3

R3: part with more musicians music will probably fill space more, it makes sense the visuals also grow; when she starts playing in the first part there is a good harmony; not bad there is no further light used on stage because of type of music they play; no need to get more focus on artists, if they are performing they should not be seen visually, but by what they play; only if musician feels that she wants it	no light on musician needed	no light needed
R6: first bigger screen does not seem to be based on dots appearing/moving around but more of different shapes that move, makes more sense in the context of more people performing together; better without object in front of window; without light shining from the table; could be good to not project onto the performers and having the visuals behind them; improvement is visuals reacting live to the music (in case it is not already); it is nicely balanced and not taking up too much of the attention and that the music still seems the main part of the performance	no projection on musicians; connection visuals and audio; positively balanced	projection on musicians; connecting visuals and audio;
R7: good to build a story, starting small and quiet; sometimes visualization was a bit long and not a lot is happening; big visualization is interesting because it felt like a whole; it is good if visuals are more in rhythm with music; make it a complete story; faster/slower, changing colors, clearer pictures; the attention the visuals ask are perfect, it stays abstract	build a story; more happening; connection visuals and audio; changing colours	story; surprising visuals; colours; connecting visuals and audio

R8: I miss the surprise; good to keep curiosity, because you will tell a story; more contrast to visuals; sometimes no visuals (totally black) so attention goes 100% to music; I like abstract visuals, sometimes I need more specific to understand it better	no surprise; make audience curious; story; contrast between visuals; abstractness visuals	surprising visuals; curiosity audience; story; contrast; abstractness
R9: good to make the musician stand out more, harmoniously with the installation, or disappear, or both; good if she is dressed appropriate/chic but colorful; if the musician is light it gives her more attention; if projection will be on the whole room it is like you are in a garden; map the place better, taking the architecture in consideration, not too much in ceiling; put musician in middle, project not on her but behind her; create black space between projection and where musicians stand; put small light on musicians; distinguish musicians from projection; project colors on them (purple); do not change visuals too fast; some places faster but not everything at same time; needs to be harmonious with music; create enough space for musicians (not overwhelmed by the projection); I like when there is black space in projection-screen; make the projection grow slowly; think of piece as a journey and make it into visuals	musicians more visible; lighter needed on musicians; projection location; location musicians; no projection on musicians; changes visuals; connection visuals and audio; visuals' impact; brightness/darkness visuals	visibility musicians; light needed; location projector; location musicians; projection on musicians; connecting visuals and audio; visuals' impact; brightness/darkness
R10: three different sections are well defined, and makes sense when projection grows with musicians and music growing; first section, two elements are more separated because of space between visuals and musician, other section she is more inside visuals; good if she is interacting with visuals, making it more dynamic; she is a bit dark, which makes you focus more on visuals; most important to make them interact as a whole; I did not feel visuals asked too much attention (only more in the first part)	location musician; location visuals; interaction musician music; brightness musician	location musicians; location visuals; interaction; visibility musicians
R11: in second part visuals mixed less with music; you do not take away the attention from music; you are making a whole experience; I am not interested in the musician, only music and visuals; spotlight could be possible to use to focus on musician; images on top of her look great; I liked bigger one better than first ones; it looks like a painting	connection visuals and music; visuals' impact; performance as a whole; brightness musicians; light needed	connecting visuals and music; visuals' impact; visuals and audio (performance) as one; brightness musicians; lights needed
R12: I noticed video was sometimes a bit faster than sound, or more activity, which takes more attention; music was a harmony; when it was bigger projection I was more connected to her; first one is more connected with her; audience will not look at the musician, but music will be central; when you link music with visuals it gives it another dimension, it complements it	connection visuals and audio	connecting the visuals with audio
R13: video is good; very connected; took too much focus away; she was too hidden, she needs light; some videos were better than others, last one she did the same movements as visuals; last one is connected with her, it follows movements; support is okay; maybe more light on musician; the music is main thing	musicians invisible; light needed; visuals' impact	brightness musicians; lights needed; visuals' impact
R14: I liked colorful flower in second part,she was more involved so I gave attention to her; she should be involved in projection, ideally putting her in a place and the projection will go around her, standing in the middle for example; with light on her the focus would be more split up between projection and her; in square one I look more at her; the projections are simple enough for me to appreciate the music; if visuals escalate too much it asks for attention; good not being too much; good to have visuals close to her, especially if she is alone; it makes perfect sense that visuals grow, when visuals are small with more musicians maybe they ask also more attention; I did not think the bigger projection was too distracting; third one is my favorite, second section with the flower bowing to her, it has a natural shape and true nature, and she is under the flower	interaction musician and visuals; location projection;	location projection; interaction
R15: the visuals bring different meaning to the performance, instead of her alone; maybe when it is too bright it can be uncomfortable for audience; the last part makes more sense, she is part of projection; first parts can take your attention to visuals and not her; extra light can also make visuals differ from musicians; if she does not take too long from one song to another, it is possible to have a continuous video projection; make the performance as a whole; depends if they need to turn lights on in between sections; good that with higher sound there was more light, and other way around; good to do it a bit and not too much; grow as the song progresses; support and not try to steal the show; minimal and connected to music	brightness visuals; continuity visuals; performance as a whole; connection visuals and audio; build-up	brightness/darkness visuals; continuity; visuals and audio (performance) as one; connecting visuals and audio; build-up

7. What do you think about the type of visuals chosen for the music?

REHEARSAL 1 & 2

R1: vegetation part is beautiful; it supports the music	beautiful; visuals support music	beautiful; support music
R2: first and the third were perfect because you loose sense of space and immerse in piece; in video of tree up high you can add something in bottom of the screen, or vary a bit, remove textures, so it is not too intensive for music; you can change it slowly with different aspects of the same tree, synchronizing with rhythm of musical piece; vegetation part is beautiful; supports the music; fits perfect with sound but this might be subjective and another person's experience might be different	beautiful; visuals support music; individual experience	beautiful; support music; individual experience
R4: it works; an idea is to add layers of people, and other things, and the plants can be one of the layers; most important is to serve the music	working	possible
R5: I like the vegetation; it is like waves; possible to make plants grow	positive; connection visuals and audio	positive

REHEARSAL 3

R3: in first part fountain works well, being connected to projected flower; not immediately notice it is vegetation; later I saw the visuals were a bit too much, but when more musicians are added it will be in better balance; the theme of visuals works well; I imagined a silhouette of a castle, or tried to find patterns in visuals	positive theme; imagination grows	positive; imagination
R6: it is nice; dreamlike and a bit like looking at stars, music is dreamlike as well; use of more colors for more performers makes sense; good to leave it abstract so it is open for viewers' interpretation and gives it more of a supportive role rather than trying to tell its own story	nice; imagination grows; positive abstractness	positive; imagination; positive abstractness
R7: I like it, because of 'nature' vibes; gives me a relaxed feeling	relaxing; liking it	positive; relaxed
R8: I see it is a flower, but not sure	unsure	unclear
R9: good; I like it; flute is an air-instrument which links to vegetation, air, wind, movement	flute links to vegetation; positive	positive; linked to instrument
R10: good to link movements of visuals with movement of audio, then you will see it as a whole and not as separate elements; link them to perceive it as one; type of visuals are good, I saw painting being created; they match with the music; fine when abstractness is mixed	connection visuals and audio; performance as a whole; positive; painting; imagination grows	positive; painting; imagination
R11: instead of closing visuals they can grow in between three sections, maybe while they are walking; type of visuals are good; everything mixes well; fine when abstractness is mixed; sometimes not taking up whole space would be good; I like it a lot	visuals continuity; positive; abstractness; location visuals	positive
R12: I saw nature; it fits with music; makes you feel happy; less abstract helps me with focusing on music; fine when abstractness is mixed	visuals linked to music; abstractness	linked to music
R13: appropriate; very abstract but you can see your own thing; nature is soft and fragile and gives you that feeling; I prefer abstractness to pay attention to music; fine when abstractness is mixed, it is both focusses on vegetation	appropriate; abstractness	appropriate
R14: when song is faster it is good to move visuals accordingly; when there are more instruments and you show more colors our brain connects the dots automatically; it can be problematic is it too much; when there are 6 people it can be hard to take the attention of them; the movements you made make sense with what she was playing; type of visuals connect with flute which connects with nature for me; softness and feeling of the flute make sense with nature; classical music we relate with calmness, nature, down to earth, out of space; it makes perfect sense	connection visuals and audio; visuals linked to instruments; visuals linked to music; positive	connecting visuals and audio; linked to instrument; linked to music; positive
R15: it suits the music; for the flute it is perfect; very Nordic; fairy tales	positive	positive

GENERATING INITIAL CODES AND THEMES

REHEARSAL VIDEOS 1, 2 & 3

DESCRIPTION

flute	**8**
video	**8**
vegetation	**7**
performance	**3**
visuals and audio connected	**3**
audiovisual performance	**2**
cosmic	**2**
music	**2**
processed video	**2**
rehearsal	**2**
baroque	1
connected elements	1
colours	1
exhibition	1
musician	1
painting	1
story	1
surrounding performance	1
variety of visuals	1
video in darkness	1
visuals	1
visuals and audio as one	1
visuals and audio unconnected	1

FIRST FOCUS

video	**6**
music	**5**
musician	**4**
understanding	**4**
build-up	**2**
light needed	**2**
movements	**2**
room	**2**
colour	1
development	1
exiting	1
flute	1
fountain	1
immersed in video	1
Interaction musician visuals needed	1
musician without projection needed	1
positive mapping	1
screen progress	1
vegetation	1
visuals and audio as one	1
visuals and audio connected	1
visuals and room connected	1

FEELING

beautiful	**3**
harmony	**3**
positive	**3**
relaxed	**3**
vegetation	**3**
imagination grows	**2**
absence of patterns is good	1
beautiful music	1
beautiful room	1
beautiful videos	1
calm	1
complementation	1
contrast between room and visuals	1
depressing	1
dreamy room	1
flute relates to vegetation	1
happiness	1
joy	1
medieval	1
no overwhelming visuals	1
painting	1
pretty music	1
story	1
subjective answer	1
uplifting	1
vegetation fits music	1
video	1
visual and audio connection needed	1
visuals and audio as one	1
visuals show musical story	1
vivid	1

LATER FOCUS ON

video	**4**
musician invisible	**3**
video while listening	**3**
visuals and audio connected	**3**
attention lost	**2**
change grabs attention	**2**
lights needed	**2**
musician blended in projection	**2**
exciting	1
bored	1
imagination grows	1
music	1
music is decoration	1
musician	1
musician without movement	1
positive mapping	1
reactive	1
subjective focus	1
thoughts	1
video without listening	1
videoclip	1
visuals too abstract	1

AUDIOVISUAL PERFORMANCE (general)

FOCUS AUDIOVISUAL PERFORMANCE

depending on performance	**8**
visuals	**5**
depending on individual	**4**
audio	**3**
depending on set-up	**3**
depending on environment	**2**
visuals' impact	**2**
depending on connection	1
depending on focus	1
depending on personal feelings	1
depending on quality	1
instrument	1
searching relationship	1
visuals are distracting	1

FIRST RECOLLECTION OF AUDIOVISUAL PERFORMANCE

visuals	**8**
individual experience	**4**
visuals and audio (performance) as one	**4**
audio	**2**
depending on performance	**2**
surprising elements	**2**
visual's prominence	1

THIS AUDIOVISUAL PERFORMANCE

IMPROVEMENT POINTS FOR THIS PERFORMANCE

connecting visuals and audio	**8**
visuals and audio (performance) as one	**5**
visuals' impact	**4**
brightness/darkness visuals	**3**
lights needed	**3**
location projector	**3**
brightness musicians	**2**
interaction	**2**
location musicians	**2**
projection on musicians	**2**
rhythm	**2**
story	**2**
surprising visuals	**2**
visibility musicians	**2**
abstractness	1
build-up	1
colors	1
continuity	1
contrast	1
curiosity audience	1
expressing musical feeling	1
focus on music	1
location visuals	1
no light needed	1
play with sound	1
projection square	1

VEGETATION THEME

positive	**8**
imagination grows	**3**
beautiful	**2**
linked to instrument	**2**
linked to music	**2**
support music	**2**
appropriate	1
connecting visuals and audio	1
individual experience	1
painting	1
positive abstractness	1
possible	1
relaxed	1
unclear	1