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Tecnologia e Comunicação
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Projeto apresentado ao IADE – Faculdade de Design, Tecnologia e Comunicação da Universidade Europeia, para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Design e Cultura Visual realizada sob a orientação científica do Doutor Carlo Turri, Professor Auxiliar do IADE e da ESEC.

MOD-195.IADEV00; 07-02-2020

To those who know the best ideas come from going out, exploring, experiencing, and learning.

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acknowledgment

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palavras-chave

projecção; video mapping; festival; parede da falésia; audiovisual; criação de conteúdos; visual music; som; filme; modelação 3D; processo.

resumo

Rendering the Reality, como conceito, quer difundir a ideia de que aquilo que as pessoas experimentam não é apenas a representação objetiva da realidade, mas a sua interpretação subjetiva. Todos podem perceber algo diferente dos outros e este aspeto é analisado neste trabalho através de uma imersão total no mundo das projeções.

O principal objetivo desta tese de projeto, de facto, é desenvolver um espetáculo de *video mapping* sobre uma superfície irregular dentro de um festival de música. Para tal, inicialmente, foram analisados os antecedentes históricos e o estado da arte. Foi levado em consideração três tópicos principais: história do cinema, história do som no cinema, e história do video mapping. Relativamente a este último, no qual o desenvolvimento é mais recente, foi também discutida uma análise adicional e notícias relacionadas ao assunto.

Posteriormente, foram apresentados e investigados alguns projetos inspiradores. Estes são instalações ou espetáculos que levam à concretização da tarefa principal.

A parte central é o desenvolvimento do projeto. Primeiro, foi apresentado o conceito do festival e detalhes relacionados. Fundamental nesta secção é a análise do local, uma vez que o mapeamento da projeção teve de ser assentado numa falésia de uma montanha. Uma vez analisado o espaço, foram feitas muitas inspeções ao local a fim de produzir uma maquete. Esta última foi feita utilizando fotogrametria e impressão 3D. O protótipo 3D foi então mapeado e o conteúdo de vídeo foi projetado sobre ele. Os conteúdos para o *video mapping* foram devidamente registados, editados e distorcidos para se obter uma proposta do programa no protótipo.

O resultado final é um *video mapping* de 3 minutos ao vivo feito de conteúdos visuais mistos e uma faixa musical criada para o efeito. Este resultado é a soma de todo o processo e dos obstáculos encontrados ao longo do percurso.

Em conclusão, a relação que o público pode estabelecer com este espetáculo de video mapping não pode ser esclarecida, já que o festival não se realizou. Mas é evidente que o artista que desenvolveu o espetáculo tentou dar uma interpretação do festival e da sua localização através do conteúdo audiovisual, ou seja, tentando *renderizar* a realidade.

keywords

projection; video mapping; festival; cliff face; audiovisual; content creation; visual music; sound; movie; 3D modeling; process.

abstract

Rendering the Reality, as a concept, wants to spread the idea that what people experience is not only the objective representation of reality but the subjective interpretation of it. Everyone can perceive something different from others and this aspect is analyzed in this work through full immersion in the world of projections.

The main goal of this project thesis, indeed, is to develop a video mapping show on an irregular surface within a music festival. To do so, initially, the historical background and state of the art were analyzed. Three main topics were taken into consideration: History of filmmaking, History of sound in movies, and History of projection mapping. Concerning this latter, whose development is most recent, additional analysis and related news were discussed, too.

Subsequently, some inspiring projects were presented and investigated. Those are installations or shows that lead to the concretization of the main task.

The central part is the development of the project. First, the festival concept and related details were presented. Fundamental in this section is the analysis of the location since the projection mapping had to be settled on a cliff face of a mountain. Once analyzed the space, lots of site inspections were made in order to produce a maquette. This latter was made using photogrammetry and 3D printing. The 3D prototype, then, was mapped and video contents were projected on it. Contents for video mapping were appositely recorded, edited, and distorted to obtain a proposal of the show on the prototype.

The final result is a 3-minute video mapping live made of mixed visual contents and a music track created for the purpose. This outcome is the sum of the entire process and obstacles encountered along the way.

In conclusion, the relationship the audience can establish with this video mapping show cannot be clarified, as the festival did not take place. But it is clear that the artist who developed the show tried to give an interpretation of the festival and its location through the audiovisual content, that is, trying to render the reality.

INDEX

FIGURE INDEX

Part 1

INTRODUCTION

1.1 WHY CHOOSING PROJECTION MAPPING?

The incipit to understand it all

In our lives, we must understand what makes us happier.
Then, we must understand if it coincides with our nature.
If it does, we are in the right place!
Eduardo Côrte-Real, September 2018

Sometimes in life there is no reason. Some things come in people's mind or life randomly and overwhelm them all the way. It is difficult to explain this feeling and try to understand what really happened. It is something that cannot be controlled, and for this reason, it is marvelous.

The secret here is having tried for long time to understand what is this wonder – not trying to find where it comes from, but where it can go.

It was October 2019, I was sitting beneath a tree, in the park in front of the tower of Belém. It has been long time since then, things got worse after that moment, but I consider that the turning point of my existence – so far. I was asked to find a convincing environment to develop my project thesis, so that I went there to brainstorm with myself. After a couple of hours of saturated brainstorming, I decided to focus on what I really like to do in my life and write down the results. My outcome was a list of activities, things, and people I most love in my life. Some examples: trekking, to spend time with friends, music, festivals, visuals, nature, to camp, to be patient, art, colors, to wait, to listen to people, to meet new people, to explore, to travel, etc. Some of them can be considered as synonyms, but to me each of those words means something really clear and specific. I thought that the solution was hidden in merging all those items and see what it could come to light.

The final result is something that I called Trekking & Techno and I will explain it further in details in the following pages. Here, I can just say that it gave a new light to what I think is right in life. A new reason to follow the dreams and make them come true. Thanks to it, I really understood what I can do with my life, where I want to converge all my energies and which kind of obstacles I can overcome.

In the context of Trekking & Techno, I tried to develop a video mapping show, which is the main topic of this work. Perhaps, I challenged myself too much. But this is exactly what makes me feel alive. The secret, again, is that it is not always necessary to find the reason why things happen. To better live my life, I decided to find a way to turn what happens into the best thing ever.

It is not a matter of what happens, but it is a matter of how you react.

It is not a matter of the problem, but it is a matter of the solution.

1.1.1 Overview

Rendering the Reality is a project that crosses the history of cinema and sound in order to arrive to what video projection is and means in these days. To do so, history of cinema will be analyzed in its most important happenings, giving more attention to the moments that concern this project. After that, history of music in cinema will be also discussed, in order to focus in what makes music important for video making, and vice versa. Both ways will be investigated, giving attention to the turning point in which music has become the main character, to the detriment of video, in specific fields. This, along with the history of video projection, will lead to the field in which music has the main role and video follows it: projection for live music shows. Well known in clubs and event environment, this opens the scene to artists, designers and professionals able to make magic with lights, namely VJ or video jockey. In order to have a full perspective, it is necessary to understand how projection and video mapping were born, how it has evolved and how designers can adapt their contents to different surfaces. It will be a long journey from first projections made with shadows and candles till holography and innovations of these days.

After that, it will be possible to jump into the influences which inspired this work. In that part, works by famous VJs and designers will be taken under analysis, but even works of land art, live shows, and music festivals will be presented in their importance concerning the project in question. This part will open the way for the main project on the thesis. Trekking & Techno will be explained as the environment where the projection will take place. Constraints, surfaces, themes, and methodology will be explained as much as possible in order to make everybody understand what is behind a huge event. In conclusion, an attempt will be made to explain what difficulties and errors can be encountered when designing a video mapping show. But also,

what are the results that can be obtained and the wonderful experiences that can be given to the audience. In the end, one will understand that for every obstacle, beyond it there is always a great satisfaction.

1.1.2 Goals

All this excursus through history of cinema and projection has as main goal to develop a video mapping show as final project.

Trying to answer the main question “why video mapping?” through all the chapters, this work wants to understand what the reasons behind the use of video mapping by corporates or artists are. What has projection mapping more than a simple screen? Do people catch the message in a different way? Which is the plus that projection mapping can add to a show?

Considering the assumption that not everything must have an explanation, in any case this project was born from a belief that the audience can get in touch in a more sensory way with video mapping, instead of classic devices such as screens. Avoiding entering into sociological and psychological mechanisms, this thesis will try to understand which is the relationship between the preparation and creativity of a designer and the fruition of the final product. In other words, which is the relation between the public and the content. Is it true that less is more? Perhaps not in the concept for which this rule was born, it is not the minimalism of Mies Van Der Rohe that is sought in the production of a content – but actually in many cases this method will be revealed as the best. But it is certainly a minimalism of contact, a minimalism of relationship. The relationship between the viewer and the device is minimized as much as possible, to the point of eliminating it. The projections are extremely functional because the audience - wherever it is - does not perceive where the content comes from. What people watch is something that seems pure reality materialized in front of them. One can quickly understand that the work to eliminate the device is so much upstream but what really matters is what remains to the audience.

Less is more then: less devices, and more experience.

1.1.3 Structure of the work

The work has got a first part where state of the art is explained. This first part comprehends the history of cinema, music in cinema, and projection mapping.

After that, the focus is moved to a chapter concerning influences. Influences are shows, performances, and events which have inspired this final work. This chapter's goal is to understand contexts in which artists work, techniques used by them to develop their projects or shows, and also reasons and goals leading projects.

Practical part of the thesis is about the development of *Beyond Rocks* project. *Beyond Rocks* is a video mapping show in the context of a music festival, projected on a mountain's cliff face. For this reason, festival, surface and themes will be explained as concerned in the briefing. Along with this, methodology and constraints to realize this specific show will be explained.

In conclusion, the result will be shown in a prototype of the final show appearance.

Part 2

HISTORICAL BACKGROUND AND STATE OF THE ART

2.1 A NEW WAY TO COMMUNICATE

The History of filmmaking

Considerate la vostra semenza:
fatti non foste a viver come bruti
ma per seguir virtute e canoscenza
Dante Alighieri

The history of Cinema is long and intricate, made up of many events and countless innovations. Between twists and turns, changes of direction, and attempts, telling the entire history of cinema would be impossible. It would also be impossible to tell it taking into account the various points of view and interpretations.

Here it will be necessary to make some cuts; the goal of this thesis is to analyze the various historical events in cinema that led artists to experiment with visual music and understand the reasons for this. In this regard, parts pertaining to the studio system, Hollywood, or major war films will not be covered. These areas will be sacrificed to give more space to the introduction of editing techniques, the introduction of sound, and the various visual experiments that led a niche of artists to devote their art to what would later be called music visualization.

The rest of film history, that which runs through the various decades of cinematic twists and turns, is well etched into every inch of film and every theater ticket sold and purchased. The last few years of cinema history are also well imprinted in every single frame of filming and in every single computer file.

2.1.1 The dawn

2.1.1.1 New Jersey

East Coast, US, end of 19th century. Film was born.

Thomas Edison was a passionate and obsessive inventor. He was the one inventing lamp bulb and phonograph. In his factory, he had a frame with the following quote by Joshua Reynolds:

"There is no expedient to which a man will not resort to avoid the real labor of thinking" (Cousins, 2011). He was used to move this frame around the factory, so that employers did not get used to see it in the same place.

Before Edison, there were already fun fair, lantern shows, magic, static images reflecting on mirrors or moving images. Edison was working with William Kennedy Dickson, together they discovered that if images flow inside a dark box, outside illusion of movement is created. *Black Maria* was the first film studio ever, invented by Edison and Dickson. With this huge structure, the two understood that cinema was working, apart from tools, with nothing more than light.

If movie has been the art of light from Edison's discover, then the problem was that he was able to show movies just from a little fissure where just an eye could fit in. Cinema will have become the one of the big screens, and for this there was Lyon.

2.1.1.2 Lyon

France, Europe, end of 19th century. Film was born, too.

Louis and Auguste Lumière were as clever as Edison. They understood that the same mechanism of sewing machine could let the film moving forward, stop, impress people, and keep going in loop. Lumières's film cameras could be turned into projectors when open.

Their ambition was to show their movies to many people at the same time, different from what Edison was doing on the other side of the Atlantic. This dream came true on December 28, 1895. On that day there was the first movie projection of the history. Filtering through the camera, light was able to display moving images on big screen. In this way, *L'arrivée d'un train en gare de La Ciotat* (1896) shocked the audience in the theatre, because the train was thought to go straight against public.

This huge innovation, given by light projected on a surface is what city of Lyon still uses nowadays to shock people. More than a hundred years later, Lyon attracts people from all over the world to show them what can be done with light, once a year at the Fête des Lumières.

In this context, it is possible to analyze the importance of the word *Lumière* in French language.

The first reason why France took so personal this discovery of cinema comes from the French Revolution and "the dream to project something to the world and to itself, something that French people call *le lumière*, the light" (Cousins, 2011). So that, Lumière brothers invented

cinema. But before there was *le Siècle des Lumières* (in English Enlightenment): French Revolution, Encyclopédie, Kant, etc. In the following centuries, cinema has led France as a lighthouse – still *lumière*.

George Méliès was one of Lumière brothers' workers. He was filming at one of the first projections in Paris, and his camera blocked for a moment and then it started up again. This accident led Méliès to discover editing techniques. In this way Méliès understood that he could be able not just to show the world on screen, but also modify it as he wishes. Due to this, he moved his movies from outside to inside in order to build magical and visionary pieces in studio; such as *Le voyage dans la Lune* (1902), considered the first science fiction movie of the history of film.

Figure 1. The first outcome of special effects in History of cinematography, Le Voyage dans la Lune by George Méliès

2.1.1.3 Brighton

George Albert Smith was living in Brighton when film was born. He started to experiment new framings. He is the first one to shoot from a moving train, creating the phantom ride. This latter would become very important for movies, and it was used in various forms such as Second World War's frames of rails in Auschwitz or futuristic views of outer space like in *2001: A Space Odyssey* by Kubrick.

Smith also invented close-ups, which was a great innovation for the fruition of details. In 1927, Sergei Eisenstein showed a perfect example of detailed close-up in *October: Ten Days that Shook the World*, in a particular way when a drawbridge is raised. In that moment, the camera only frames a dead woman lying between the two parts of the bridge; the sense of movement is given by the woman's hand and hair slipping away while the bridge separates. On the other side of the ocean, Enoch J Rektor broadened cinema's horizons – literally. He started to shoot with a larger negative of 63mm format rather than 35mm. With Rektor's widescreen, images resulted to be more active in the new aspect ratio of 1.75:1.

2.1.2 First innovations in film editing

In the early 20th century, while the first plane was taking off, Einstein theorized light as the only constant in the universe, while Titanic was sinking, the First World War began. Along with all this, cinema also evolved in an immense way, exploring editing techniques. Editing was discovered by chance by Méliès and over the years, others improved various ways to use it. Classical cuts were discovered in those years:

- Continuity cutting

Standard cut, also known as decoupage, is the most classic editing technique. The action is presented in a continuous long take. The only thing that is cut is the space. Dividing the space is the first real difference between cinema and theatre: indeed, while in theatre the space is singular, in movies the space can be different and from different points of view. In any case, this editing approach is to film narrative as the word "after" is to language. A good example of it is *Life of an American Fireman* (1903) by Edwin S. Porter.

- Parallel editing

Also known as cross cutting, this is the technique which is possible to alternate two or more scene with. Scenes often happen simultaneously but in different locations, and they can eventually culminate in a single place. This technique is usually applied to give suspense to the movie, and it replaces the word "while".

- Reverse angle

Shot reverse shot. So far, actors had never turned their back to the camera. Thanks to reverse angle, the camera started to move around people and film them from different perspectives, also from behind. In this context, the importance of sight between actors has been introduced

by Cecil B. De Mille in 1914. Better explained, if the goal is to give the idea that two subjects are looking at each other, they need to be aligned by the camera frame on an imaginary line of 180° connecting their eyes.

2.1.3 First American movies and its rebels

In the early twenties, the studio system was born in Hollywood, but it was more like a cinema industry. The myth of Hollywood had just blossomed, and they were making magic with lights and studios over there. Hollywood production, anyway, was defined as a dictatorship and compared to Ford's production line, where the artist was quiet and obedient (Cousins, 2011). *Gold Diggers* (1933), directed by Mervyn LeRoy, is the perfect show of this Hollywood dictatorship's genial elements. In this movie Busby Berkeley was the choreographer, he made girls moving in a perfect symmetrical and geometrical way, generating real schemes with body movements (Figure 3).

Figure 2. Poster of Gold Diggers

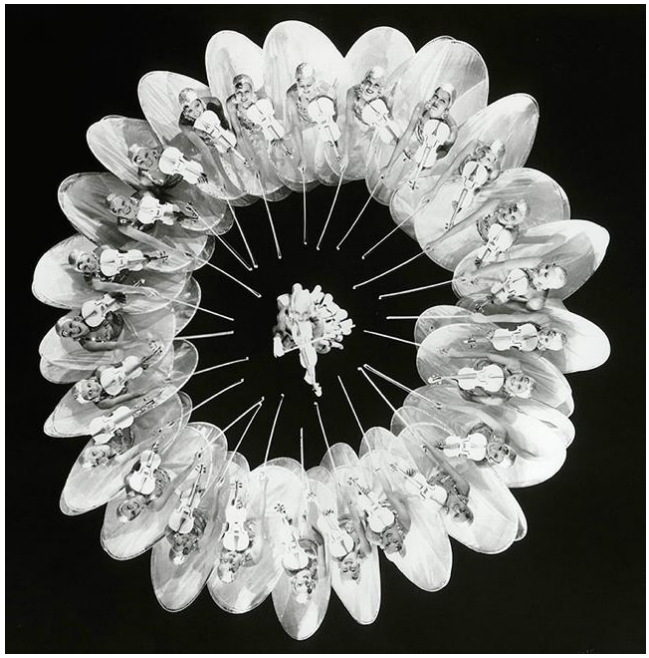


Figure 3. A shot of the choreography by Busby Berkeley

Great Hollywood studios were born in those years, too. Studios such as Paramount Pictures Corporation, Metro-Goldwyn-Mayer (MGM), and Warner Bros. Entertainment Inc mainly produced romantic movies during the twenties. The real innovation coming from those years were American comedy movies by Charlie Chaplin, Buster Keaton, and Harold Lloyd. While Chaplin would be remembered forever to be the genius of body movement in his silent movies, Keaton would be remembered to be the greatest inventor of comic images. Along with this

latter, Keaton is famous also for his use of camera: he used the camera as if it was a direct sight on happenings. In *The General* (1926), he created a bridge collapse for real, just for the movie. Even Lloyd has been very influential in comedy and every genre. He was able to interpret in an original and very effective way the precariousness of the ordinary perception of things and the feeling of imminent danger of losing life that dominate the experience of urban space, using space-time manipulation techniques to obtain comic effects from suspense. The climbing scenes in *Safety Last!* (1923) gives perfectly this feeling.

At the end of the twenties, indeed, writers noticed that less fiction and more realism was needed. In this context, the first rebels against romantic films were born.

2.1.3.1 Great rebel filmmakers around the world

Between the twenties and the thirties, some directors from all the corners of the planet were showing their rebellion against standard romantic movies. There were several main groups of rebels:

- Realism

The first group of rebels was the one of realists. At the end of the twenties, filmmakers realized that cinema needed to change its romantic images. Until that moment, actors appeared bidimensional and shiny, as in Raoul Walsh's *The Thief of Bagdad* (1924). Transformation from this genre of imagery to the new realistic one was well clear in *The Passion of Joan D'Arc*, a 1928 movie directed by Carl Theodor Dreyer, in which Joan D'Arc is represented in a simple way, in pain and with no make-up.

- Comedy

The revolution of comedy began with American filmmakers such as Charlie Chaplin, Buster Keaton and Harold Lloyd, but with Ernst Lubitsch it reached peak in those years. He was a German-born filmmaker moved to Hollywood. In his movies, he snorted the idea of Victorian love and seduction of that time and built his own style – subversive and satirical – then called *Lubitsch touch*.

- French impressionism

Filmmakers such as Abel Gance, along with Louis Delluc, Jean Epstein, and Germain Dulac contributed to bring to life the season of the French avant-garde, namely impressionism.

Reasons were relied to the relationship between movie makers and the fast pace of cameras and visual fluidity in expressing lyrical or dramatical sensations.

- German expressionism

Expressionism in Germany hit all the cultural fields such as architecture, dance, painting, and cinema. This movement in Germany was born after First World War, that is when Germany was separated from the rest of the world. The demand of film production increased a lot and German filmmakers started to experiment with creative ideas. Budget was so poor that they invented non-realistic sets, absurd uses of angles, geometries, for instance, shadows and lights were represented with paintings on the wall (Figure 4). One of the most important movies of those years was *The Cabinet of Dr. Caligari* (1920). It is a silent horror film by Robert Wiene which tells the story of a hypnotist who uses a somnambulist to murder people. This movie shows a dark and twisted visual style, high contrasts and geometrically impossible angles to represent the main character's unbalanced mind. This visual style is visible in the poster of the movie, too (Figure 5).

Figure 4. A scene of The Cabinet of Dr. Caligari, where shadows are painted on the walls

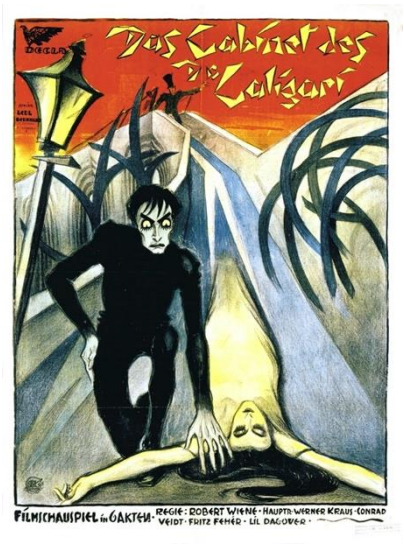


Figure 5. Poster of The Cabinet of Dr. Caligari

Other examples are the futuristic urban dystopia set by Fritz Lang in *Metropolis* (1927) and the romantic drama of *Sunrise: A Song of Two Humans* (1927) by Friedrich Wilhelm Murnau. Both of them took German expressionism to Hollywood when migrating due to Nazi laws.

- Abstract art and Dadaism

Cinema was becoming more and more interesting among art students in France and Germany. Experimental cinema and avant-garde privileged absurdity and surrealism as it is evident in

Buñuel's works, such as in *Un Chien Andalou* (1929). This short movie written and directed along with Salvador Dalí consists in a collection of surprising images of Freudian nature. This movie is completely surrealistic, and it does not have a plot, but just scenes which change without changing characters or events. Buñuel represents the complete refusal to romantic cinema.

While Buñuel was acting between France and Spain, in Germany Walter Ruttmann was becoming one of the most important representatives of abstract experimental cinema. Inspired by biology, he painted on glass and recorded the final result. Then, when dry, he painted again and recorded again, and so on. In this way, he created one of the first abstract animations.

- Soviet avant-garde

Between 1918 and the end of the twenties, just after the Russian Revolution, Russian movies lived a moment of avant-garde. They seized the opportunity to show new revolutionary ideals of freedom and modernity. In this context, Dziga Vertov launched the new theory of *kinoglaz*, kino-eye. With this theory the director intended cinema as a mean to show people what, looked at with the eyes, was considered banal and obvious. Camera has, in his opinion, the privilege to see in movement, see what the simple sight cannot, deleting all the story but generating visual poetry.

This Soviet period gave life to pioneer of montage theories and practices: Sergei Eisenstein. *Battleship Potemkin* was produced in 1925, and it is still considered the greatest film of all the time. It tells the story of the Russian battleship whose facts brought to the beginning of the First Russian Revolution in 1905. Facts in the movie are both real and fictitious and it is divided in five acts, for a precise reason: classic tragedies were always divided in five episodes.

The innovation in *Battleship Potemkin* is mostly concerning the editing. In opposition to kino-eye, Eisenstein used something called kino-fist in his montage, that is the sequence of strong, impressive images in order to give a shock to the audience. Examples of this theory are the close-ups of two women during the attack at Odessa Steps. To give this sense of shock, the average length of an Eisenstein's scene was 3 seconds. A lot shorter comparing it with typical Hollywood's scenes of 5 seconds or German ones of 9 seconds. The final result is that the viewer is enveloped in a sense of chaos and bewilderment. Events are shown quickly and in a fragmented way: the various scenes never have an end but are accumulated without giving the viewer time to understand the logic. It is an accumulation of events and violence that does not make the audience breathe.

- Japanese balance

Japan, between the 1920s and the early 1930s, was experiencing a golden age of cinema. In this context, filmmakers were mainly divided into two groups. On one hand, there were Mizoguchi, Ozu and Naruse who produced contemporary films, whether they were dramatic or comic, called *gendai-geki*. On the other hand, there were classic film specialists including Ito, Inagaki, and Kinugasa.

Ozu, in particular, was a pioneer of realistic cinema, he made paced films about ordinary people doing ordinary things. He used to tell the story of growth through the sadness of time flowing. His style was characterized by hip level angle shots, straight gazes into the camera, great geometric balance, and careful use of pauses in space and time.

Figures 6. Ozu's style in filmmaking, Late Spring, 1949

- Left party realism

First films appeared only from the first decade of the 1900 in China. The 1930s are considered the golden age of Chinese cinema, but in those years, Japan invaded China and occupied Shanghai, and therefore there was a sharp decline in movie production. Shanghai was considered the center of Chinese cinema, which was divided between nationalist and communist movements. The latter covered the movement called *progressive* and it was concerning with ordinary people by analyzing contexts of class struggle and external threats. More than a director, an actress stood out among others: Ruan Lingyu, who represented the women of the time in a Shanghai, which was considered to be the city of sex.

2.1.4 The advent of sound

Cinema has never been truly silent, but always animated by various sound manifestations, whether they were orchestras playing in the hall, applauses and comments from the audience, or experiments by foley artists. Furthermore, research and patents in the field of sound reinforcement began in the same years in which the first animations and the first cinematic films appeared. However, in the twenties, the introduction of sound in movies occurred in a violent and almost unexpected way, causing one of the most radical changes in the history of cinema.

2.1.4.1 Sound in silent movies

Thomas Edison, considered the American inventor of cinema, was told as unsatisfied because, while introducing moving images, he was trying to provide movies with words. In 1895, he was already comparing his kinetoscope to the phonograph's ancestor, the cylinder record. The starting point here is to reverse the primacy of the image over the sound, as it will be possible to see later in the 1940s. Edison, indeed, used to consider moving images as an illustration of what was produced by the phonograph – this idea will shape the whole concept of visual music. Other experiments to insert sound in film were run with live recorded dialogues by actors as the projection was screened. An example of this is the *Phono-Ciné-Théâtre*, which allowed the actors to record lines on the phonograph and, at the same time, the projectionist to change the speed of the film in order to make the final result synchronized. Another experiment was the *Phonorama*, patented by Berthon, Dussaud and Jaubert, on January 1, 1898. In this case, sound reached spectators through telephone headsets, connected with 12 phonographs synchronized with the film. Each of these twelve phonographs presented the sound recorded from a different point of the room, a taste of current Dolby Surround.

Therefore, sound movies arise thanks to intersection of various sound media. It is possible to assert that, at the beginning of the century, there were already enough experiments to introduce a sound film. But instead, it seems that the silence of cinema ended up among the prerogatives of films, connoting the first 30 years of films as "a silent symphony of images" (Valentini, p. 16).

In addition, cinema, even silent cinema, has never been completely silent, whether it is about music played by an orchestra, audience or projector's noise. In most cases, film needed an explanation of what was going on, and this was up to a *bonimenteur* - the pitchman, or

commentator in charge. Another widely used method, especially by Soviet filmmakers, was to change the size of words to express the related mood. At that time, words were written in large letters on the posters, almost screaming what they wanted to say to the crowd. Also captions within scenes in the films managed to give the scene an intonation.

In 1927, Luigi Russolo added sound to short films in Paris at Studio 28 with an instrument called *Rumarmonio*. In the first 30 years of the twentieth century, audience that went to watch movies was not only dealing with music and words, but also with real noises. Thus, noise machines – the *Rumorarmonio* among them – were positioned inside the room to produce sound effects of scenes of the various films. Production of noises directly in the room, coming from various corners of the same room considering where the position of various spectators, was able to create a great emotional impact.

2.1.4.2 Music beyond movie

The ennoblement of cinema and its affirmation as a real art necessarily pass through the collaboration with successful musicians. Those latter not only provided a musical accompaniment but became real fundamental sources in the cinematographic shows. The doors will open to famous collaborations between directors and composers, such as Italian ones including *Cabiria* (by Pastrone, 1914) with *Sinfonia del Fuoco* (literally "Symphony of Fire" by Ildebrando Pizetti).

In this context of interactions between visual and sound, it is necessary to mention avant-garde experiments. Among these, the *Chromatic Music* of Bruno Corra and Arnaldo Ginna, in which the film strip was painted with chromatic sequences dictated by listening to a piece of music. But also, abstract art of Germans Oskar Fischinger and Rudolf Pfenninger. Both, along with others, will be analyzed in detail in the next chapter. In these manifestations, the relationship between visual and sound is no longer subordinate, but the role of music becomes central in the creative process.

2.1.4.3 Talking pictures

Even if from the beginning of film production sound was present in movies, movies became definitely spoken only in the twenties. Experiments to add sound to films had already started

from the first beginnings of cinema but only between 1926 and 1930 the real revolution took place. The transition appeared fast and violent, but as a matter of facts, the transition to sound forced a slow and radical transition in filmmaking, in which modifications of shooting techniques and projection rooms happened. Despite the various attempts of many cinema visionaries of earliest 1900s mentioned in the previous paragraphs, but also of latest 1800s, primacy of sound era goes to Warner Bros. On August 6, 1926, the world premiere of *Don Juan* (directed by Alan Crosland with John Barrymore and Mary Astor) was presented at the Warner Theater in New York. The production company took the risk by relying on sound, and decided to buy the *Vitaphone*, a sound-on-disc system, which made it possible to create the first sound tracked feature film, in which the images were synchronized with the audio recorded on a disc. The *Vitaphone* system was patented by the Western Electric, an American electricity company, which took the leap to create this system considering the introduction of telephony and radio at that time. *Vitaphone* made possible to record on disc along with the visual recording with perfect synchronism, and then to pair projector and disc during playback. Warner Bros, taking the risk, saw a great increase in takings. The investment for the *Vitaphone* was half a million dollars, but with *The Jazz Singer* (by Crosland, 1927) they earned 3.5 million dollars. And above all, they launched the revolution of the American film industry, introducing the studio system of those years. In fact, a year later, Warner Bros presented "the first all talking picture", the first fully spoken movie: *Lights of New York* of B. Foy (Figure 7). This film was supposed to be a short that was later made into a feature film due to the growing demand for sound films. It also became famous for the unintended comic effects created by many songs, few dialogues, omissions and inaccuracies by actors. Warner Bros got another big deal with this film, through

Figure 7. Poster of Lights of New York, 1928

it they affirmed the sound film not as a passing novelty, but as something destined to last forever. However, Warner Bros had not come to terms with the limitations of technology it had invested in, that is the *Vitaphone*. Indeed, back in 1923, Lee De Forest with his *Phonofilm* presented in New York, had already presented a new way of recording sound: that is directly on film. Within a few years, therefore, sound-on-disc recording was replaced by a new acoustic recording system: the photoelectric recording of sounds on the sensitive emulsion of the film strip, as known as sound-on-film.

It was Fox to take the first steps in the direction of sound-on-film, focused on removing the various records gained by Warner Bros. For this reason, it bet on the experiments carried out on the *Movietone* system, which could count on the efficient photoelectric recording with variable density, that was able to pick up frequencies that were sacrified using the sound-on-disc. The new *Movietone* has been used since 1927 for shorts but also the first feature *Seventh Heaven* (directed by F. Borzage), which received a lot of awards. Advantages of this new technique were evident and among these the most important: *Movietone* allowed to record also outdoors.

In this context, another giant entered to make the difference, the Radio Corporation of America. This latter had developed a variable area optical system called *RCA Photophone*. Since the *Vitaphone* and the *Movietone* had the duopoly of the market, in 1928 David Sarnoff decided to find a small production company. The RKO was mainly engaged in producing sound movies and addressed to independent theaters to which it offered films at advantageous prices for the adaptation of theaters to its system.

After this three-way fight among Americans, the Europeans began to come forward too, especially Germans. Race for patents raged among studios, banking groups and large industries leaded to a structural change of the film industry and the final division of the market between *RCA Photophone* and Western Electric (American) on one side and Tobis Klangfilm and Gaumont-Petersen-Poulsen (European) on the other side. From the first great films in which sound occupied no more than 20-30% of the film, after *Lights of New York* improvements reached the so-called *100% talkies*, which offered a well-blended mixture of music, sounds and dialogue.

2.1.4.4 Innovations in sound production and use of sound in genres

With the advent of sound, words became central inside the soundtrack. In classical cinema, dialogues have been recorded, protecting their complete intelligibility, even at the risk of sacrificing noises or music. Sound effects, in fact, have always had a secondary relevance, until Jack Foley entered the scene. This name will remain well fixed in history of cinematographic sound, he became famous for having codified the *art of foley*. Employed at Universal, he ushered in the era of sound post-production at that time when directors believed it was enough to place a microphone next to the camera to record sounds. His working method was completely different, indeed he started recording sounds at the end of the film. In this way a real noise-making laboratory was introduced, a mix between craftsmanship and typical Hollywood industry. Foley thus began to record common noises, such as the creaking of a chair, or footsteps in the snow. But in reality, he was also commissioned to create customized sounds, especially tailored to the characters in question - such as Marlon Brando's walk.

In recent years, sound experiments within films have given life to various film genres: musicals, horror, fantasy, comedy, crime, and legal drama.

- Musical theatre

In musicals, the ability to include songs in cinema literally invades the movie itself. Example of this is *Singin' in the Rain* (by Gene Kelly and Stanley Donen, 1952), considered the most famous film that celebrates the transition from silent to sound. This musical is also considered as a celebration of sound cinema, as its idea of song's use is deeply dramaturgical and dance – which follows the previous – is never random but, on the contrary, it is central action and synthesis of image and sound. The same happens in *Top Hat* (by Sandrich, 1935): when Fred Astaire and Ginger Rogers start dancing *Isn't it a lovely day (To be caught in the rain)*. They do not just start dancing, but they mark the real beginning of their love, and it could not be otherwise within that movie.

- Horror and fantasy

In horror or fantasy movies, research on cinematic sound reaches the top and becomes very elaborate. The experimentation goes from the in-depth study of noises able to recreate mysterious characteristics of a space, to the search for new and impressive sounds - as in *King Kong* (by Merian C. Cooper and Ernest B. Schoedsack, 1933) but also *Tarzan, the Ape Man* (by W. S. Van Dyke, 1932). Interesting facts about Tarzan is that all the images of the jungle

were taken from the unused material of another movie and enlivened by the sounds of various animals, coming from the darkness.

- Legal drama

Courtroom dramas, on the other hand, are the triumph of words, plots within the film are rendered precisely thanks to the use of words. Those latter are in fact able to transmit various steps of reconstruction of events in a complex way. Thus, aided by mimicry and gestures, the impact of interrogatories and debates is enormous on the audience.

- Comedy

Comedy takes central role, as it is the true place of institutionalization and affirmation of the classical sound. In Billy Wilder's definition, an ideal soundtrack in classics is the one that manages to be invisible. Therefore, use of sound is wide in comedies but it is always bent on the centrality of the storytelling.

- Crime fiction

The first *all talking* movie *Lights of New York* is noir – not surprisingly. In this genre, codification of voice and its territories and environments is experienced in an enchanting way. In noir fictions, a voice can be captured in a thousand different facets and even in its great power over the image. In crime fictions the narrator assumes a connecting role between literature and narration, this genre opens up to a psychological dimension, and totally diverts the sound-visual association.

2.1.4.5 Charlie Chaplin and Walt Disney

In these early years of sound cinema, American cinema bumped into two great cinema figures who stood out both for their style, but also for their opposition and anticipation of some disruptive logics of film industry.

On the one hand, Charlie Chaplin waged his own war against sound, and indeed he presented *The Great Dictator* only in 1940. It was his first fully spoken film. In those years, Chaplin was part of those rebels opposed to the nascent Hollywood studio system, and reasons why he, and his colleagues, went into crisis were several. The economic reasons were first: the unconventional methods of production used by Keaton or Lloyd did not reconcile with the rationalization of production and the major film studios – RKO Radio Pictures, United Artists, Metro-Goldwyn-Mayer, and 20th Century Fox. Among that, there was also the dynamism of

comedy in opposition with the static nature of the first sound-included cameras. Chaplin used sound in a hybrid form, as if to suggest a constant passage between silent and sound film. In *City Lights* (1931), for instance, the dialogues are replaced by some comical hums. The hybrid way with which he intends the juxtaposition between silent and sound will stay in every movie, showing how words, noises and music can continuously mix, rejecting any rigid hierarchy.

On the other hand, Walt Disney established the turning point of sound experimentation in the animation film. Disney's experiments were not that different from those of European asynchronism. In animated drawing, method of composing the entire soundtrack first, including dialogues, sound effects, and music, spreads. Then, produced soundtrack is synchronized frame by frame with illustrations. Walt Disney's most famous experiment still is *Fantasia* (1940), in which the focus is not only on sound but also on sound technology and the improvement of this latter. This project aimed to give a cultural dignity to cartoons and to experiment the universe of music visualization – for this reason it was created with *Fantasound*. This latter was one of the first attempts of stereophony, soundtrack was synchronized with the images. Music was propagated through a specific equipment made by RCA and composed of three speakers behind the screen and another 65 small speakers placed around room's walls. In this way, the sound experience was something never experienced before. *Fantasia* was first presented on November 13, 1940 at the Broadway Theater of New York but remained an isolated case due to the prohibitive cost of the used system.

2.1.5 Animation

Talking about Walt Disney, it is mandatory to introduce the world of animation, which is the real connection between cinema and visual music. Even though animation has a beginning much preceding to real cinema, in what people knows as cartoons. The word in issue, animation, comes from Latin and literally means the "action of imparting life" (Online Etymology Dictionary, 2021), that is giving life to something. Animation, indeed, comes directly from *anima,* which is life, the spirit, what humans have inside and what makes them alive. For this reason, in cinematography the word animation took the meaning of "production of moving pictures" (Online Etymology Dictionary, 2021). It can be asserted that humans started to illustrate the idea of motion since the Paleolithic Age, but in the second half of 17th century the world recorded the first projected moving images on a screen, resulted from lanterns and shadows moved by hand. Later on, during 19th century a lot of innovations came out.

2.1.5.1 What happened before 1900

Primordial of moving images can be dated back to Ancient Egypt and China along with shadows projected on walls. Lots of inventions were produced to depict animated images since then. Several devices where invented to display images in motion, a lot before the invention of motion pictures.

The *Magic Lantern* (Figure 8) is dated back to 1659. It is said that the first moving images were projected by this tool invented by Christian Huygens.

Later on, experimenters understood that "if drawings of the stages of an action were shown in fast succession, the human eye would perceive them as a continuous movement" (Animation in Europe, 2021). For this reason, history of animation saw the introduction of various items, such as the *Thaumatrope* (1824) which is a really simple paper disk with an image in each side, twirling fast the disk the sequence of the two images appears in movement (Figure 9).

The *Zoetrope* is another tool invented in 1833 by William George Horner that produces the illusion of motion thanks to a series of drawings depicting the idea of a defined movement. Drawings in the *Zoetrope* were inserted into a cylindric structure. The evolution of this latter was the *Praxinoscope*, invented by Charles-Émile Reynaud in 1877. It was a *Zoetrope* with an additional circle of mirrors at the center in order to obtain a more stationary image while the wheel was rotating. The same person, some years later, invented the *Théâtre Optique* (Optical

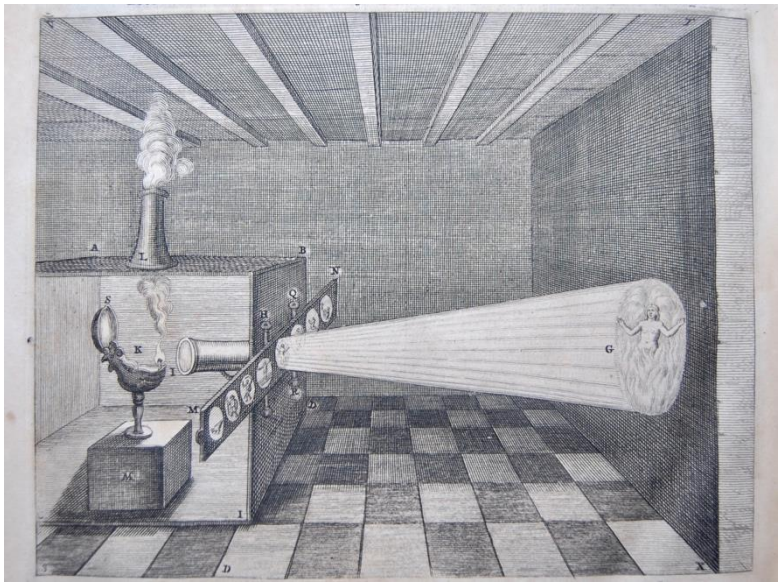
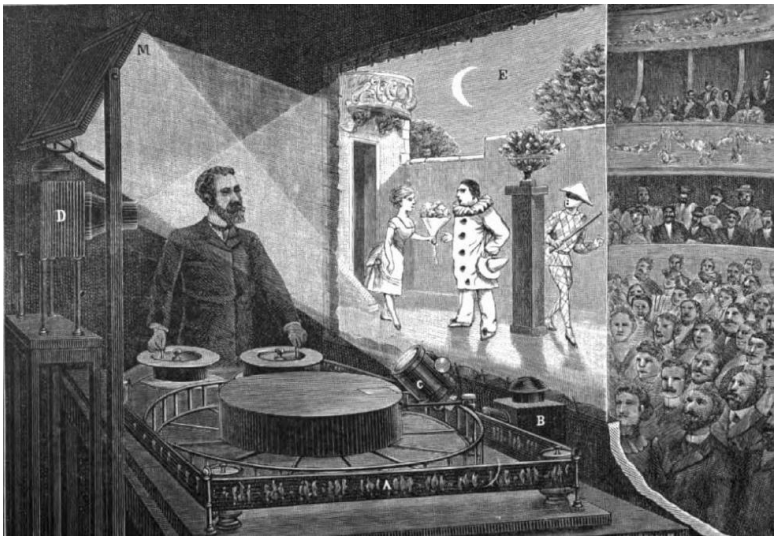


Figure 8. The first illustration of the functioning of the Magic Lantern



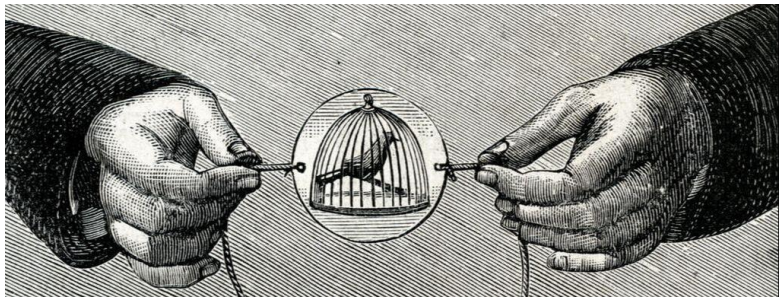


Figure 9. Théâtre Optique by Reynaud (top)

Figure 10. How a thaumatrope appears (bottom)

Theater) which allowed the first ever projected animation in the history of cinema. *Pantomimes Luminouses* is dated back to 1888 and it was projected for the first time on 1892 at the Musée Grévin in Paris (Figure 10). The animation was made of five animated sequences, each of them was composed by 500/700 glass slabs manually painted by Reynaud and was lasting about 5 minutes. For the portability and the dynamism of this job, Reynaud began to paint the scenes on little and flexible strips where he created little holes on top and bottom – what later was turned into film.

After the precursor of cinema, Reynaud, the world met the inventions of Thomas Edison and Lumière brothers. However, Edison invented the *Kinetoscope* which was a true piece of furniture with an ocular. Looking inside it was possible to see animated drawing on film. But Lumières did invented the *Cinematograph* that went beyond the idea of projecting paintings. This tool allowed for the first time to project real images, because it was able to record moving images and project them.

2.1.5.2 Animated film spreading to any direction

After 1895, during the rise of industry of cinema, many different animation techniques were developed, such as stop motion in all its variations, but also drawn and painted animation. J. Stuart Blackton created the first short made of stop-motion in 1906 called *The Haunted Hotel*, distributed by Vitagraph Company of America. A French artist, Émile Cohl, on his side, created the first animated movie, *Fantasmagorie,* in 1908. This latter was created with what currently is known as traditional animation methods, that is drawing on paper all the scenes and shot them on negative film.

In the decade of the First World War, animation saw the rise of many independent animators who founded their own production studios. Mostly from America, but even from other parts of the planet, they led animation to the next level, improving the methods and the tool to create animations. Winsor McCay was one of the artists to make the difference in the world of animation. Most known as a cartoonist, in those years he was experimenting with animated version on film of his cartoon *Little Nemo*. Then, exactly in 1914, he produced his most famous animated film called *Gertie the Dinosaur*. The innovation is that Gertie was the first character to be born for animated film, while, as Nemo, all the previous characters had origins in comic strips and newspapers. McCay produced his drawings on two different stripes then tied together, so for each scene he drew both the foreground and the background and inanimate elements. For this worldwide success, McCay is considered one of the first founders of animation, he invented the animated film and set off the turning point after which every animated film will be produced

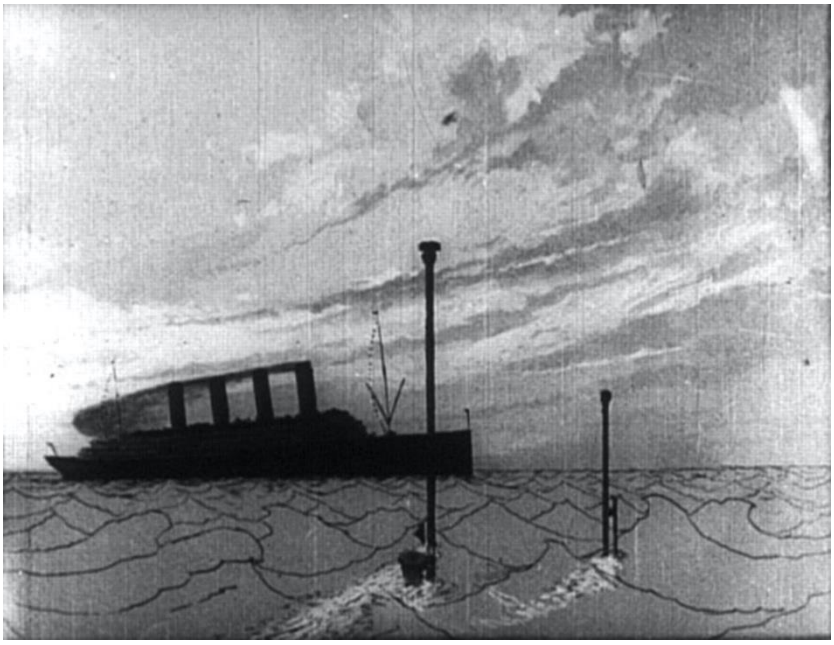


Figure 11. A frame from The Sinking of Lusitania by McCay

on film. He also produced the first animated documentary of history of cinema, in 1918, about the sink of British ocean liner Lusitania torpedoed by a German submarine in 1915. *The Sinking of Lusitania* was the pioneer of animation on celluloid. This first outcome allowed animators to leave paper behind and draw directly on celluloid sheets, which eliminated the need to draw for every scene the same backgrounds or stationary objects. Celluloid sheets, indeed, permitted to produce various layers of drawings that could be overlapped to create the final outcome of each scene. This latter is the method that is still used in these days.

The continuous research in the world of motion pictures, and the introduction of sound in the following years, took artists to experiment more and more new ways to produce several kinds of animation. Those artists were mostly European, and they were part of the movement already mentioned called Dada. Those people have been the most influential ones for the rise of visual music.

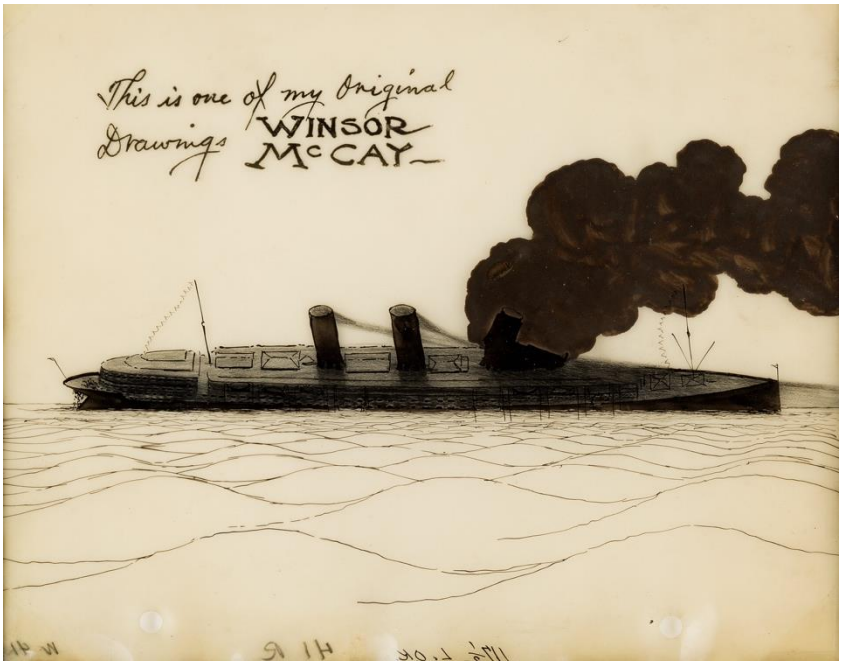


Figure 12. A signed drawing on the celluloid used for The Sinking of Lusitania

2.2 MUSIC IN CINEMA AND CINEMA IN MUSIC

The History of visual music

It's long been said that you do a great job in sound when no one notices it.
Gary Rydstrom

The advent of sound in cinema has been one of the most important turning points in the History of film. But later, after the advent, experimentation on the use of music in movies has been wide and even incredible in some cases. The soundtracks of movies have turned very famous in many cases and sometimes movies were turned to be the *image-track* of songs. This latter is considered the turning point of the perspective that everybody had until the 40s when artists – mostly from Germany – were experimenting for the first time with what currently is known as visual music.

All those aspects are analyzed in the following paragraphs, but also the very beginning. Here, the very beginning is intended as the first relations that sound and lights, or images, had during history.

2.2.1 Sound and light: primordial elements

The relation between sound and light can be traced beginning back to ancient cosmologies. In Western culture, this association is dated back to Pythagoras's studies of proportions. Later in centuries, those studies were assumed as the representation of the divine harmony of creation, and they were applied as the basis to studies of music, mathematics, astronomy, and all sciences. Indeed, Kepler asserted that "planetary orbits were elliptical in order to reflect the Greek masters' idea of proportion" (Abbado, 2017, p.11). This concept was represented by the musical octave in ratio 2:1. This latter was for Kepler the imaginary sound representation that the spheres drawn by the planetary movements would emit (Figure 13).

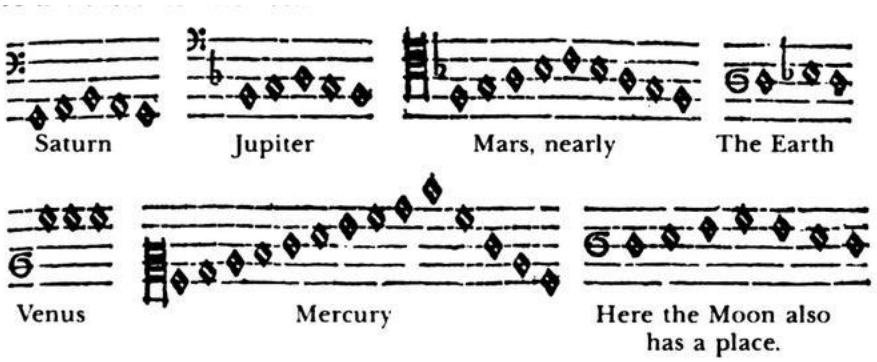


Figure 13. Representation of sound emitted by planets according to Kepler

2.2.1.1 Finding a relationship between light and sound

An Italian painter, in 1608, named Giuseppe Arcimboldo, created a specific scale of brightness – not colors – based on music intervals. He defined a double octave containing the entire range of shadows from white to black. More than one hundred years later, Louis-Bertrand Castel, invented the *Ocular Harpsichord* (1725), which was a modified instrument based on Newton's theories but even Athanasius Kricher's. This latter, indeed, stated that if there is an analogy between light and sound, the same analogy can exist between colors and notes. Castel installed 60 multi-hued lanterns to his harpsichord and those colors were played associated with the music notes. The main idea was to make the harmony of any music visible (Figure 14). While Castel and others stated the "objective correspondence between physical phenomena" (Abbado, p. 13) – and in this case, light and colors are the physical phenomena on topic – other conceptions were convinced that is the idea of the scientist to modify the correspondence. Better explained, on the one hand, to some it appears objective that two physical sizes correspond in some way, but, on the other hand, others thought that it is the subjective interpretation of the scientist to determine the correspondence. Concerning this topic, Ernest Chladni was very relevant. Chladni, in 1787, published the results of his studies. He figured out that the relationship between sounds and patterns was surely objective, and he proved it out thanks to a vibrating metal sheet strewn with sand (Figures 16 and 17). The system operated with sound frequencies which made the panel vibrate: when the metal panel gets a vibration, the sand organizes itself into various patterns. Different patterns are determined by the frequencies of the sound which are produced.

Figure 14. Illustration of the Ocular Harpsichord by Castel

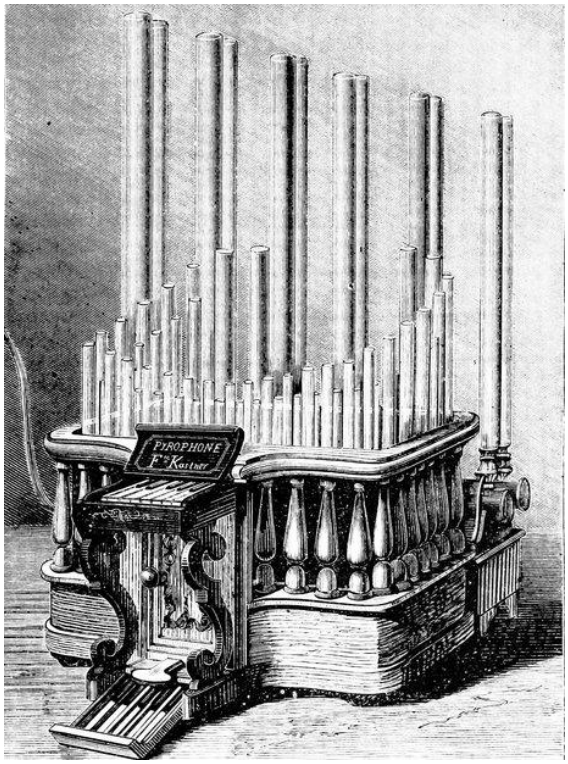
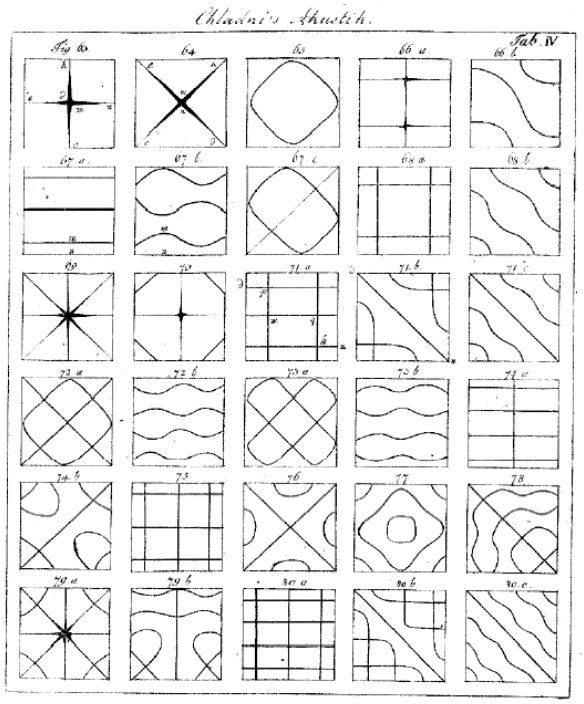


Figure 15. Pyrophone by Kastner



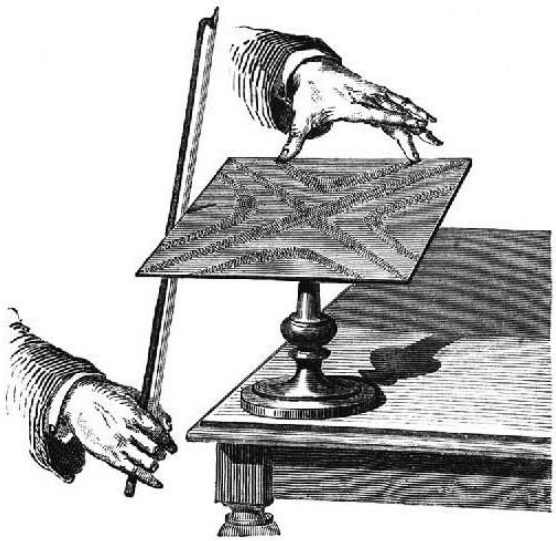


Figure 16. Sound pattern obtained by Chladni's plate (left)

Figure 17. Functioning of Chladni's plate (right)

Lots of devices were introduced to experiment with this correspondence. The *Eidophusikon* (Figure 18) was invented by Philippe Jacques de Loutherbourg in 1781 and it was a small stage where typical subjects were painted on glass and shown combined with lights and sound to give a sort of multisensorial experience to the public. This, and its evolution in 1822, were the first synesthetic devices. They did not aim to find a correspondence between sound and lights but simply to blend the two forms of art. This latter can be called, at first sight, the first attempt of synesthesia.

During the 19th century, even philosophers analyzed this combination between lights and sound. Some of them distinguished clearly eyes and ears stating that they have different functions and so they were very skeptical about a correspondence between lights and sound. On the other hand, some claimed that this relation between sounds, forms, and colors is extraordinary. But what really elevated the scientific research on this topic was the introduction of new technologies, such as, electricity. Frédéric Kastner developed an instrument called *Pyrophone* between 1869 and 1873. It is also known as the "*Orchestral Fire Organ*" (Sommerlad, 2012), which was a wooden organ that combines fire with sound. This is a little beyond the studies about light and sound, but Kastner understood that flames canalized into glass pipes could produce musical notes and even colored lights (Figure 15). Sadly, the *Fire Organ* did not obtain the expected success, but some years later, another inventor gave his contribution to a new organ. Bainbridge Bishop analyzed the spatial extension of colors related to sound. He asserted that sound follows a sort of pattern in real life, "low frequencies spread into space and are

Figure 18. Representation of Eidophusikon by de Loutherbourg

difficult to place, while high frequencies can be perceived in space with more accuracy" (Abbado, p.16). Thanks to the evolution in the technology of the end of the 19th century, Bishop succeeded to design his instrument. He developed many tests but the most convincing one was an organ with a semicircular glass panel where the color appeared. The functioning of this device was allowed through a series of small windows with colored glass and a shutter that allowed the colored light to pass through by a key. The color obtained was reflected on the glass panel and diffused on the surface.

Ten years later, British painter Alexander Wallace Rimington created the *Colour-Organ*, to prove his belief in correspondence between sound and light. The organ worked emitting colored lights through several apertures above the instrument. The entire device was about 3 meters high, had 14 apertures for light and a 5 octaves keyboard for music. It also had a pedal to regulate the intensity of hues, and thanks to that it was possible to see colors fading in and fading out.

The spread of innovative technologies came till this point when organs working with lights made the way to those instruments which anticipated cinema. Devices already mentioned such as the *Praxinoscope*, the *Kinetoscope*, or the *Cinématographe*.

2.2.2 Analogic luminous instruments

Since the beginning of 1900, visual music had grown widely in many directions. One of them was audiovisual concerts with instruments that were literal descendants of various color organs. Two main positions existed concerning audiovisual concerts: one gave importance to audiovisual expression, and the other used moving abstract images without sound. It is correct to disclose that these two perspectives were actually intersected and never divided.

In the previous paragraph, it was possible to discover many instruments antecedent to the 20th century. In the following pages, other innovations will be brought to light. Morgan Russel was an American painter of the first years of 1900, he was one of the founders of Synchromism, an art movement aimed to contextualize color to music. In the years between 1913 and 1923, he worked on and realized his *Kinetic-Light Machine*. His main thought was that abstract images had to follow – or have to be followed – by sound, more precisely slow music. With his machine, he intended to create abstract compositions in free evolution, with no specific correspondence between sound and color but always in dialogue.

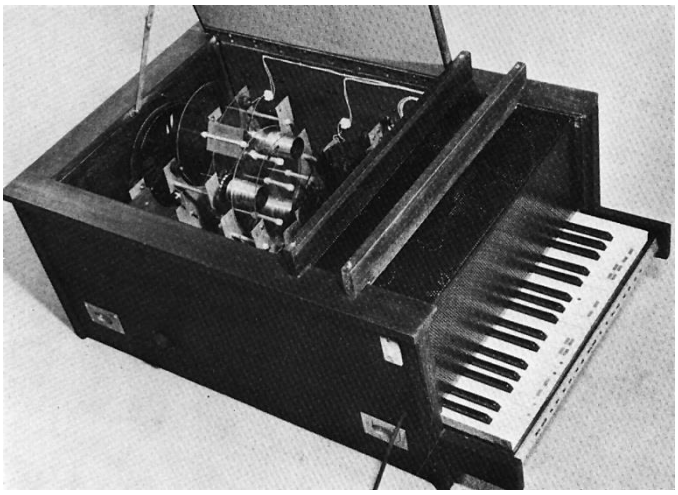
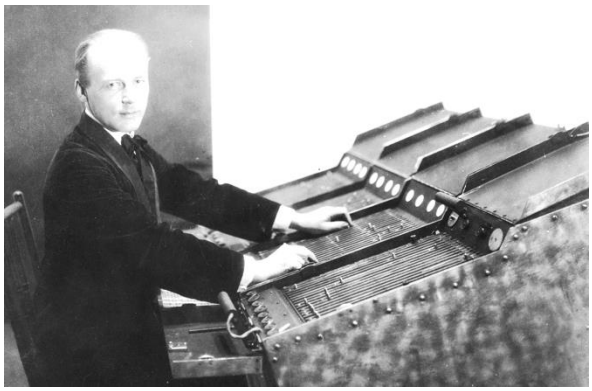


Figure 19. The Piano Optophonique by Baranoff-Rossiné

Figure 20. An example of the images produced when playing the Piano Optophonique

Vladimir Baranoff-Rossiné, a Russian avant-gardist, was another painter of the early 20th century. Around 1920, he produced the *Piano Optophonique*, a special instrument able to play a disc of colored glass crossed by a ray of light and distorted by prisms, lenses, and mirrors. The result can be linked to what is currently known as a kaleidoscope (Figures 19 and 20). What makes Baranoff-Rossiné diverge from other color organs creators was the idea to create a different way of making art. To him, establishing random correspondences between sound and lights was not enough. His goal through creating moving abstract images was to produce a continuous reinterpretation of those images in concerts, and thanks to this transmitting emotional content to the public. The same approach was followed by Achille Ricciardi, an Italian writer and avant-gardist. Indeed, Ricciardi thought that color possessed, like music, the ability to access another reality, more sensitive and hidden. He intended, therefore, to entrust color with the task of revealing on stage the spiritual and inexpressible contents of the drama. So, according to his project, the chromatic scansion in continuous transformation had to accompany the gesture and the word of the actor, reproducing visually the psychological evolution of the characters in every nuance. This was his experiment held in Teatro del Colore (Color's Theatre) of Rome from 1920 till his death, three years later. Another experiment worth to be mentioned is that of Grigory Gidoni, another artist from Russia and acting in the same years. He developed a project that was never realized called *Light Monument to the Revolution* which consisted of a huge globe of glass able to contain up to two thousand people, pioneering immersive environments.



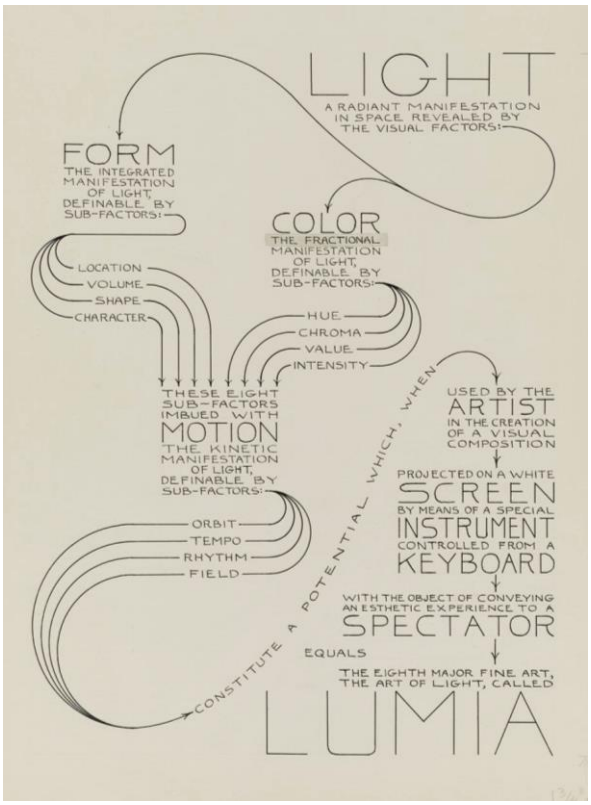


Figure 21. Wilfred sitting at his Clavilux (top left)

Figure 22. Lumia diagram about the concept and the functioning (bottom left)

Figures 23. Outcomes obtained during Lumia shows with the Clavilux (right)

On the side of silent abstract projection, Thomas Wilfred began his experiments in 1905. His works had been modified and improved many times. In 1922, he created his *Clavilux* (Figure 21) and presented the show called *Lumia* (Figures 22 and 23) to the public in New York, later on in the following years, he replicated that show in several cities around the US and Europe. Wilfred was able to produce two kinds of devices, one with a keyboard if it had to be played on live performances, and the other automated in case of self-standing installations. His instruments consisted of three main parts:

- colored discs to emit colored lights,

- distorting elements, such as curved glass from candelabra, modified filaments from lamps, reflective aluminum surfaces, or metal cylinders, and
- a series of wheels, gears, and pulleys to rotate the components.

Those three components and the genius of Wilfred made it possible to emit white light sources, give them forms, add color and movement. And all this was possible before 1930.

Another artist working hard on audiovisual research was Alexander László. The latter was a Hungarian composer and orchestra director born in 1895 and, before emigrating to the United States in 1930, he worked on experiments to prove his idea of a connection between notes and colors. In 1925, he invented an instrument called *Sonchromatoscope*, which was able to generate colored lights. During his European experience, he collaborated even with Oskar Fischinger – whose works will be analyzed in the following chapter. Together they worked on concerts accompanying abstract films and projections of lights around Germany, where concerts of audiovisual art were extremely famous. In this context, László became a true celebrity since he introduced a new form of audiovisual art, that is the direct correspondence between different components of a concert. In his works, indeed, variations of colored lights would take place only when variations of rhythm occurred, so that to have no element subordinated to other ones.

In the 1930s, Charles Dockum was a young American electrical engineer and was fascinated by Wilfred's works. He started working on machines able to perform color abstract imagery – some sort of projectors – and continued to increase their capabilities till the 1970s. As he stated, his *Mobicolor Projectors* were able to produce "the art of creating patterns of light upon a screen or wall which function in Time, Space and Color" (Abbado, p. 35). To Dockum, it was kind of easy to obtain color distortions through various intersected media – such as lights, filters, or oils on water – as done by other artists, but his goal was to produce one truly satisfactory medium of art, controlling those elements thanks to his devices. Dockum's projectors were actually complex machines, two people were needed to make them run, but he started in 1936 to exhibit with them. He produced a series of *Mobicolor Projectors*, for instance, the fourth was commissioned by New York's Museum of Non-Objective Painting – known today as Guggenheim Museum – between 1942 and 1952, and the number VI could have been the very first device working with computerized mechanism, but it was not completed due to Dockum's death in 1977.

2.2.2.1 Sixties' innovations and first music festivals

Despite what was happening all over the world in the sixties, technologies saw the advent of cybernetics and the first attempts of artificial intelligence. In this context, the research on projection approached and devices produced extraordinary systems. Gordon Pask was one of the artists who took part in the exhibition called *Cybernetic Serendipity* at the Institute of Contemporary Arts in London (1968). This event was curated and ideated by Jasia Reichardt, who was born in Poland in 1933 but British nationalized. It was the very first event totally aimed to celebrate the union between technologies and art, which was locked into research laboratories till then. The event wanted to show to the entire world how mankind could use computers and new technologies to broaden its creativity and inventiveness (Di Nunzio, 2015). Indeed, every kind of artistic form was welcome into the event, from music to visual arts, from literature to video production, any artistic discipline that could stand alongside computer environment had every right to be represented within *Cybernetic Serendipity* (Figures 24 and 25). Moreover, it is very interesting the choice of the name of the event, the idea seems to be that, although the artistic techniques were the most disparate, through the advent of new technologies, the long-established art forms opened up to real serendipity, that is the possibility of coming across something completely unexpected to achieve if research had to be carried out within each respective field. Serendipity is usually described as a pleasant discovery, something that one had not considered but fortunately comes across in the person, in this case, the artist.

At *Cybernetic Serendipity*, Gordon Pask presented the *Musicolour Machine*, which was built in 1953. Pask's device was able to create light shows initiated by sound. It was predisposed to memorize sounds associated with visual patterns and it was composed of a microphone, an

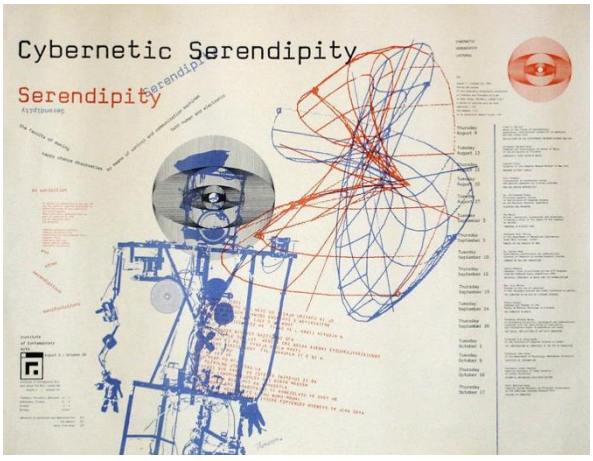


Figure 24. Poster of Cybernetic Serendipity exposition, 1968

Figure 25. View of the exposition, The Honeywell-Emett "Forget-me-not" Computer by Rowland Emett

amplifier, and a board with filters. These three elements permitted to select and display the combinations, but the system was even intelligent enough to the point that if it recognized a sound as repetitive, it was able to create variations in the final result.

Nicolas Schöffer distinguished himself thanks to his major project which has never been realized, *Tour Lumière Cybernétique de Paris-la-Défense*, as known as the Cybernetic Light Tower of Paris-la-Défense (Figure 26). This project, supposed to be realized in 1963, was a cyber-tower of 52 meters with 66 rotating mirrors, and 120 colored light projectors, photoelectric cells, sensors, and microphones. This invention was the first cybernetic sculpture where the various elements contributed to modify the appearance of the sculpture itself thanks to motors and computers. By the way, Schöffer was one of the first digital artists and he introduced electronics, cybernetics, and industrial techniques to his research, but his works included even visual music instruments, such as *Mur Lumière* (1962, powered by Philips).

At some point in this unstoppable evolution of devices, some artists began to develop their machines and use them in festivals and music concerts. In the sixties, several lights show of any kind flourished with devices for special effects, projectors, and other innovative ideas to be brought to life during events specifically created for experimenting with such technology.

Seymour Locks was the first artist to develop a visual show entirely made of colors in a glass container, which was accompanied by jazz music in San Francisco in the 1950s. Then, Glenn McKay created projections using inks and colored oils in water and performed in such concerts as that of Jimi Hendrix. And Tony Martin created light shows for Frank Zappa's Mother of Inventions' music concerts and others.

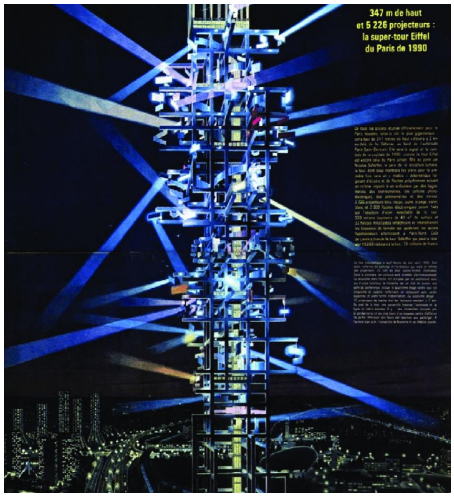


Figure 26. Tour Lumière Cybernétique de Paris-la-Défense by Schöffer

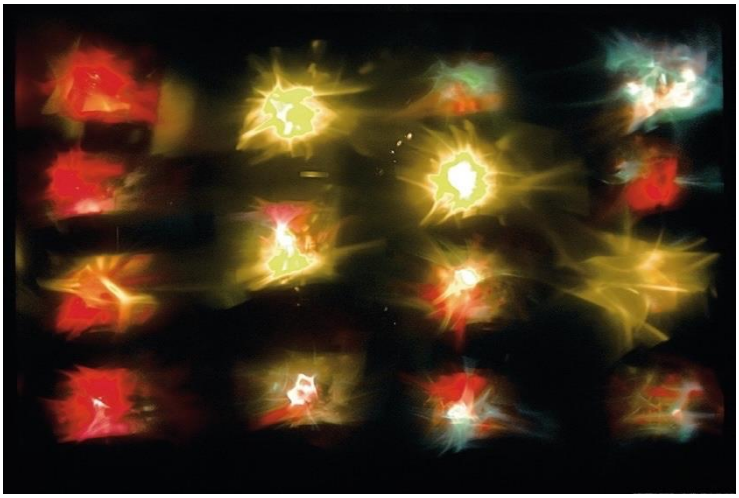


Figure 27. Outcome of Mur Lumière by Schöffer

In those years, lots of artist collectives were born to produce more widely this type of shows. A very popular one was *The Joshua Light Show* founded by Joshua White, who also invented the *wet shows*, in order to promote light performances with liquids. In the US, the Avalon Ballroom but also the Fillmore West and East (respectively in San Francisco and New York) worked hard to regularly hold light shows. And on the other side of the Atlantic, in the United Kingdom, light performances were used mainly for the biggest rock bands' concerts, such as Pink Floyd, Soft Machine, or The Who.

In the following years, technology could develop more and more, and in the seventies, laser shows arrived on the stage. Laser projections opened up to another level of abstract and light performances, they were used both in open-air avenues and in planetariums where people could feel immersed in the ambient.

2.2.3 Abstract movies

Along with luminous instruments, visual music developed in the context of abstract cinema. In the early years of the 20th century, abstract animation was representing a real innovation. Among abstract movies' creation, two different approaches emerged: some created animations with music, while others related their works to ideal music and for this reason, worked with silent movies.

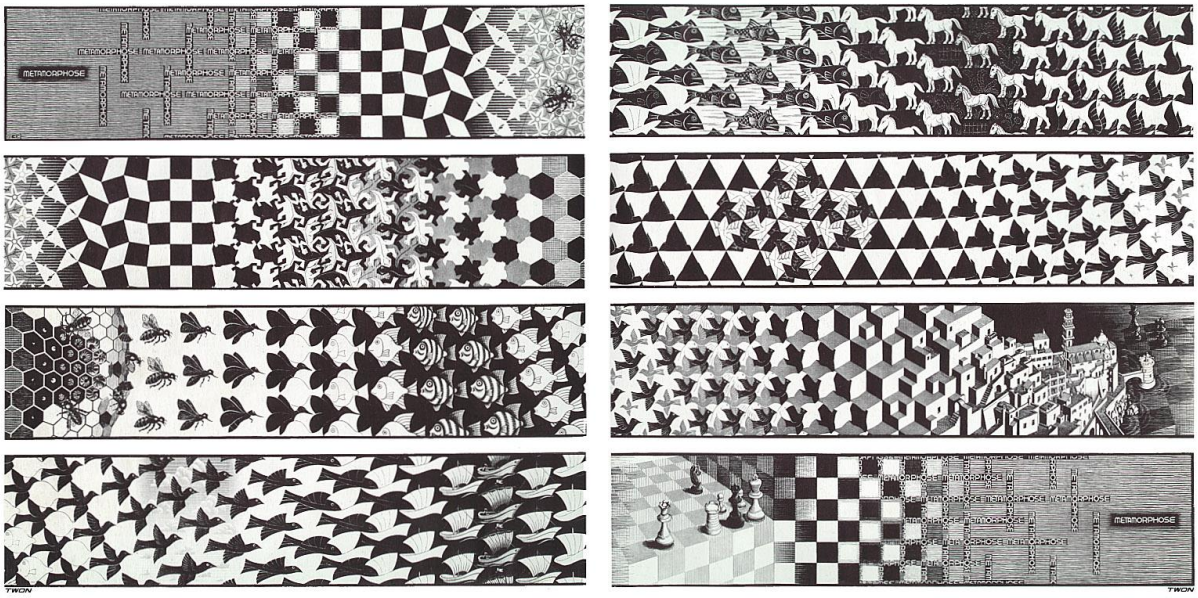


Figure 28. Famous example of scroll painting is Metamorphosis by Escher

In this context, the first artists to produce abstract animation were Arnaldo and Bruno Ginanni Corradini. Back in 1911, they painted for the very first time onto unexposed film, and in the same years, they began to be identified as the precursors of abstractionism.

Another couple of artists collaborated in those years, Hans Richter and Viking Eggeling. These two started with kinetic abstract art and ended up with scroll paintings. The latter consisted of various shapes or drawings connected one with the other, aimed to form a loop sequence when in movement (Figure 28). Scrolls permitted them to distance themselves from traditional painting and pass to the next level, the one of abstract art. By the way, they separated and one of them, Richter, who was fascinated by the rhythm of his movies, co-founded the Dada movement in 1916 along with Tristan Tzara and Jean Arp. Eggeling, on the other side, was interested in the visual form and its evolution through time. After a first experiment, he worked and produced his first abstract movie called *Symphonie Diagonal* in 1924. This is a 7 minutes long abstract film that had the privilege to be one of the earliest outcomes in abstract movie production.

2.2.3.1 Who made the difference?

The aforementioned artists are considered to be the very first pioneers of abstract movie genre. But others made the real revolution and evolution in this field.

Walter Ruttmann was born in 1887 in Frankfurt am Main. He studied architecture but also fine arts and painting, he started to work as a graphic designer, and once back from the First World War, he dedicated himself to the cinema. In 1920, he produced his first movie, called *Lichtspiel Opus I*, which was screened to the public with the music of Max Butting in Berlin the year after. It was the very first abstract movie to be publicly screened and even the first one colored by hand with oil on glass. This piece was the first of a collection in which Ruttmann added *Opus II*, *Opus III*, and *Opus IV*. These series are among the best examples of abstract animation, along with works by Eggeling and Richter.

In the same years when Ruttmann was presenting his *Opus*, he met another really significant figure working on visual music. At that moment, Oskar Fischinger (Figure 29) was exploring colored liquids and 3D modeling of several materials, such as wax and clay. Indeed, he invented a wax-cutting machine which was used both by Fischinger and Ruttmann to create original animations. Born in 1900 in a little city near Frankfurt, he then moved to Berlin in 1927 where

Figure 29. Oskar Fischinger in his Hollywood studio with the panels of Motion Painting No.1, 1947

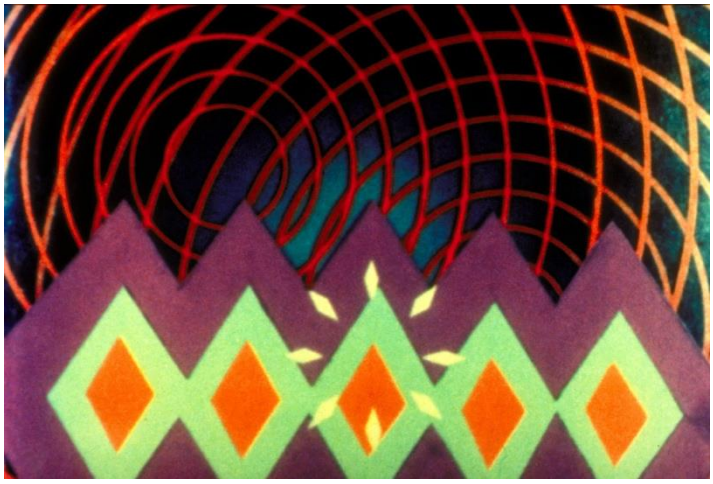


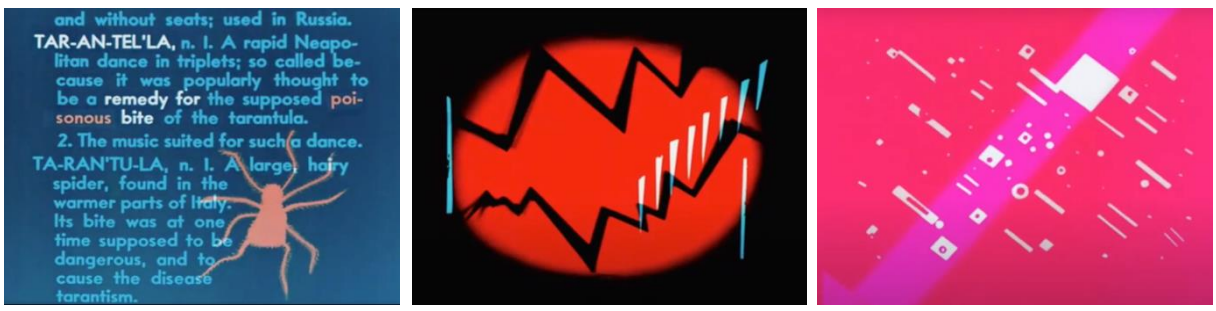
Figure 30. A frame from Allegretto by Fischinger, 1943

he created many special effects for movies, conceived lots of multiscreen shows, and created frame by frame various black and white animations. In 1933, with the promulgation of Nazi racial theories, abstract art and art communities disappeared because they were considered degenerate art. In this context, many artists moved away from Germany and the rest of Europe towards the United States. Even though, on the other side of the Atlantic, the situation was calmer for artists, they had to face Hollywood and the big studio system that was rising in the US. Indeed, Fischinger arrived in Los Angeles in 1936 and he started to work at Paramount Studios and MGM. In those years, he produced two of the most famous works of his career: *Allegretto* (Figure 30), which was produced in black and white for Paramount but later repurchased by Fischinger and released in color in 1943, and *An Optical Poem* (1937), which was the precursor of the animation movie *Fantasia* by Disney. Anyway, Fischinger never got used to Hollywood's production system and its canons, so he restarted to work as an individual artist. He got some commissions from the Museum of Non-Objective Painting in New York and other museums, so he created *Motion Painting No.1* in 1947 which won the Grand Prix at Brussels International Experimental Film Competition. The revolution led by Fischinger is about his way to build his works, sometimes he synchronized images with instruments or soundtrack, in other cases no synchronization was present. But in any case, he was able "to seize a sort of musical essence and translate it visually with great imagination, technique, and sensibility" (Abbado, p. 48). What changed with Fischinger was that, before his works, music had always been the soundtrack of movies and later, the visual flow began to be the *image-track* of the music.

Figure 31. Seeing Sound introduction by Bute

Figure 32. Mary Ellen Bute working

From the other side of planet Earth, in New Zealand, Len Lye was born in 1901 and studied art, he lived in Australia and Samoa Islands but at 25 he moved to London. Over there he started with abstract paintings, textile paintings, and kinetic sculptures. In 1929, he turned his career into experiments of abstract movies and release his first animation called *Tusulava*, which was based on Samoan motifs, and accompanied by Jack Ellit's music. Lye was among the first ones to experiment with painting directly on film, which permitted him to save money. Some years later, he was based in New York and was able to merge his various disciplines such as abstract expressionism, filmmaking, and kinetic sculptures. By combining these tree realms, he worked to pursue the so-called *art of movement*, namely the aim to affect people physically and emotionally and make art a full-body experience. Moreover, he had got a completely distinctive approach to synchronization. Indeed, Len Lye preferred to start from animated images and then try to reach music (or sound, or rhythm) able to follow the animation. The interesting fact is that Lye was interested in jazz and ethnic music, which were in some cases very difficult to juxtapose with the fast editing approaches he was used to employ, and this considerably differentiated him from other artists stuck to classical music.



Figures 33. Shots from Tarantella by McLaren and Bute, 1940

Meanwhile, within the North American scenario, Mary Ellen Bute (Figure 32) was born in Texas in the first years of 1900. Told to be "a pioneer of visual music and electronic art" (Halter & Starr, 2019), her first series of visual music work is called *Seeing Sound* (1930) aimed to visualize a bunch of classical music pieces by various composers. Her main vision was to manipulate light in order to produce visual compositions using sequential loops and repeating patterns, in the same way musicians do when manipulating sound (Figure 31). To do so, she used analogic materials and techniques, for instance, cardboard, cellophane, but even objects to shot distorted by various forms. In 1937, she started to work in color, her first movie was *Escape*. Some years later, she produced, along with Norman McLaren, her best movie *Tarantella* in 1940 (Figures 33).

McLaren was an artist born in Scotland but moved first to London, then to the United States (where he met Bute), and finally to Canada. This artist was fundamental in the field of innovation and research of new different techniques and technologies to create visual music. During his career, he used devices like the oscilloscope or the electronic pen, and what is really interesting about him is that, unlike other artists, his movies came along with detailed notes on used techniques. He stated that animations could express the spirit of music, and there was no need to find correspondences but let the two elements flow spontaneously giving space to pure creativity. He used a code to associate colors with sound but in *Synchromy* (1971) the key message was what you see is what you hear. Better explained, it was a complete fulfillment in synchronizing images and sounds, obtained by setting a single-seamless source capable to generate both at the same time: the visual part was exactly what appeared on the celluloid's optical soundtrack.

Around the twenties, two other leading audiovisual artists were born, the two Whitney brothers (Figure 34). Sometimes together, sometimes separate, John and James Whitney were much important for visual music's history. The oldest one, John, worked with music and images for about fifty years, while James was mostly a painter. In the first years of their work, the animation techniques they used consisted of shooting paper cutouts on a lightbox and then the use of an optical printer to elaborate the final result. They developed lots of analog devices and in 1966, John began to collaborate with IBM, and over there he was able to access the very first digital technologies. Integrated into this digital adventure, John Whitney produced *Arabesque* in 1975, a 7 minutes movie inspired by Islamic art with Persian music. After that, he moved his career into audiovisual compositions. Like his brother, James Whitney followed the same path, even if this latter was more into visual art than music. His most famous work is *Yantra*,

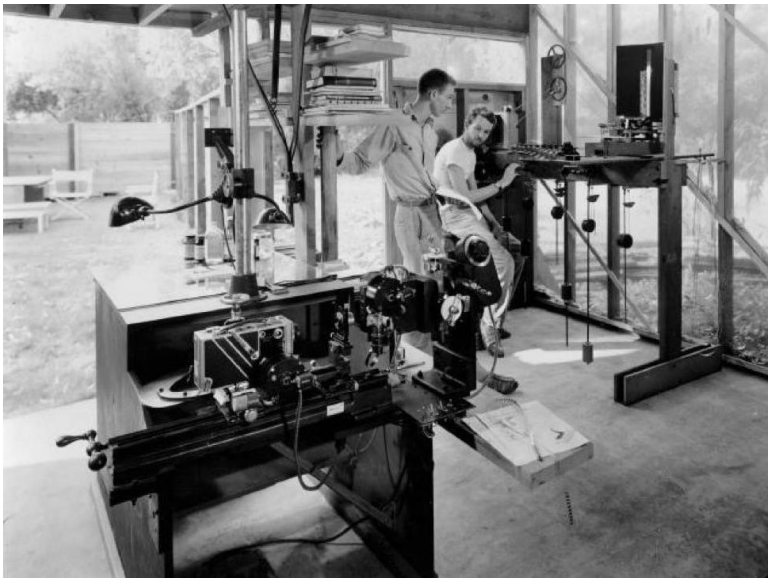


Figure 34. John and James Whitney

presented in San Francisco along with other pieces in 1959. It was formed by millions of dots, accompanied by electronic music and, to be noted, totally handmade. Some years later, thanks to a computer equipment developed by his brother, he produced *Lapis* (1965). Still made of moving dot patterns, this time the difference was the camera controlled by the computer, which permitted to reproduce the image from different angles, so that to obtain a kaleidoscopic final result.

Born in Chicago and raised in California, Jordan Belson is another visual music artist worth to be mentioned. He studied fine arts and bumped into abstract animation by Fischinger, McLaren, and Whitney brothers. So that, he merged the two disciplines making films with scroll paintings and traditional animation techniques. He was interested in spiritual matters, indeed he asserted that "the instruments that produced images were an extension of the mind" (Abbado, p. 58), and mostly he was influenced by oriental religions, yoga, cabala, astronomy, and surrealism. Between 1957 and 1959, Belson was the visual director of Vortex Concerts in San Francisco, where he was able to create a real immersive environment with a multitude of projectors and

Figures 35. Shots from Lapis by Whitney Brothers, 1965

loudspeakers during electronic music concerts inside the Morrison Planetarium. Among his most notable pieces, in 1961 he produced *Allures*, in which the Belson's mysticism became blended with deeper science-centric tones. Later in years, Belson became reluctant to spread his knowledge and methods. Visually talking, Belson's works were a continuous source of colors on different visual layers able to communicate directly to the emotions of the public without passing through the intellect. Belson did not create visualizations of music but neither *musicalizations* of images, his animations were truly independent audiovisual creations.

To conclude, a completely different approach was the one of Stan Brakhage. Born in 1933, active in the second half of the 20th century, he believed that music interfered with the visual flux produced by the animation so that he called his works *moving visual thinking*. His first period of work was aimed to explore the possibilities of light and did this directly by painting on films or with collages. Perfecting his techniques, he obtained to paint the same frame two or three times in his animations, obtaining an outcome of shorter perceived speed of sound and images. This latter made the audience destabilized, that is the reason why his works needed mental attention and concentration on what happened on the screen.

2.2.4 The advent of new technologies and artist collectives

In the second half of the twentieth century, electronics and cybernetics were totally part of the world of art. The growing availability of both analogic and digital technologies helped to find a connection between the world of art and the world of science. But actually, among the entire world, artists emerged from every corner and kept on the experimentations. Not only artists but even engineers and scientists had the opportunity to mix up their knowledge in what is called the era of Expanded Art. During the sixties, audio synthesizers appeared and started to be mass-produced and distributed, with those devices, electronic music started to rise and develop and to look for its visual correspondence. Something helped this context a lot, that is the artistic *happenings* introduced in New York by Allan Krapow. Those events were aimed to make artists and audiences meet up, they were sort of jam sessions in which people from the public had the opportunity to work and show their ability to the artist exhibiting.

In those years, artist collectives started to be founded for the first time. One of the most known in the field was Fluxus, a movement aimed to explore acoustic and visual events. To Fluxus artists it was important to differentiate their performances from the happenings, indeed the first ones were shorter, simple, and accompanied by music, while the second ones were longer and

aimed to involve the public. Part of this movement was La Monte Young, a minimal music composer, and Marian Zazeela, an American artist working mainly with lights. Together they worked on immersive environments of different kinds, as did by other artists. *The Dream House* is their most famous piece, an environmental installation of sounds and lights, conceived as an organism in evolution based on ratios. Moreover, *Oracle* (1965) was another installation by Robert Rauschenberg and the engineer Billy Klüver. It was the first attempt to create an interactive immersive environment, consisting of a space where light, sound, temperature, and smell changed as a person walked into it.

The two latter mentioned artists, a couple of years later, formed an organization called Experiments in Art and Technology (EAT), which aimed to make artists and engineers collaborate. In the same years, the Expanded Cinema movement was raised using multiple screens or even architectural structures for exhibitions and installations. Andy Warhol founded Exploding Plastic Inevitable, events where there were installations, projections, lights, live music, and other performances.

Even experiments on new instruments were conducted by artists in the sixties and seventies. Eric Siegel, born in the US but traveled to India to study local medicine and lived during Vietnam War, built a series of devices. First of all, the *Processing Chrominance Synthesizer*, later the *Electronic Video Synthesizer*, and finally the *Colorizer*.

A bit more forward was the invention of four artists, who developed the *Glowflow*, an audiovisual interactive environment, in 1969. A decade later, one of the inventors of the latter instrument, Daniel Sandin traveled the world presenting his shows and performances. Stephan Beck, in those years, was an engineer who became involved in music and visual arts. In 1971, he created the *Direct Video Synthesizer* and the *Beck Video Weaver* three years later. Beck was an interesting figure, as Sandin, he came from California, and during his experiments and research he made use of cannabis, LSD, and other mind-altering substances which helped him to reach his *spiritual technology*.

2.2.5 Music video

As seen in the chapter about cinema, when talking about music in movies, the first music videos appeared during the twenties. Actually, even before, when silent films were accompanied by orchestras. It is possible to state that in every case, sound has always been following images,

Figure 36. Giorgio Gaber introducing the Cinebox in 1964 Sanremo Festival, Italy

Figure 37. A poster of Scopitone, 1965

and vice versa. The real difference between music videos and what has been analyzed till now about visual music is that this latter was – and still is – performed live while music videos present everything recorded and given to the public. The very first film where music was synchronized with visuals was *The Jazz Singer* by Crosland, premiered in 1927 in New York. This movie is important since is the first outcome where the music performance was not live.

Through the whole first half of the 20th century, lots of instruments and devices were created by the most various artists to project images or lights followed by music. But at the beginning of the sixties, explained Bovi, in Italy and in France, respectively, the *Cinebox* and the *Scopitone* appeared (2015). In Italy, the *Cinebox* was invented by Pietro Granelli and built by OMI (Ottica Meccanica Italiana). In France, the *Scopitone* (Figure 37) was ideated by the engineer Frédéric Mathieu, the general director of CAMECA (Compagnie d'Application Mécaniques à l'Eletronique au Cinéma et à l'Atomistique) and presented in Paris. Both were able to reproduce up to 40 songs accompanied by a video. The functioning was the same as jukeboxes, with a keyboard one could select a song, and then the device played the song and reproduced a video which was possible to see through a screen above the keyboard. The videos were distributed on 16mm color film and accompanied by a magnetic soundtrack. Their popularity lasted shortly however, for several reasons: during the second half of the sixties,

16mm films became more accessible for people thanks to Kodak, and, most importantly, the broadcast television grew up and the audiences were attracted by the rise and availability of pop culture.

In those years, the band that played a fundamental role in this context was The Beatles. Indeed, *We Can Work It Out* (1965) was considered to be the first music video to be broadcasted on television. The Beatles were that band that wanted to give their fans the most audiovisual experience ever, they recorded several clips to go abroad and even two full-length movies called *Help* and *A Hard Day's Night*. Lots of bands followed this trend, for instance, David Bowie and Queen. These two released their first music videos in the late sixties and early seventies. *Bohemian Rhapsody* by Queen was actually made because they were on tour and they were not able to exhibit in a British music show at the same time, so that they filmed the video in order to play even though they were absent.

2.2.5.1 Video killed the radio star

On August 1, 1981, the MTV channel launched its first video. Even though this was the first one in the history of television, the interesting point of this launch is that the music video was by The Buggles, another British band from the late seventies. The name of the song was *Video Killed the Radio Star*, which was a kind of prophecy for the coming years and events. MTV rapidly has become an influential source of pop culture not only in the United States but even in the rest of the world. Surely, it was not the precursor of pop culture, but instead a real springboard for bands that already were acting in the ambient. It had perfect timing, indeed in those years British music saw punk cede to post-punk and other experimental music, and at the rise of the eighties, people fell again the need of something completely different. As Nick Rhodes stated, to eighties' bands, the video was like stereo was to Pink Floyd. "It was new, it was just happening. And we saw we could do a lot with it" (Lester, 2017).

Artists started to create music videos aimed to be screened on MTV. It really changed the attitude of making music and music videos. It opened up the road to stars as Michael Jackson, Madonna but it also gave a second chance for success to older artists and seventies' rockers that were not afraid to embrace the new medium.

With the increasingly strong affirmation of the MTV channel as a medium for a new form of communication, over the years, the same channel gave birth to new generations of directors. In

this way, some experts in the field had the opportunity to consolidate their directing style and ideas, collaborate with some of the major music artists, and lead to groundbreaking innovations. These synergies meant that, during the nineties, the general public could witness unprecedented music video masterpieces produced with incredible budgets.

Michel Gondry was a French director who began working in those years in the field of music videos. He was the creator of video clips for artists such as Paul McCartney, The Rolling Stones, Daft Punk, White Stripes, The Chemical Brothers, and others. His style is characterized by surreal settings and visual effects (Figure 38), and they are clearly present both in the music videos he directed and in the most recent feature films, such as *Eternal Sunshine of the Spotless Mind* (2004).

But still on the topic of surreal settings, Chris Cunningham's debut in 1997 is the perfect example. *Come to Daddy* by Aphex Twin was released that year and was completely mind-blowing (Figure 39). The collaboration with Aphex Twin was what allowed Cunningham to experiment and develop his style in an exceptional way. The electronic music produced by Aphex Twin turned out to be perfect for shaping his visionary ideas and his experiments in synchronicity between music and video pushed him to the limit. Cunningham, in an interview about his style and the *Rubber Johnny* project, states that the main goal of his work is to tell a story, to describe emotions and atmospheres (Mancuso, 2005). The perfect medium to achieve this result is the video clip or the short film since he can shape in his own image and likeness the rules of storytelling that instead are ironclad in feature films. His way of working has allowed him not to be subjected to the rules of cinema, and to create his own style that ranges from video making to video art with no clear boundaries.

From the other side of the Atlantic, during the same years, the works of David Fincher became among the most notable ones. Even though he is most known as feature films director, he started with advertising and video clips. Over the years he has directed music videos for artists like Madonna, George Michael, and Michael Jackson, and in all of them – as in his later films – his directing style is evident. The key characteristics of a Fincher film are monochromatic color schemes, highly contrasted tones, long shots and low camera angles. (Figure 40). These are all elements that are repeated in all of his work and make it so that the viewer can quickly recognize when there is a Fincher film in front of him of her.

Figure 38. Shot from Star Guitar - The Chemical Brothers, music video by Gondry

Figure 39. Shot from Come to Daddy - Aphex Twin, music video by Cunningham

Figure 40. Shot from Express Yourself - Madonna, music video by Fincher

2.2.6 MTV style in filmmaking

A filmmaker, whether in the context of creating video clips or other strictly music-related cinema, needs to pay close attention to how the audience will hear the final result. It is not just a matter of creating an audiovisual experience or a *song for the eyes*.

What happened from the eighties onward was a true transformation of Hollywood's movie storytelling. As early as 1983, MTV had begun to influence the creative process of filmmaking. *Flashdance* (by Adrian Lyne, 1983) is proof of that, as in that year it was already defined as a product that went beyond being just a longer-than-usual music video.

It would be more accurate to say that by the eighties, MTV style in filmmaking was establishing, as music videos had already begun to affect American films for at least 20 years prior. Indeed, the experiments from the various corners of the Earth, allowed directors such as Francis Ford Coppola, Stanley Kubrick, Brian De Palma, Dennis Hopper, or Martin Scorsese, to create real masterpieces in the years before the entry of MTV. Their productions were later associated with the MTV aesthetic, especially for their consciously provocative design, editorial and editing style.

It was the latter that was totally redefined during the golden age of MTV: with such "fragment editing" (Calavita, 2007) the storytelling is no longer linear and unitarian, but, on the contrary, the whole film appears as formed by a series of multiple small films. Each section can exist without the others and have its own story, but in connection with the others it assumes a different meaning. The key issue of this change, and of the criticism that has followed it, is that with the advent of MTV, filmmakers have been able to give more importance to style, spectacularism, and chaos. Prior to the eighties, on the other hand, consistency and storytelling were paramount. If MTV has allowed the greatest artists in the story of cinema to emerge, create, and produce unparalleled masterpieces, after all, who can afford to say that storytelling is more important than the creative flow of an artist? The trend of cinema, like the one of music fruition, was changed once and for all thanks to this MTV revolution.

MTV was incredibly successful for music promotion until the advent of YouTube, and when the worldwide channel itself turned to other models of entertainment. In the regards of cinema, on the other hand, it was the opportunity for artists, authors and directors to give space to their creative impulses, without having to account for the tradition of storytelling that they had behind them. For two decades, MTV allowed creativity to be expressed without any limit.

2.3 THE MAGIC OF MANIPULATING LIGHT

The History of projection mapping

A material that takes shape in space,
making something that had been previously unknown visible;
this could even be a beam of light.
Bruno Munari

In the field of augmented reality (AR), there is a spot for projection mapping. The concept of AR is easily understandable: it is more than just the reality people experience every day. The process of augmenting, or increasing, the reality has several environments where to operate. In this particular case, it will be analyzed that part in which there is no device between the human and the augmentation he or she is experiencing. What really differentiates projection mapping, immersive environment, and simply everything that is enjoyed by a projection from mobile phone or broadcasting is exactly the absence of the device that usually connects the person to the content. As reported by Donato Maniello (2017):

> *"The reality can be "enhanced" through various devices such as smart phone, webcam, sensor, earphone, or in our case through the use of a video projection system. Of course, augmented reality can also remove perceived information, and doing this generated a reality which is clearer or more fun." (p. 15)*

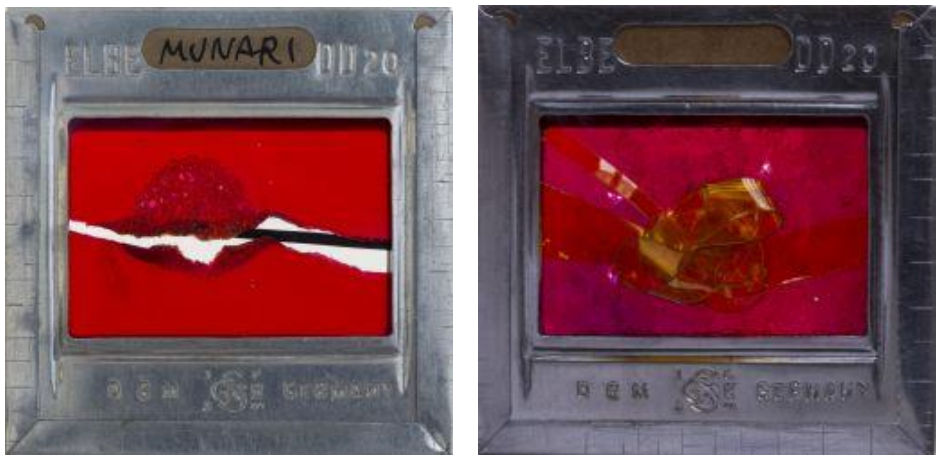
Augmented reality must be distinguished from virtual reality (VR), indeed the last one adds information through an electronic substrate, while AR interacts directly with the perceived reality. To complete the interaction, AR, as video mapping, use three geometric transformations that allow the digital content to correspond perfectly with reality:

- Homotethy, which is a contraction of objects on a plane, that transforms the size of the object itself without modifying corners or shape.
- Homography, which is a mathematic correspondence between two spaces such that one point in the first space has one and only equivalent point in the second space.

- Anamorphism, which is the transformation creating an optical illusion, which permits to project a distorted image on a surface and make that image recognizable just from a precise location.

2.3.1 Video projected on spaces

In the first chapter, the history of cinema has been analyzed. It is possible to claim that video mapping was born when cinema was born since this latter can be considered a particular part of mapping. By the way, the first experiments of use of video projections for installations are dated back to the fifties. In those years, Bruno Munari produced *Direct Projections* that were projected for the first time in Milan in 1953. The concept behind the show is to realize miniatures (Figures 41) on something similar to microscope slides and project them on a large



Figures 41. A pair of slides used by Bruno Munari Direct Projection, 1950

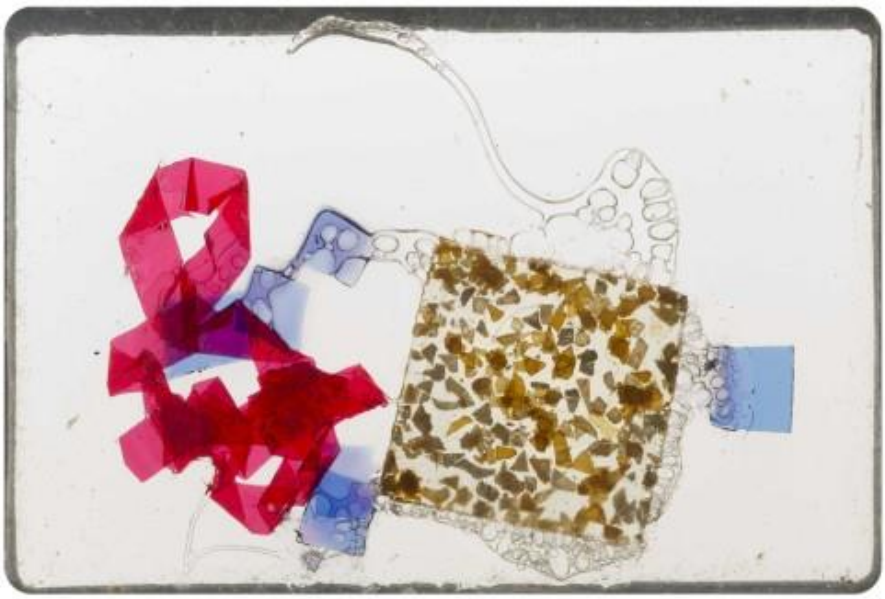


Figure 42. Example of Direct Projection by Munari

scale thanks to a projector. The power of the lamp, the dimension of the surface, and colors were variables that could change every time. To Munari what really mattered was the fact that in this way for the artist it was possible to carry everywhere his or her art. In addition, he was one of the first artists to experiment with dynamic paintings and he literally drew with light, his dynamism came from his ability to transform light into space and even the portability of the set of materials to be project from one location to the other (Figure 42).

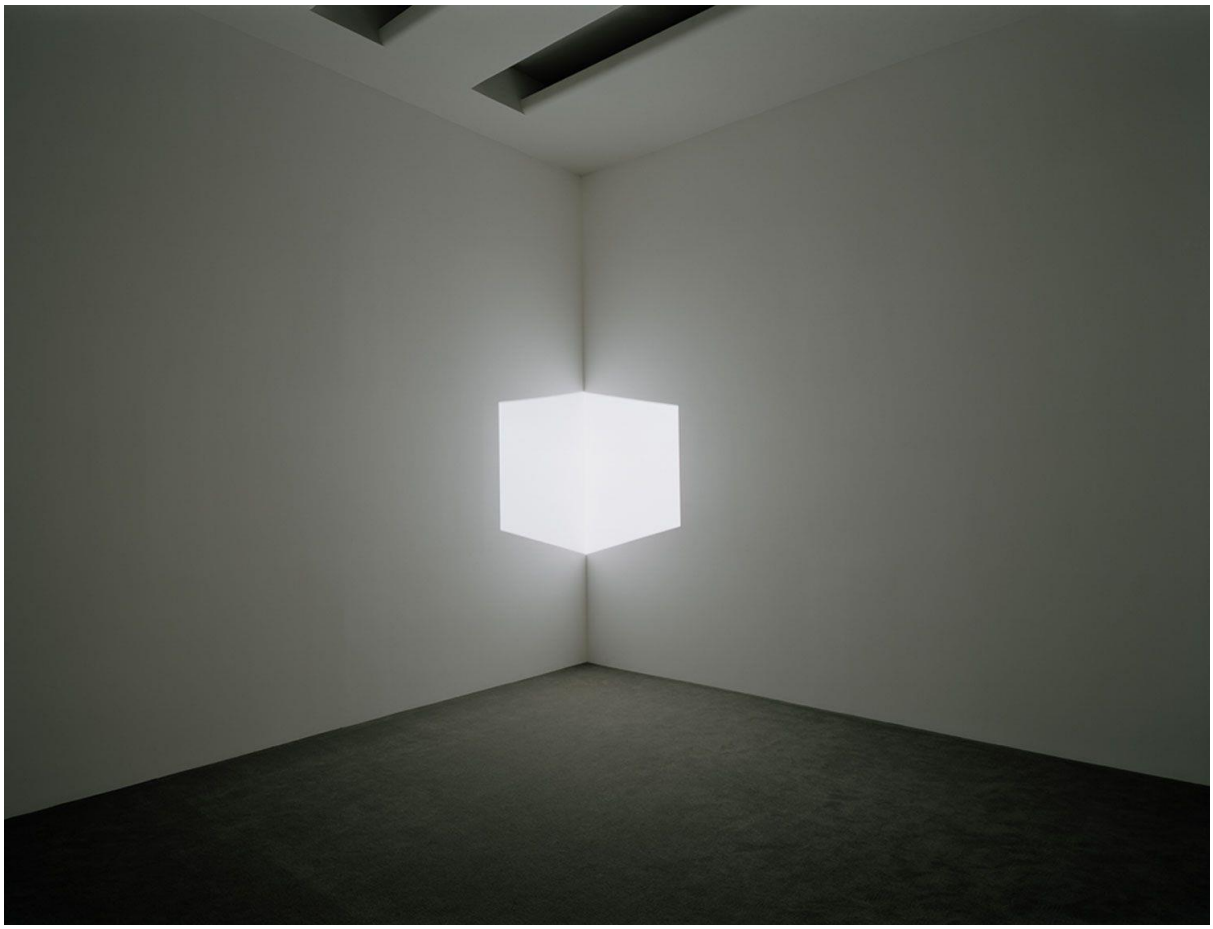


Figure 43. Cross Corner Projections by Turrel

Some years later, in California, James Turrel was adding interesting elements to the history of projections. In 1966 he rented an entire abandoned building in order to create and experiment with his art, he was a minimalist and he created an installation called *Cross Corner Projection*. If Munari transformed light into paintings, Turrel managed to transform light into volumes (Figure 43). Indeed, this latter was just projected light filtered through pierced metal plates and the result obtained was to give the illusion of a volume standing or floating in the corner of a room.

During the sixties, Walt Disney was already famous in the field of animation, and he was very attentive to innovations. Indeed, Disneyland was inaugurated in 1955 and he created the very

first *proto-mapping* on an uneven surface (Maniello, p. 23). The name of the installation was *Grim Grinning Ghosts* and consisted of five busts singing. The busts were simply the surface on which a video of singing faces was projected, creating the illusional effect of singing sculptures.

During the eighties, experimentation in this field started to become more interesting. It is possible to attend to the very first architectural video projection by Mario Mariotti, an Italian artist who projected on the Church of Santo Spirito in Florence. He actually invited artists and friends to that projection, intending to make them finish the façade of the church through the mapping, which was left unfinished by Brunelleschi.

In 1994, again, Walt Disney Company registered a patent for the video mapping technique. *Apparatus and Method for Projection upon a Three-Dimensional Object* was the first written document to describe the entire technique of digital painting of real objects, and thus caused a lot of interests among researches and artists at the time. But nowadays what is known as video mapping is something that officially was born in 2001, when five researchers of MIT in Boston published a scientific paper called *Shader Lamps: Animating Real Objects with Image-Based Illumination*.

In the following years, that are the more recent years, software and several techniques have been developed. Italy can be proud to have been and continue to be an enormous contributor to the evolution of video mapping. Many notorious pieces were developed by Claudio Sinatti around the country, but a particular leap came from the establishment of Studio Azzurro. This latter was, and still is, a collective founded in 1982 with the aim of exploring artistic research in the field of video production through a union between electronic images and the physical environment.

In any case, what really has helped the rise and the evolution of video mapping are the festivals. Since the beginning of 2000, lots of festivals of lights, or dedicated to the multimedia area, allowed artists and designers to meet others from the same field and exchange ideas, methods, and techniques. Some of the most representative festivals around the globe are Mutek (Montréal, Canada), or Fête des Lumières (Lyon, France). Some specifically Italians: Kernel Festival (Monza), LPM (Rome), GLOW festival (Ostuni ed. 2013-2016).

Pablo Valbuena, a Spanish artist mostly focused on space, time, and perception, is incredible in his symmetrical and geometrical works. In 2007, he produced a series of works called *Augmented Sculptures*, which allowed him to introduce new mapping elements to what was

already known. Those elements gave the possibility to move video mapping from outdoor to indoor, so that to be used for installations and artistic media. As Joanie Lemercier did in the same year with his project *Inode*, which is a live paper folding and synchronized mapping with electronic music (Lemercier, 2007).

The transfer of the mapping from outdoor to indoor, or better explained, the possibility to project both outside and inside, allowed many more usages of projection mapping. While outdoor it is possible to map an entire building using huge projectors, indoor it is now possible to map walls, screens, stages, and other structures, in order to obtain every kind of shows and environments. Worth mentioning that this progress has been allowed by the evolution of software and digital innovations able to design video mapping with increasing accuracy and versatility.

2.3.2 Video mapping in shows, live events, and performances

The continuous evolution of video mapping has encountered infrared cameras, sensors, or stereoscopic cameras. These updates lead to the introduction of video art, in which artists could express their art in new digital ways. Nam June Paik is considered the founding father of video art. He was a South Korean artist who held the first-considered exposition of video art in 1963. *Exposition of Music – Electronic Television* took place in the private residence of the architect Rolf Jährling in Germany. It was an exhibition aimed to show Paik's transition from music to electronic images. He basically distorted the images broadcasted in old television on music rhythm, even though in that year Germany had not a significant broadcasting schedule. He was

Figure 44. Nam June Paik working on his first exposition of video art (left)

Figure 45. Tomas Schmit, a Fluxus artist, sitting at Exposition on Music - Electronic Television (right)

able to present thirteen distortions for electronic televisions for the first time, and a couple of years later he experimented with the use of a camera and elaboration of the footage recorded.

> *"We are digital artisans. We celebrate the Promethean energy of our work and our imagination to give shape to the virtual world. By hacking, writing code, designing and mixing, we build interconnected future thanks to our commitment and our creativity." (Barbrook & Schultz, 1997)*

This is what is written into *The Digital Artisans Manifesto*, composed in 1997 by Richard Barbrook and Pit Schulz. It is clear that this world of video projection and video art is an environment of continuous research populated by people with a passion for knowledge and innovation. People who have spent and continue to spend their time and lives finding new insights, new ideas, and new techniques.

In the new millennium, innovations started to be not only related to media or methods, but even to contents. Artists started to work in visual show areas, mixing music with images. Situations presented more and more opportunities to test and so video jockeys were born.

2.3.2.1 VJing

A video jockey, also known as VJ, is an artist who performs live a show of visual effects, lights, clips, or lasers in time to the music.

What distinguishes a VJ from another digital artist is actually the ability to improvise. In most cases, artists design their shows and performances before showing them to the audience. What is generally done is a correction of any error at the time the performance is installed, as well as rehearsals to confirm that everything works. As far as the visual jockey is concerned, however, this confirmation will never occur. He or she will only get confirmation of successful work once the performance is over.

The work of preparing the show, in the case of the visual jockey, includes the design of a series of visual elements and the programming of impulses and commands that will be mixed to obtain as many different results as possible for the duration of the show. The real research, in fact, in this area is precisely that of being able to obtain shapes, colors, and new sensations thanks to the intersection and sequences available to the artist. The final and always different result is

also given by the fact that the visual mixing follows the musical mixing, which is also improvised or not entirely predetermined. Moreover, it is fair to claim that the art of being a video jockey is the most recent and striking example of what was affirmed in the forties with the revolution of abstract art: it is no longer the music to be the soundtrack of the video, but it is the video to be the *image-track* of the music.

It goes without saying that this type of show has found its highest expression in concerts and deejay set events. Actually, the art of video jockey appeared in the nineties with the spread of techno music all over the world. Electronic music still is its habitat. But what can be considered as further evolution in the area of video jockeying is the application of these projection techniques to concert stages themselves.

Over the years it turned out that anything could be mapped, and any surface could – and still can – be projected and brought to a new life. It will be analyzed in the following pages which were the objects but also the places where the designers were able to project and also how far their creativity has been pushed. The introduction of stage mapping gave a new light to what was not understood by the general public in the world of techno music. The fact that they have expanded to concerts of all kinds has taken the universe and visions of visual jockeys to another level. That level where projections can accompany any kind of music, from rock to classical music, from synthesizers to pianos. And audiences appreciate it more and more. The sensory experience one gets at a concert is in itself something fantastic for the viewer. But the fact of having found an additional plus to that experience is something that produces a show without equals, something that remains imprinted in the heart and mind of the audience.

> *"Doing video mapping means moving people and producing whatever is necessary to captivate both the ears and the eyes." (Maniello, p. 42)*

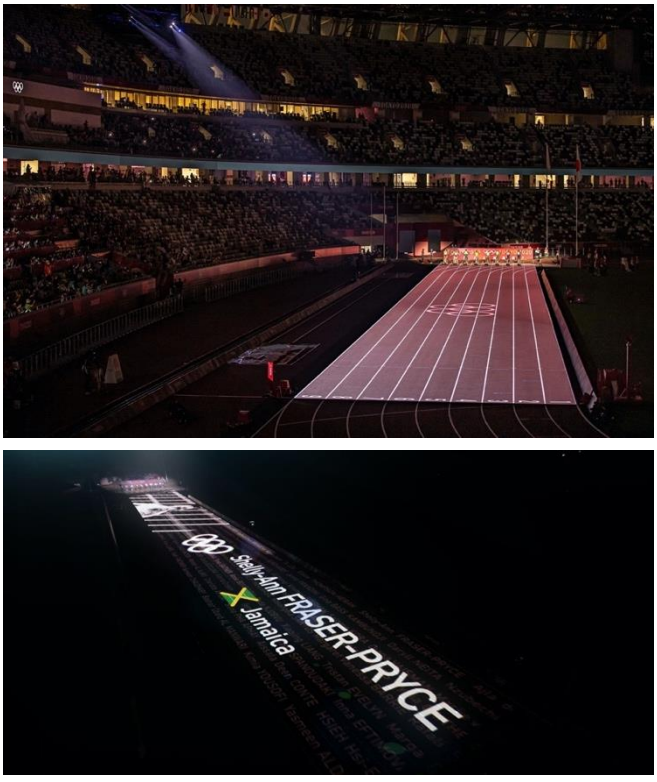
2.3.2.2 The latest events

The VJ world is always evolving and seeking for innovation. However, over the past couple of years most – if not all – of the live visual world has come to a standstill due to the onset of the covid-19 pandemic. This occurrence literally put the world of entertainment, large events, and festivals of all kinds on standby. What can be reported as the latest news in the area of video mapping, is what was possible to watch on the sprinters' tracks in Tokyo, during the Olympics, this past summer. In fact, with the Tokyo 2020 Olympics, it was not only in the opening and

closing ceremonies that the public enjoy spectacular fireworks shows and video mapping. This year, for the first time during the Olympic Games, there was another use and improvement of video mapping, that is, on the track of the two finals – male and female – of the 100 meters. To be fair, the very first time a video mapping was used on a athletics track, was in World Athletics Championships in Doha 2019, in Qatar. It was there that a delegation from Tokyo 2020 Organizing Committee saw the show and decided to work on such projection mapping.

In any case, 100m final was the only Olympic competition to benefit of video mapping, for many reasons – aside from the fact that 100m is one of the most popular competition – such as the logistic of the stadium and the event. The short show was created as anticipation of the race and aimed to introduce the various athletes competing (Figures 46).

As the World Athletics Event Presentation Manager, Florian Weber, stated, they "created a Hollywood-style introduction for [the] athletes because they are the stars" of the show and they deserved this kind of attention (Projection mapping light show makes the Olympic debut in Tokyo, 2021). But the most important thing is that they must not be distracted from what they are preparing to do. That is, another time, the power of projection mapping, that power of being pervasive but not intrusive. Projections, in this way, allow spectators to live an additional experience, enriching sporting events, but without introducing objects or people on the field of competition that are not useful for purely sporting purposes.



Figures 46. Video mapping show before 100m finals in Tokyo, the illuminated track and the presentation of a Jamaican athlete

2.3.3 Projectable surfaces

As mentioned so far, the possibilities of finding a surface on which to project are endless. What are the real limits of achievement, then? Is creativity the only limit? The limits are several, but it is not here that the budget or feasibility of projects will be discussed. In this context, some of the most amazing and unbelievable projects will be sifted through. Over the last 20 years, designers and artists have produced jaw-dropping shows, things that manage to take the audience to another dimension. And they do it – and they know how to do it – mainly because they research these dimensions. Dimensions are like creativity, in this case, screens have seen all kinds of innovations throughout the 20th century. The history of cinema has brought moving images from a giant screen to the TV, to computers, and, lately, to smartphones. Videos are now available on every device with a small or big screen. But, if the history of cinema and technology has evolved to smaller and smaller, as far as video mapping is concerned, the evolution has become bigger and bigger – or better said, to the removal of the device itself. From simple screens to buildings, churches, and skyscrapers, ways to project inside domes have been found, and it has been possible to manage to transform interiors into immersive worlds, too – here is the other dimension. And then some have even projected onto forests, snow, or water.

Those developments about surfaces where to project imply a variety of software and skills that artists and designers had to develop. The creative process itself starts from brainstorming and gathering ideas among the teammates, in order to solve the problems and start to sketch the visual improvisation. The following steps are about the production of the visual content through software for 3D and motion graphics. Contents can be produced not only in digital ways, in some cases they can be created with lasers or other technologies, but even with analogic devices such as lamps or oils.

Video mapping is, therefore, an art form that manages to transform any surface into a dynamic screen for displaying video content. The main objective is to create a physical illusion given by the shape of the structure combined with the audiovisual content produced by the artists. The technologies to create this combination can be the most diverse and, above all, the surfaces that are selected give different sensations to the audience that is watching. In particular, for example, the inhabitants of a specific city will be accustomed to see a specific building in a specific position with a specific purpose throughout their lives. Video mapping allows, for the duration of an event, to transform that structure or building and give it a new life. To understand in detail

what are the feelings that video mapping arouses in the audience, a research was conducted in 2011 – when video mapping was in its infancy – about the show at Yekpare in Istanbul. People who were present at the show were selected for a survey and gave feedback about the projection mapping. It turned out that projections elicit feelings that cinema, TV, or any other media cannot. The sensationalism of the content is emphasized to the point that people cannot even describe what they experienced, and more importantly, some cannot even understand which methods and technologies are needed to create such a thing (Ekim, 2011). Within video projections, not only the audiovisual content is important but also the actual space that is selected to be the projection surface. The latter, to say it better, is even more important than the content itself, since it directly determines not only the fruition but also the design and the choice of the content. The combination of the two elements makes it possible for them to merge and cooperate and give the physical illusion already mentioned and the feeling of being in another dimension.

The seek for other dimensions just mentioned above has led to the proposal of a taxonomic division to the projecting surfaces. This division is proposed in the following lines and stems from the following reasoning. Assuming that the goal is to give the audience the illusion of being in another dimension than the real one through projection, then the surface on which the content will be projected will play a key role in the accomplishment of this goal. In particular, the division follows the relationship that the receiving subject – hence the audience – has with the video mapping devices. These devices are the projected surface, the projected content and the projecting medium, that is the projector. The subdivision that follows has as its criterion the perception that the audience has towards these devices. In particular, it will start from the architectural surfaces, which are recognizable by the public as buildings or facades of known buildings, and therefore leave the public aware of where it is and what is seeing. Next, irregular surfaces will be analyzed as natural or handcrafted surfaces that can change over time but also allow for distortion of the projected content. Then, there will be the immersive environments, which are no longer properly simple surfaces but whole environments that surround the audience. Immersive environments are those spaces that mentally transport the viewer to another dimension and allow him or her to be entirely overwhelmed by the projection. Finally, it will be analyzed the case in which the surface is completely eliminated, and the viewer is faced with a visual content that subsists alone in space.

2.3.3.1 Architectural

Since projections are the tool used to give life to static three-dimensional objects, they will not be analyzed here in the context of flat screens or simple white walls.

Within the universe of video mapping, various types of surfaces are used, in particular, video mapping has developed on buildings, churches, and architectural facades within cities. Some of the most famous and spectacular video mapping shows have occurred on the facades of churches, ancient buildings, stations, and so on.

To be able to do video mapping it is needed to know how to use some particular software and with those technologies, objects are transformed into display surfaces. Regarding the design of a video mapping show on an architectural facade, the process starts from gathering ideas among teammates. The first part concerns the development of the idea to realize, the scenario, and the sketches. In this step, designers analyze which building has been assigned to the event, where it is located, what are themes to mention during the show, and other elements. Doing this, they get to know the history of that building, its uses, and how it is related to people's life.

The main goal is to know all these elements and variables in order to produce audiovisual content to propose to the viewers and to make sure that those extraordinary feelings are aroused.

Once the topic, the themes, and the style with which it will be produced have been decided and identified, the following step is to start producing the actual content. The content, in the case of video mapping, is not only produced on the computer with motion graphics or editing programs – which produce an image within a rectangle in 16:9 format – but must be created ad hoc on the surface on which the content will be projected. To do this it is necessary to produce a 3D scale prototype of the building, facade, structure, or whatever it is that will be used as the projection surface. Methods for creating the scale model can be 3D printing or simply a calculated scale reconstruction of the building facade in wood or other material. In this way, one can literally have the facade that will be used at his or her fingertips, on the table or desk, and with the help of a projector connected to the appropriate software the surface can be mapped directly. The mapping process is meticulous and very detailed. There is dedicated software including Mad Mapper or Resolume Arena to do it. As detailed and precise as it must be, it is also paradoxically simple as a process. It is enough in fact to apply anchor points in the various vertices and corners of the facade in scale, which will then be reproduced in real size at the time of the show. By creating various polygons and various anchor points in all the structures of the

Figure 47. The wireframe of a building when the mapping process is finalized, and each part highlighted with Mad Mapper

facade one will get something similar to the image (Figure 47). In this way, the program no longer projects directly onto a 16:9 rectangle but projects only into the highlighted section leaving in black the parts not selected by the user, namely a mask. It is possible to select different elements within the facade that can be, for example, the supporting columns, or only the windows, or only sections of the structure thus creating various layers of the projection. In this way, it is also possible to create different content for each selected section. This is why the space of the structure or the architectural facade is much more important than the content itself. Because the content has to adapt to the spaces. If it is shown, for example, a video of fishes swimming into the open ocean, it certainly will be not possible to make it match only the sections where there are two columns. But it is rather possible to use those columns to give it a new life and create, for example, underwater columns that can be integrated into the main video.

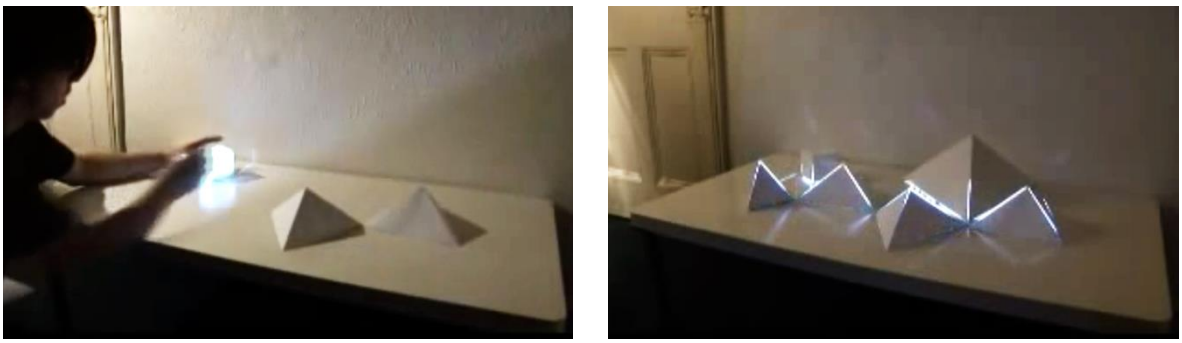
If this building is in a particular city, it is assumed that the majority of the audience will be local in that city. In light of this, it is important to take into account the relationship these people have with that building. If the building is a station, projecting an underwater video on it will completely overturn the perception of that building. It is precisely this element of surprise, or rather of distortion of the context, that leaves viewers with a sensation they have never felt before, that of not being in front of the usual building they are used to.

In addition, some say in the interview reported by Ekim (2011) that they do not entirely understand how such a show is possible. In fact, the audience often wonders if the light and

images come from outside or inside the building itself. The fact of having, for example, windows on a facade allows for an interplay of dimensions and levels that can destabilize. The fact of being able to use the various shapes and objects of the facade of a building on which it is projected leaves open the interpretation of the video content itself. Going back to the example of the video set underwater, it is possible that all viewers see the same images, but such a content can stimulate different effects based on each person's individual perceptions.

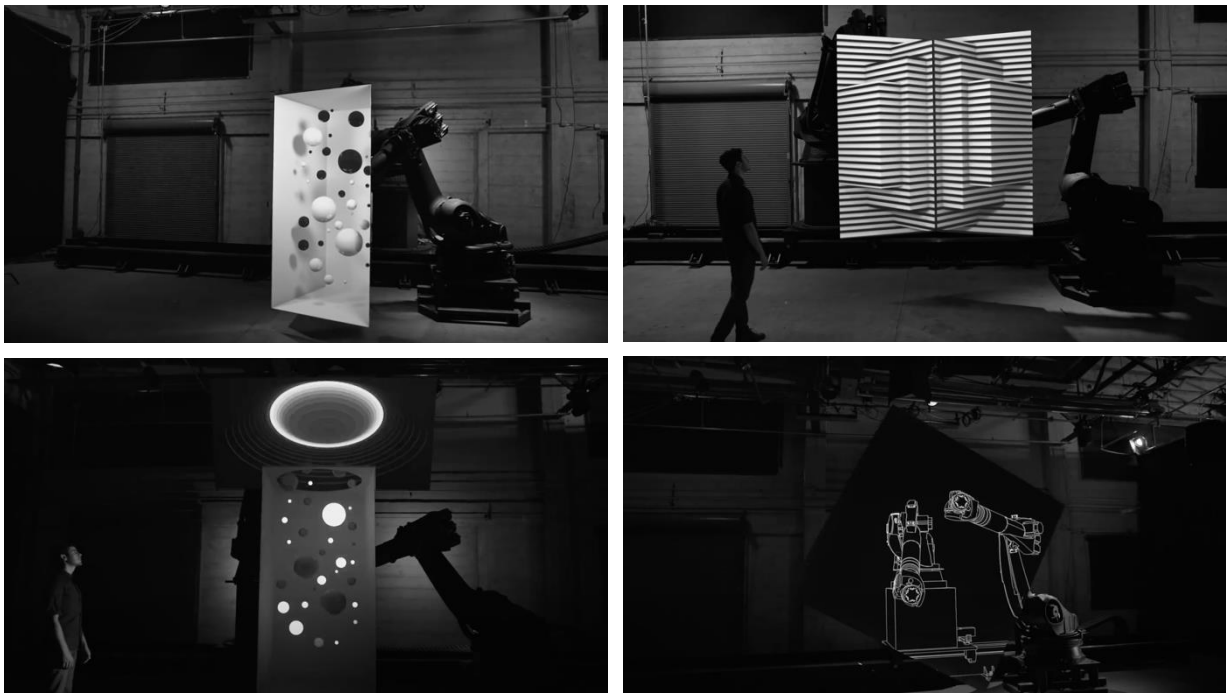
- Moving geometries

Considered as small architectures, geometric shapes are used to produce mesmerizing projection mapping in movement. Using simple geometric figures is not synonymous of simple video mapping. In fact, the use of rectangles, triangles, cubes, cylinders and so on, is matched by moving them. Producing a show on a moving figure does not require as complex a mapping as that of building facades, but it does require a great deal of complexity in terms of content production and synchronization with the movement. In reality, the projector will need to be connected to software that will only display certain images on the surface in certain positions. This software is set up by the designer with certain timings and parameters, but in addition to this, the geometries being used will also have to perfectly follow those same timings and consequently different parameters. To understand this use it is possible to have a quick look at the images below (Figures 48) to observe how at the positioning on the table of each new small origami pyramid, the projector illuminates it, all this to the rhythm of music. It's clear that this little video mapping experiment was not improvised but instead studied in every single timing and position. Surely, Joanie Lemercier first calculated how long it takes to fold the sheets of paper to create the pyramids, in what position to lay each pyramid, and the beats of the music to get in time. All of this must also be given as information to the software that controls the projector, in order to create an almost magical end result.



Figures 48. Shots from Inode project by Lemercier

The same result, years later and with a much more sophisticated technology, has been used for the BOX video made by Bot & Dolly Studio. The video of the project shows a man interacting with a giant magic box. This mesmerizing result is obtained thanks to a generative video mapping on two 4 x 8 inches panels hooked on two robotic arms that make them move and interact sinuously with the projection. The level of the result obtained is incredible but what should be emphasized is that this type of video mapping can only work through video. Better explained, there is a third robotic arm which is moving the camera that shoots everything. In fact, if the video projection and the mechanical arms are synchronized to create an insane optical effect, this latter can only be enjoyed from a very specific position, which is that of the video camera that shoots everything. This show could not, therefore, be presented to an audience of people scattered in a room, because the perspective would not be respected, and the vision would be distorted. The video camera, therefore, is an additional element synchronized with everything else, including the man who pretends to move the panels, because he has to shoot all the moments of the video mapping from the best perspective to destabilize the audience.



Figures 49. Shots from BOX video by Bot & Dolly

2.3.3.2 Irregular

The fundamental part of projection mapping is that it is possible to display on any surface. Surely, a flat surface gives a major possibility and feasibility, but it is not always so easy. One

can have a much more dynamic and unexpected show if he or she projects on water, for example, or on rock walls or tree leaves. Each surface above mentioned, and many more, has its own challenges.

The main difference between video mapping on regular or flat surfaces and video mapping on irregular surfaces is the ratio between the projection itself and the projected surface. It will be used the term flat surfaces to address what has been taken into consideration so far, i.e. buildings and facades. It is because it is easier to map a flat surface than a non-linear surface. The simplicity lies in the fact that once the projector is placed at a certain distance from the architectural facade, all points on the facade will be equally distant from the light source. This is a considerable advantage for the designer as he or she will have to make less effort to adapt the visual content to the projected surface. On the other hand, in the case of irregular surfaces – such as water, smoke, or rock walls – they will be more complicated to map since the distance the light travels from the projector, the starting point, to the endpoint, can vary at different spots or through time. In these cases, a mesh warp will be needed, which is a distortion of the content given by the distance and the perspective of the surface in relation to the direction of the beam of light.

To better explain what is intended with irregular surfaces, some video mapping shows that have used uneven surfaces will be analyzed.

- Trees and forests

Trees and forests, but also any organic element that can be found in a forest, can be excellent projection surfaces. In the case of linear surfaces, mapping is simple but meticulous. In the case of trees, the mapping may be less detailed because the branches do not have clear contours. For best results, one can, for example, draw the approximate boundary of the foliage in question, and blur the projection boundaries to make it less sharp to the human eye.

Despite the issue of projection boundaries, another feature of tree mapping is the total irregularity of the projection surface. In fact, when it comes to branches and leaves, it is never

Figures 50. Shots from Bioluminescent Forest by van Schoor and Mawad

about an approximately flat surface. On the contrary, generally speaking, the foliage of a tree is composed of leaves that can present themselves in front of the projector in the most disparate ways. These are leaves in profile, in front, tilted, more inward or more outward, branches that follow unexpected lines, different sizes, and so on. For these reasons, video mapping on single trees or single plant organisms is often done with abstract and geometric figures, and often with single light particles that can give a different life to the projected object (Figures 50). See for example the *Bioluminescent Forest* project made by the two artists Friedrich van Schoor and Tarek Mawad in 2015. This project has seen the two creatives living in a forest for six weeks trying to map and project onto trees, mushrooms, little rocks, and even frogs and spider webs (Figures 51).

Figures 51. Mawad and van Schoor working during the night in the forest for 6 weeks to complete Bioluminescent Forest project

In addition to geometric and dotted projections, there is more that can be achieved through the conformation of a tree and its canopy. The project by artist Clément Briend, an associate of DiBari Creative Studio, literally gives new life to trees by projecting faces onto them. The project was realized in 2009 under the name of *Cambodian Trees*. He projected onto the trees in the city of Phnom Penh – and later in Paris and Berlin too – some sculptural representation of spiritual entities typical of Cambodian culture (Cambodian Trees, 2018). The magnificence here is about the fact that a tree canopy has a rounded shape similar to a face, and so it perfectly adapts to that content (Figures 52).

Another level that can be reached is when it takes to forests in general. The change is on the fact that a group of trees, taken from far away, can be considered as a canvas to project onto.

The canvas in this case is not linear but can give back an outcome such as is presented by VJ Suave in São Miguel island in Portugal in 2016. VJ Suave duo's style of projections is made of funny illustrations and so it is what they projected into natural sets around the island.

Figure 52. Cambodian Trees by Briend

Figures 53. Projection on cliff face in São Miguel by VJ Suave

- Rocks and cliff faces

Along with forests, VJ Suave projected into the natural environment in São Miguel such as rock, abandoned buildings, or waterfalls. Projections on rocks do not differ substantially from those that take place on trees or forests. What makes the difference between a projection on a mountain or a projection on a tree is the size of the content and the distance from which the projection is projected. The case of VJ Suave is an anticipation of what happens with projections on rock walls (Figure 53). That is, taking as an example the tiger projected on the forest in São Miguel, a projection on a huge scale and projected from a really big distance. This not only implies the use of a powerful projector capable to cast light 2 km away, but also to combine multiple sources. An impressive example of a rocky mountain projection is the one casted to the tallest mountain in Europe. The company which did it is called Proietta Creative and Technology by projecting from a distance of 5.7 km content for the 2006 Turin Olympics

on Mont Blanc. To do this, the company used more than 12 projectors with 40,000 lumens each. But what is a lumen in a projector? A lumen is the unit of measurement used to calculate the amount of light a projector can emit. One lumen is equivalent to the light emitted by the flame of 1 lit candle. It can be understood that 40,000 lumens emitted by a single projector produce an immense amount of heat. Such a projector can measure up to one meter in length as it needs fans and various devices to be able to ventilate the interior (Figures 54 and 55).

What characterizes the projection on rocks and on a large scale is the abstract and geometrical language of the projected video. Actually, people were able to see the logo of the 2006 Winter Olympics on Mont Blanc from almost 6 km away perfectly sharp and not distorted. And it might seem that on a large scale it is easier since the rock appears as a canvas, irregular but manageable.

Moving to a smaller scale location, inside caves, for example, the challenge is greater. In this case, designers have to take into account every irregularity and jaggedness of the individual rocks. In such scenarios, the choice of projecting abstract imagery is even more impactful. For example, there is a video clip shot by Zedd, *One Strange Rock*, in which the singer is inside a fake cave and underground corridors that are projected entirely to create an immersive environment. In this case, the waves of color and the fluid that is projected do not collide with the irregularities of the rock because both images and surfaces share the same visual unpredictability, thus blending together into a seamless spectacular way.

Another example of projection mapping on rocks is present in the De Bastei museum in Nijmegen, Netherlands. The project started back in 2018 when, excavating to expand the museum, an archeological site was found below the building. Thanks to video mapping techniques, the archaeological site has been entirely mapped and the historical information of the various elements found has been projected. Studio Louter, in collaboration with the designers of Opera-Amsterdam, has also created an interactive system. In fact, inside the

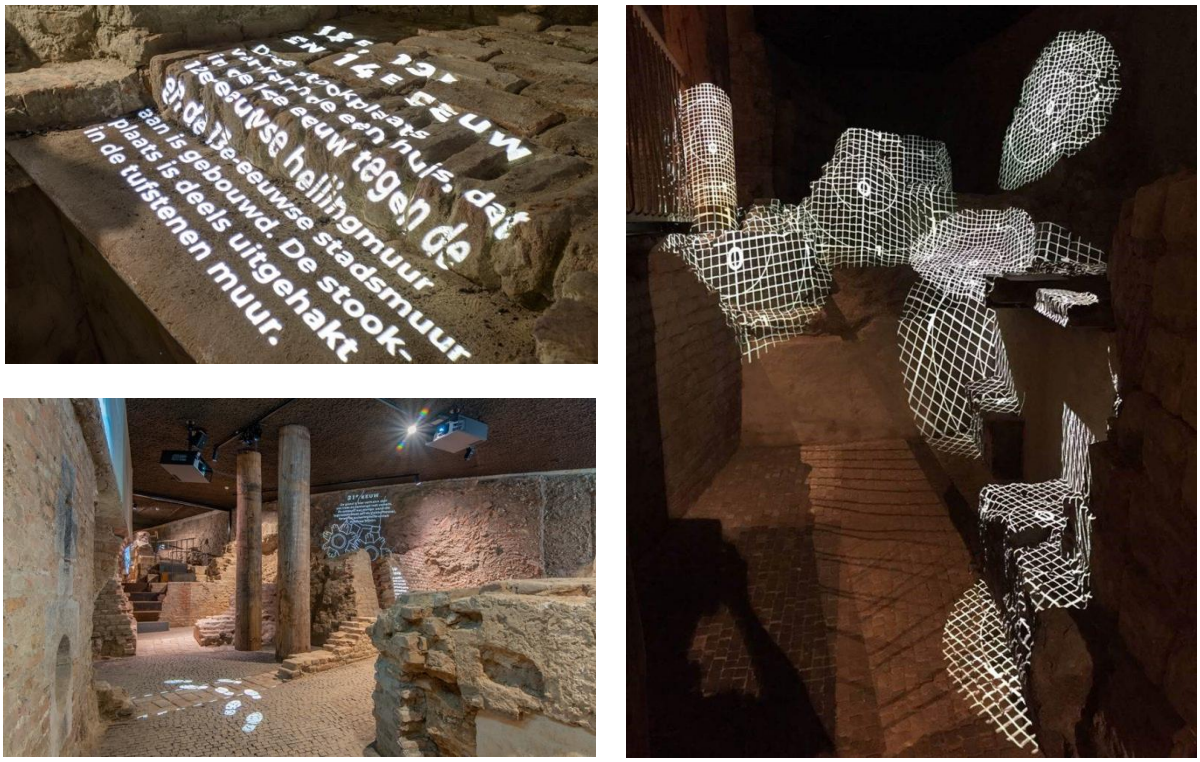
Figure 54. Projection mapping on Mont Blanc for 2006 Turin Olympics

Figure 55. Setup of projectors for projection mapping on Mont Blanc

museum, the various archaeological points can be touched by visitors to make something happen. The contact of the hands with the walls triggers additional projections. In fact, as soon as a visitor's hand rests on the walls, the latters change as they were thousands of years ago, during the Roman Empire (Figure 56). Therefore, next to the written information emitted by the projector, a sort of virtual or augmented reality is created thanks to the interaction between the projected surface and the viewer.

In a Rosco Spectrum article, it was stated that the most difficult challenge designers faced was getting the video content to adhere to uneven surfaces (Massano, 2018). In addition to the irregular areas of the archaeological excavations, the difficulty was also in the fact that the space is really tight. So, they used scale models to understand where to place the projectors but especially where to project the content and the writings so that they would not be distorted. To achieve this result within an environment that difficult to manage, they have been mapped all the structures, all the angles, all the shapes of the museum through a wireframe view (Figure 57). Since the view given by the wireframe, with the white grid, allows to have a general view and understand where the projection is distorted or has to be corrected (Figures 58).

Figure 56. Interactive projection starts as a person is touching the wall in De Bastei museum



Figures 57. How the new space of De Bastei museum appears (left)

Figure 58. Wireframe view of the mapping of structures in De Bastei museum (right)

- Water surfaces and water screen

When thinking of water projections, the first thought goes to a container filled with water or a large amount of water that creates a flat surface. This surface can be that of a swimming pool, a lake, or a reservoir. But it can also be an amount of moving water, such as a waterfall or a stream. On these surfaces, a video mapping can be made but this situation does not much differ from what is a projection on an irregular surface such as a rock wall or even better as a flat screen. As everyone knows, water adapts to the container in which it is contained and once adapted, the surface of the water will be flat. The spectacular thing about projecting on water is that the beam of lights will not stop just on the surface. But rather, it will penetrate even deeper into the fluid to the bottom of the container. This feature gives the projection itself a three-dimensional appearance. This type of event can be mainly found in corporate events or locations where a pool or a body of water is placed and maintained.

What is also interesting in the context of water projections is what is called *water screen*. A water screen is literally a screen made of water. It is made by very powerful pumps that spray water upwards and atomize it. By spraying the water, a sort of surface is created that is imperceptible but sufficient to be considered projectable. The effect of the water screen is a

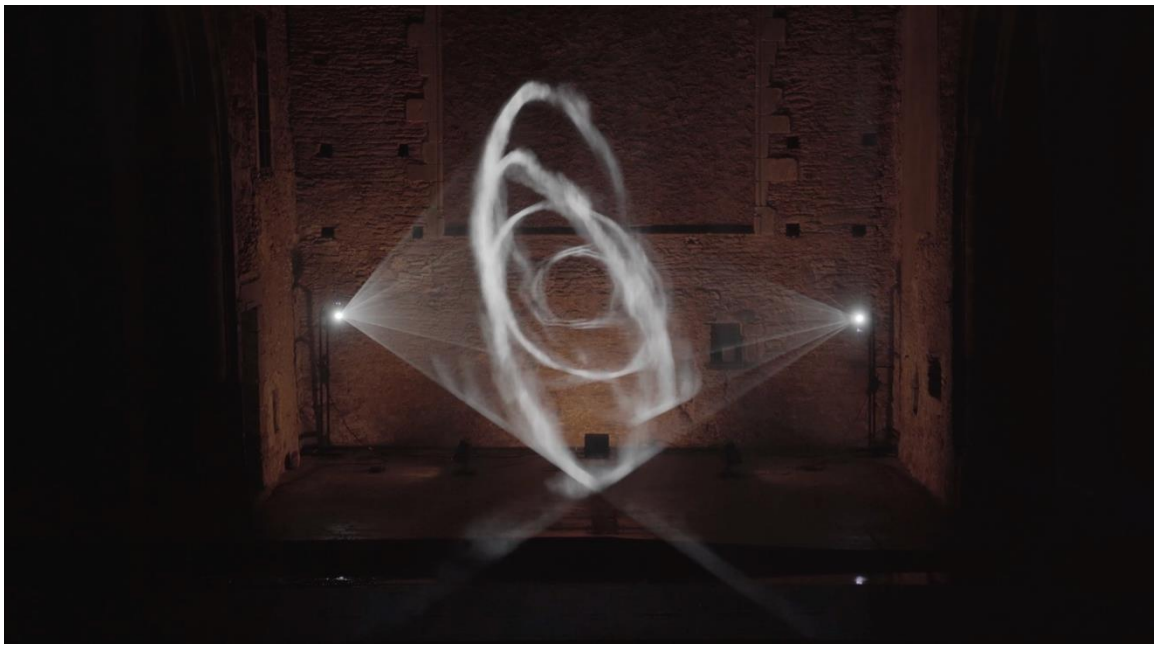


Figure 59. Constellations, an audio-visual installation on water screen by Lemercier, 2018 (top)

Figure 60. Brume, a projection on water screen by Lemercier, 2017 (bottom)

kind of semi-circle of nebulized water on which an audiovisual content can be projected. The content takes on an incredible three-dimensional appearance because the water spray, despite being called screen, does not absolutely create a flat surface. But it rather creates a three-dimensional space on which the projection will be inserted. According to this logic the nebulized particles of water are scattered into space. The light ray that starts from the projector and arrives at one nebulized particle, which can be closer or farther away, and this creates the perception of depth.

2.3.3.3 Immersive

Immersive environments were mentioned when discussing Zedd's video clip in which video projections were mapped onto the walls of a cave. Immersive environments can be placed within projectable surfaces, but they have their own characteristics. The first key feature is that to create an immersive environment one must not consider a single wall or surface. To make an environment or an immersive room, it is necessary to map everything visible – walls, corners, ceilings, and floors – and place different projectors in different points with different angles to cover all the existing surfaces. To do this, the first step is to determine where the projectors will be placed and what area they can cover with their projection. In this way, with each projector, the area of interest will be mapped. After that, the video content will be built so that it can adhere to the entire environment.

Another fundamental difference from other surfaces is that of audience enjoyment. When the audience is inside an immersive environment, it is completely transported by what surrounds it. The artistic experience in this case is much greater than what was analyzed in the study for the show at Yekpare in Istanbul. If viewers in front of a video mapping on an architectural facade are stunned and excited, within an immersive environment these sensations will be exponentially more intense.

One aspect that can increase these visitors' feelings, even more, is the fact that most immersive environments are created to be interactive. Interacting with the projection causes the viewers to be convinced that they are in another reality. As seen in the previous example of the Dutch archaeological museum, by touching the wall it becomes as it was thousands of years ago. This allows the viewer to enter into communication with the projection and transport his or her person, mind, and feelings back to thousands of years, to the Roman Empire. This dynamic can be recreated for any immersive environment. And it can lead people to every different reality.

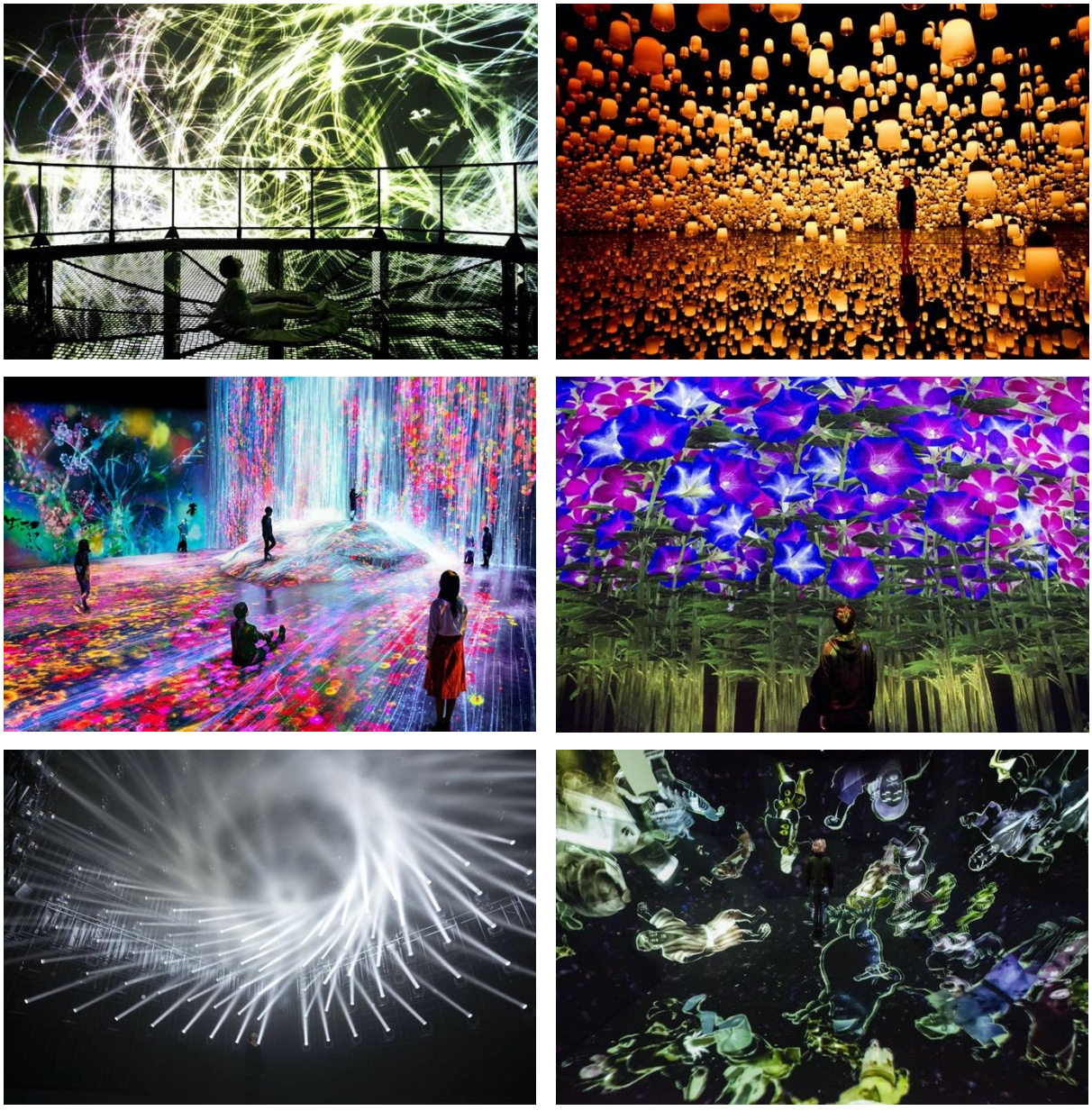
One of the projects produced during the master's in Design and Visual Culture at IADE was to design an interactive installation for a museum. The project was powered by Museu das Comunicações in Lisbon for the Digital Interfaces course with professor Cláudia Pernencar. Irene Canovi and I designed an immersive environment developed to be placed in the corridor to enter the children's area of the museum. The space was meant to be filled up with a projection of a submarine environment where children had to save marine life from plastic debris. The project consisted of an interactive projection where people were asked to touch plastic items floating in the water to increase the number of fishes and other marine animals. For each plastic

debris eliminated, an animal would appear. The final result was supposed to be an underwater corridor where visitors could walk through and remove plastic from the ocean. *Aguáviva* – the name of the project – was inspired by the immersive environment made by DrawLight during the 2019 Milan Fashion Week. DrawLight – an Italian creative studio – created an immersive environment called *Get in Sync Water* within the location of Superstudio Milano. It was an immersive installation made to increase awareness and activate the change. As the creative director of the studio, Elisa Basso, claims:

> *"Through images, lights, reflections, and sounds Get in Sync Water wants to enter the depths of people and excite them, transporting them to the heart of the Ocean where the drama is consumed to rewrite the common imagination, so far wonderful and pristine" (Get in Syn Water: Arte e Consapevolezza, 2019).*

Figures 61. Get in Sync Water, immersive project by DrawLight

The key point is that the fashion industry is becoming increasingly attentive to climate change and the methods and raw materials used to produce garments. With this installation, the aim is to sensitize people to protect and safeguard the entire environment where there are living (Figures 61).



Figures 62. Rooms and installations into the Digital Art Museum of Tokyo by TeamLab Borderless

One of the best immersive environments in the world is currently in Tokyo, made by TeamLab Borderless into the Digital Art Museum. This is not just one immersive environment but a sequence of environments that are immersive in different ways. There are mirror rooms enhanced with lights coming from the ceiling, there are led wall rooms and projection mapping of abstract and fluorescent elements. There, it is really possible to reach that otherworldly dimension it has been discussed in the previous paragraphs. Rooms and immersive graphics

are totally abstract and conduct to interpret where people are in total freedom. As they state on their website, the reason why artworks are called borderless is clear:

> *"People understand and recognize the world through their bodies, moving freely and forming connections and relationships with others. As a consequence, the body has its own sense of time. In the mind, the boundaries between different thoughts are ambiguous, causing them to influence and sometimes intermingle with each other." (TeamLab Borderless Tokyo, 2021).*

TeamLab Borderless has its first aim to destroy those boundaries and make people feel as if it is possible to live completely free to think and relate in the way each one believes best. Free to put their bodies into a space and create connections with this space and other people with no borders (Figures 62).

- Full dome

Immersive environments can be made even in domes. Thinking about this, the planetarium is a frequent example of video mapping in domes. Everyone as a child has gone to the planetarium at least once to see stars and planets. If anyone has ever had the opportunity to have a small projector to simulate a planetarium, he or she will know that inside the lamp is inserted a small disk that simulates the celestial vault. This little disk, if projected onto a flat surface, will produce a projection that that cannot provide a proper and consistent focus for each projected point of the surface. In fact, that disk has on it an image that has been created to be created on a curved surface, that is a dome. It can be understood then that the video mapping on a dome

Figure 63. Blendy Dome VJ demo at Multiplicidades Festival in Rio de Janeiro, 2014

is a projection that must have characteristics that need to be calculated depending on the tilt, horizon, and diameter of the dome. To do this, a collective of VJs called United VJ from Brazil, has created a software easy to use to do video mapping onto and into domes. When stating *onto and into* it is intended that a dome can be mapped both from the concave side and the convex side. BlendyDomeVJ is a software developed by VJ Spetto, VJ Zaz, and VJ Roger S who are experts in the field of dome mapping, creatives, and organizers of famous festivals of projection around the globe, and above all are the precursors of VJing in Brazil (Figure 63). Indeed, United VJ has also created a VJ University in Saõ Paulo, Brazil, to teach people the art of VJing and spread knowledge about the topic.

Joanie Lemercier participated in 2014 in an artistic residency within Satosphère in Montreal, Canada. He lived inside the structure for a month along with other artists, designers, and technicians and all worked together inside the space to produce audiovisual and immersive content. The structure's dome is 18 m in diameter and is equipped with 8 video projectors and nearly 160 speakers. Joanie Lemercier asserts on his website (Lemercier, 2019) that this was his first experience with full-dome projections. And in light of that, he wrote an article to highlight the multiple constraints he had to face.

For example, the first difference to be noticed in the creation of a content for screen and a content for dome is that in a content for the dome the human eye will never see all the content at the same time. In fact, the angle of vision of the human eye is 120° and the dome is 360°, so each person will see a third of the content at a time. To solve this problem, it is necessary to create content that can rotate, that can be focused at various points leaving others behind, or

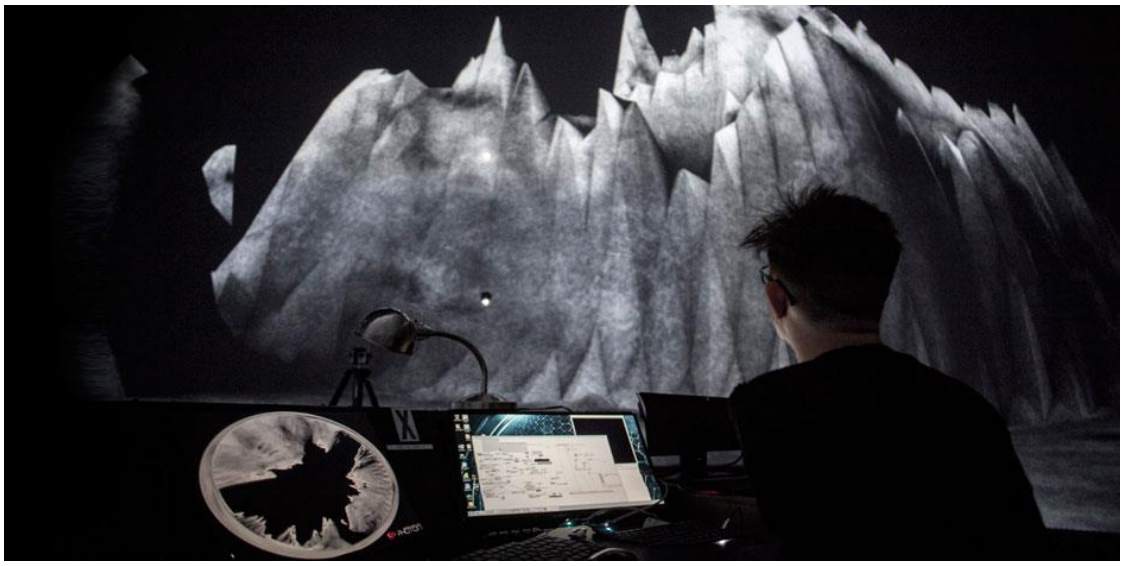


Figure 64. Avoiding white and high contrast in full dome projection mapping

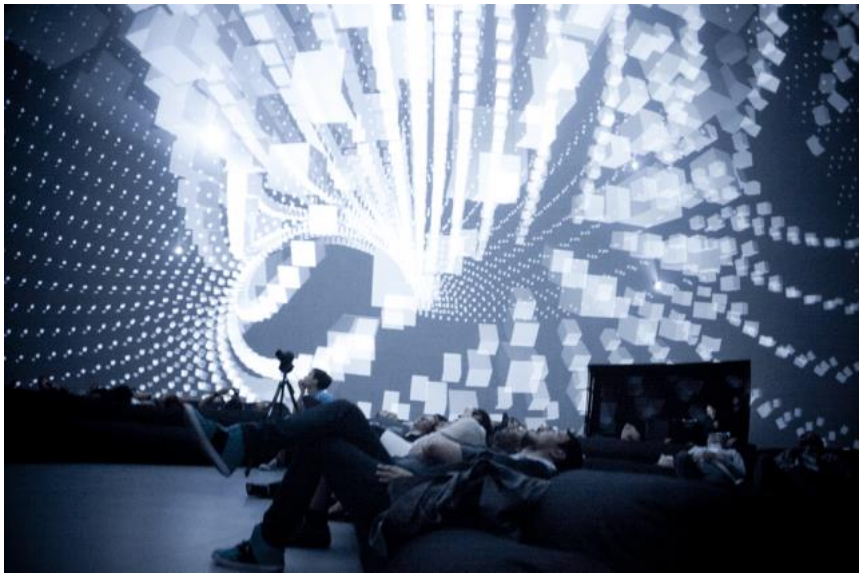


Figure 65. Using loop and rotating contents for full dome projection mapping

that can be played in a loop in sequence. In this way, it is lost what had become the fundamental basis of film history over the years, namely the choice and study of framing.

Another problem the artist encountered during the production of this content is the fact that the projection surface is uniformly curved. This feature will ensure that, when the white light of the projector hits the surface, it will be reflected on another point of the dome and will cause the black part of the projection to appear gray (Figure 64). Due to this, it is necessary to maintain a decent contrast level and low pixel brightness. And also, it would be wise to avoid producing areas where there is a concentration of white. This artist's solution is to use disturbed textures to avoid having black surfaces to show. A final problem that Joanie Lemercier encountered is the fact that projecting onto a dome means projecting onto a screen that has absolutely nothing to do with a flat, rectangular screen. So, everything used to so far have to be forgotten and revised in a three-dimensional, and round dimension.

2.3.3.4 Absent

Technologies have developed with no comparison within the area of art and new aesthetics. It has been possible to argue all the different kinds of materials, media, creative processes during the precedent pages but there has been no space for an important question. Can the audience actually interact with the work of art? It is possible to establish a way that allows a person to completely forget what he or she is experiencing? The way that has been developed to do so is

not a medium. It is something that eliminates the medium in order to investigate the relationship among art, science, and technology (Oliveira, p.1274).

The key issue of this topic is the perception of the audience. As an introduction, it is necessary to explain what *mimesis* means. This term derives from Ancient Greek and literally means to imitate. It is important to underline that mimesis is related to the act of representation. Aristotle claimed that "representation is necessary since mimesis is natural to the mankind" (Oliveira, p.1275). Human beings, indeed, are the living beings that most use association to learn things. Since childhood, young people are used to observe and copy what they see around them. This is how people learn most things, by replicating actions. It is also important to note that in addition to imitate and store information because of what people see, this memory is often redefined based on the emotions or feelings they experience while observing a certain thing.

In fact, the psychological perception developed from the visual experience then has a new influence on the identification of new 3D objects. In addition, there is a fourth dimension that increases the overall perception of reality. The movement of elements allows the localization of elements in a space and allows to show and hide others. There have been various attempts in the art world to convey this sense of 3D immersion. But with the inclusion of the dimension of time, viewers have had the opportunity to become even more immersed and empathized with. In this way, the divergence between the real and the art is increasingly lost. Despite this, with digital, art tends to go in an increasingly abstract direction. So do relations, and society instead aspires to go beyond the appearance of things in favor of a total dematerialization. So, what could be more immaterial than something that does not actually exist? It seems difficult to understand as a play on words, but the apex of this immateriality is touched – in the union between art, science, and technology – thanks to holograms. There is no more space necessary to reproduce the performance, there is no more dimension, the eye sees something that is not there. Something that one cannot touch, one can only see but cannot experience with other senses.

The experience for the viewer is transcendental and the concept of time-space changes. The object of art is no longer an object, yet it can be located in a room and in a well-defined moment. But the same non-object could be located in another place and moment. The only material thing in this circumstance is the device that is used to produce the art object, but something that no one will ever be interested in noticing.

Part 3

INSPIRATIONS

3.1 THE BRIDGE

How things connect to others

Keep your eyes at the stars and your feet on the ground.
Theodore Roosevelt

This chapter is mainly dedicated to the artists and shows that inspired this entire work, and that led a small spark of a music festival to explode into a magnificent fire that is still burning inside.

3.1.1 Awareness

Getting to this point, after all these pages about the history of cinema. But also, about the history of music in cinema, and how the relationship between music and cinema itself was born and changed over the years. And even after all the explanation about the history of video mapping and how far it has come, it is fair to ask: which is the goal of all this? What comes next?

What comes next is an ambitious video mapping project within a music festival. This ambition was born out of an irrepressible urge, still active today, which is the answer to the emblazoned and dreaded question, *what do you want to be when you grow up?*

One always tries to answer everything or almost everything. So, let's try to explain why it has come this far, but more importantly, why it is going forward.

One of the first days I met my thesis advisor, Carlo Turri, he told me that I had to find a context where I could set my video mapping project. The context concerning video mapping is really important since the projection is such only as unique in a given space-time context, the video mapping content is necessarily and specifically produced for a given medium. He underlined many times that the projected surface is not a plus, but rather a fundamental part of the video mapping show. It is therefore possible to claim that a video mapping show is made up equally of video content, surface to be projected, space-time circumstances, and experience given to the audience. These four factors are fundamental and equally important to the success of a

show. It is important to state this because the video content, if separated from the video mapping and projected, for instance, on another surface or spread on screen, would completely lose its communicative value.

This context was very difficult to find at the beginning. He gave me the most disparate inputs, abandoned buildings where anything could be created on, references, and land art of all kinds.

He told me that the idea was beautiful but that I had to find the right festival.

So, in those days, in October 2019, I was thinking a lot. One afternoon I went to Belém, right in front of the tower, where there is a park. I sat there, leaning against a tree. I began to think about this project that had yet to be born. I began to think about why I had chosen this subject, why it was so complex. I thought a lot that day, the branches of the tree were waving, the tourists were admiring the Belém Tower as everybody did at least once, the sun was shining, and I was thinking, thinking, and thinking. I grabbed a sheet of paper and my pencil and started brainstorming with myself. I wrote on that paper all the things that had driven me to make that choice. I also wrote, on that paper, what I most enjoy doing in my life. It was not easy because usually, on impulse, I can more easily list what I do not like, rather than what I do like. That time was different, in no time at all, a list – even quite long – of things I love to do came out. From this well-written and clear list, I began to do a rich, thorough, sometimes exhausting search for references on shows, installations, video mapping, events, festivals, and artists. I found so many things, everywhere. I found these references mostly in the streets of Lisbon, where I had the honor to meet the guys and girls who founded and are part of VJ Anonymous, a collective of digital artists who welcomed me in their studio and wanted to know everything about me and what I was doing.

I am going to make a brief aside regarding these people, now. In Lisbon I found myself having a great passion and I wanted to deepen it, so I started going around to meetings, events, exhibitions, workshops regarding digital art completely on my own. I used to arrive at places where generally everyone knew each other, and they would chat about their work or projects. I did not know anyone, but I never arrived at one of these events and was ostracized or left behind. Everyone welcomed me like I was a lifelong friend for them, with open arms – literally. Every time I met new people in this industry, there was a mutual interest in sharing and listening to others' ideas or skills. People from every corner of the planet, people who did not speak the same language as me, people even thirty years older than me. I remember those sensations and that sense of inclusion and welcome, which I felt in few other places, with a full heart.

I also found some references in Lyon, France, more precisely at the *Fête des Lumières*. This event is one of the oldest and most known in the field of video mapping. In Lyon, the Lumières brothers were born there and they projected for the first time, at the end of the 19th century. The city of Lyon, then, to honor its history, for one week a year turns into a magical world of spectacular lights. Generally, around the 8th of December every year, the city comes to a standstill. There are video mapping shows and light installations all over the city, from public gardens to buildings, from blind alleys to the middle of houses. The great thing is that all citizens transform themselves into artists for that week, from the streets one can see windows and living rooms set up with various lights, candles, Christmas lights, and the most experienced place a projector from the window of the house and project on the front building (Figure 66).

Other references I found on the internet, such as various land art ideas, including digital ones. Others, finding myself in the right place at the right time, like in Fano, Italy, for Robert Henke's laser show called *Lumière III*. To sum up, then, I started from a primordial impulse, trying to put in order what I like, to get to articulate this impulse more and more until I found things that I did not know existed, I did not even know I could like so much.

Inspiration in this way increased more and more until I was able to give real form to all my ideas.

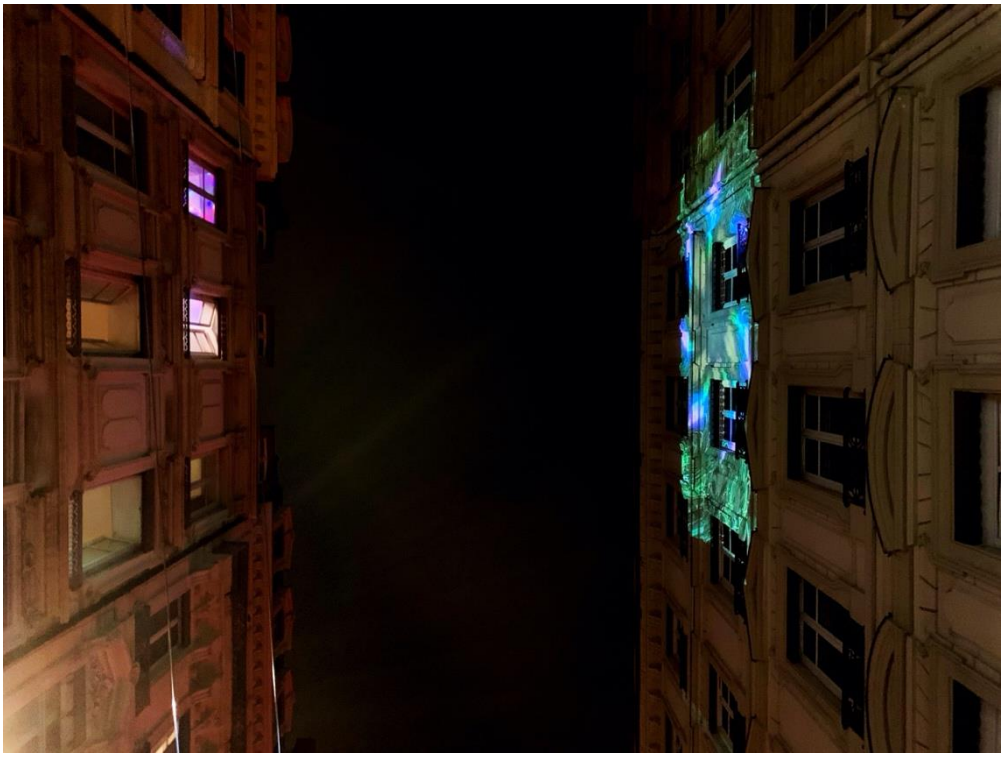


Figure 66. Projections among neighbors. During the Fête des Lumières in Lyon, people used projectors to make live visuals from the windows on the front building, 2019

3.1.2 Influences

In the following lines, some of the most inspiring works for this project and the reason why they have been inspiring.

3.1.2.1 Regarde

In December 2019, during the *Fête des Lumières* in Lyon, a huge percentage of the city park was occupied by the light installation called *Regarde*. Regarde was more than a video mapping show designed by Group F for the Parc de la Tête d'Or. Group F is an artistic studio specialized in open-air pyrotechnic shows and theatrical works. This show was directed by the artist Christophe Berthonneau, who is a pyrotechnics expert. Along with this latter, Regarde includes video mapping, special effects, dance, led-illuminated tightrope walkers, lights on trees, and a magical mixture of elements such as water, air, fire, and earth.

The first part of the show was centered on video mapping. On the surface of the lake within the park, there were a series of totem poles on which images about biodiversity were projected. The storytelling covered a kind of evolution of all the species projected that ended up disappearing over the power of fire. The end of the projection, indeed, was established through huge flames in front of the totems. While projection mapping was finishing, huge colored lights were illuminating a group of trees of the park. Suddenly, inside the trees, some dancing figures started to appear. Those figures were four or five humans who were climbing and dancing among the trees, completely dressed up in led suits. In this way, the bodies stood out in the dark, with their white led lighted suits (Figure 67).

This work was inspiring because the use of natural elements was really interesting. Nothing was harmed but instead, all the elements present in that park were used to give more value to the show. Totems could have been on the grass, but they were on the water, and this ensured that the images of the projections would be reflected on the water. In addition, the fire was in huge contrast with water, and again, thanks to this, people were sure that nothing wrong could happen, since the fire was in the middle of a lake. The only natural element which was touched by the show was the group of trees. Not by the colored and warm lights but by the men and women who climbed up the trees for the show. Those trees were illuminated and when the humans started to climb, they became dark, in order to give a sense of contrast. Even the use

Figure 67. Photo of the show Regarde by Group F at the Fête des Lumières in Lyon, 2019

of lights, in the end, resulted to be very respectful towards nature. This latter concept has been fundamental for the project thesis since the main goal was to use natural landscapes and elements but without hurting or damaging them.

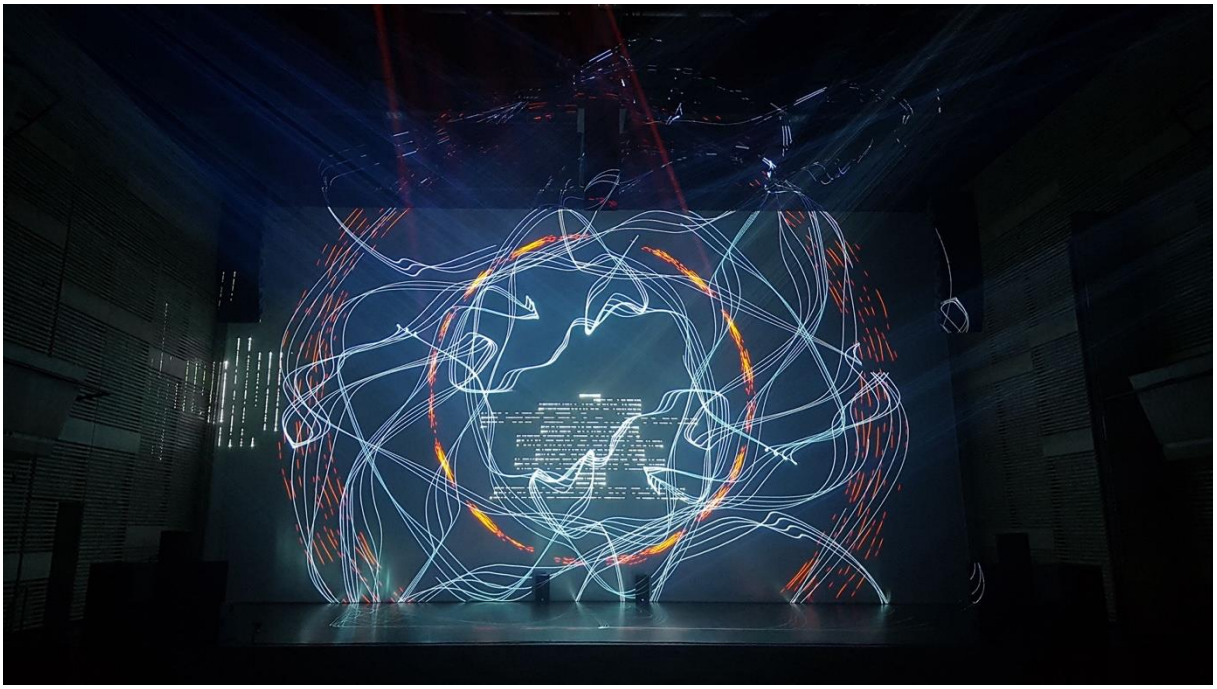
3.1.2.2 Lumière III

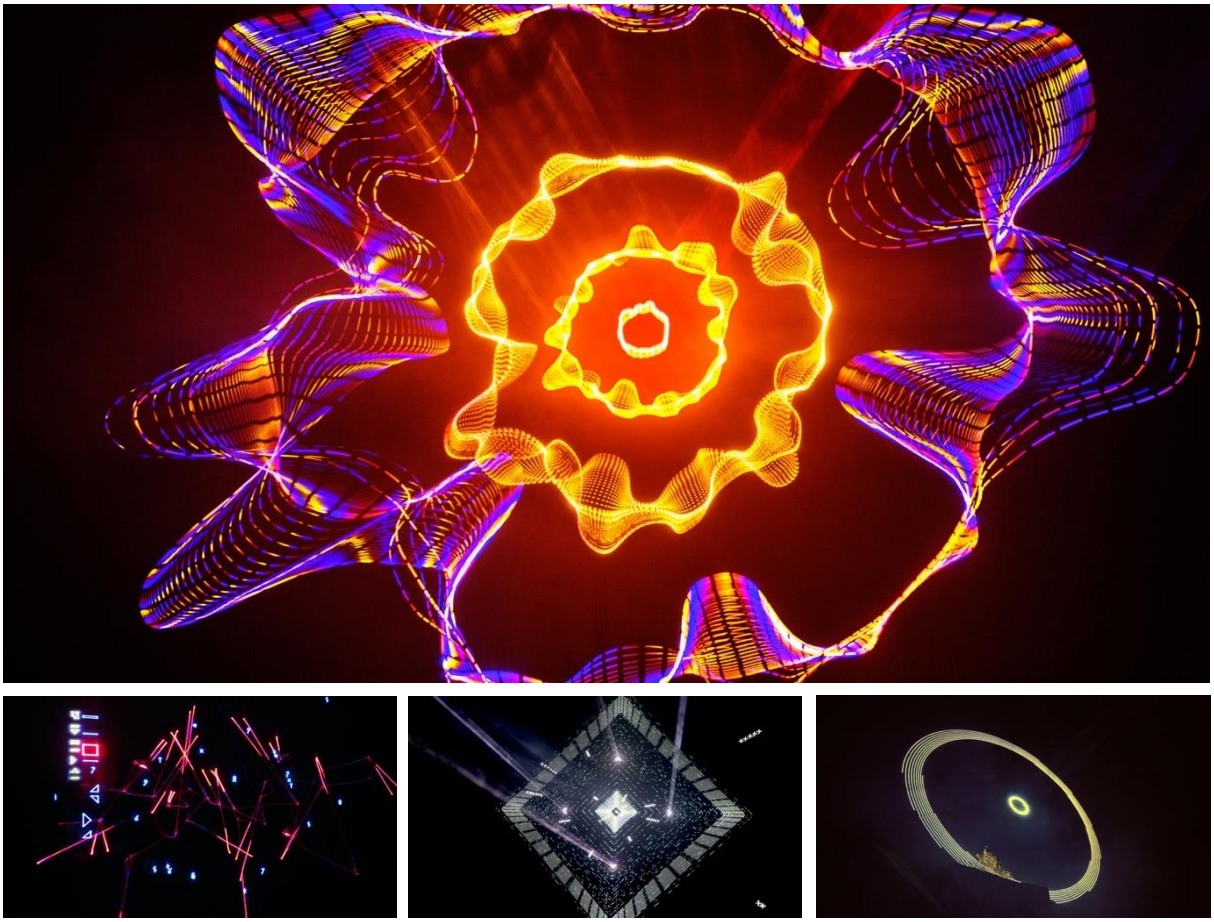
In July 2019, in the city of Fano (Ancona, Italy), Robert Henke was giving to the Italian public his show called *Lumière III*. As it is easy to understand, Lumière III is the third outcome of a show called Lumière I – at the beginning – and then Lumière II. Actually, the difference between the three concerns the power of the software that gives the commands and the use of lasers. Indeed, the series Lumière is the first laser-based live performance of the artist Robert Henke. It was the latter, among other things, who programmed the software itself to make Lumière but also many other shows. And he is known in the artistic field mainly as the programmer of another software, Ableton Live, one of the most versatile and used music production software.

Lumière III is the best outcome of the Lumière series and is on since 2017. The topic of the show, which is sometimes defined as a concert, is to explore "the artistic dialogue between high precision lasers and percussive sounds" (Henke, 2017). Basically, the software permits

the generation of a rapid succession of visual shapes made by the fast movement of lasers in time with sound. It is an audio-reactive tool at the next level. A characteristic of the show is the total darkness of the location: before starting, the public is even asked to not take pictures and switch their mobile phones off to not disturb the show. Lasers are in high contrast with the rest of the darkness, and the interesting fact is that they do not need a surface to be seen. Or better explained, there is always a surface but there is no need that that surface has a specific structure or shape. Lasers in Lumière take the easiest shapes known, such as circles, lines, triangles, dots, or squares, and those are very adaptable to each surface. Moreover, this is the other recommendation at the beginning of the performance: what people watch is just geometric shapes, it is inside the mind of those people that the magic happens and everything it is possible to be seen.

It is during this show that the love for audio-reactive visuals was born. As already stated, this performance is on another level of the audio-reactive but, in any case, the simple fact that a line or a circle could appear thanks to a beat of a music track became to be amazing. And it still is. Lumière III's performance was inspiring because of the compromise that it can reach between the show itself and the audience. Making people leave their mobiles and just watch it is currently impossible in most cases. If sitting in the balcony of the theater, during the show it is possible to see not just lasers, but even this total darkness surrounding everything. Incredibly, an audiovisual performance can make an orchestra of people forget what there is outside that theater. It is a feeling never experienced before. It is something that only pure art can fulfill.





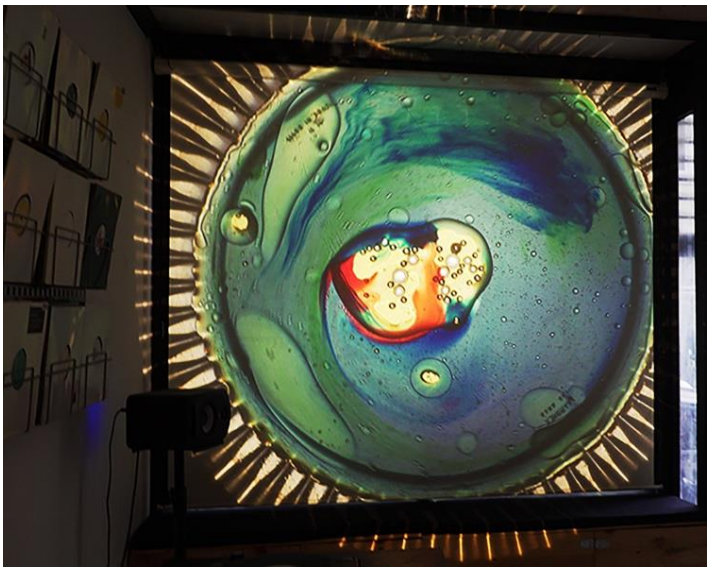
Figures 68. Official shots from the show Lumière III by Henke

3.1.2.3 Liquid visuals

In September 2018, at one electronic party in Lisbon, there was a guy doing visuals on the outside wall of a building in front of the party. The wall was huge and the projection on it consisted of colored bubbles floating through space. The man who was emitting those visuals was standing in a corner of the dancefloor with all his equipment. The equipment, in this case, was not a computer and a projector, but something totally different. He was working with an overhead projector, a glass bowl filled with water, and a series of tools and oil colors. Watching and analyzing how he was working; it was easy to understand that the projector was reflecting what he was doing into the bowl. Two years later, the same man, who is Portuguese, and he is called VJ Uliarud, was presenting his works at Inversus Studios, at VJ Anonymous's collective headquarter. Over there, many artists and VJs came to present their works and he came with all the necessary to perform. The amazing part was that he simply explained that he plays with oils and water, and sometimes even with other materials such as leaves or webs, and he makes them move and float within the space of the bowl with some tools. Those tools are nothing

more than straws, forks, little kitchen tools, or clay tools. The result was incredible. From a very simple thing, he is able to create astonishing visuals and effects.

The inspiration, here, is about the fact that marvelous things can be done in the easiest way. Surely, an overhead projector, a couple of glass bowls, oil colors, materials, and tools are way more effort and organization demanding to be carried around than a computer. But in total, the whole show orbits around one of the simplest elements: the water. It is possible, then, to create something extraordinary with something really easy. That is, in conclusion, the concept less is more, completely applied to visuals.



Figures 69. VJ Uliarud performing live with liquids at Inversus Studios in Lisbon, 2019

3.1.2.4 Nature-based projection

In July 2016, at the island of São Miguel in the Azores (Portugal), like every other summer, there was Walk&Talk Festival. In Portuguese called *Anda&Fala*, it is a festival of contemporary arts where artists from all over the world are performing and exposing their works. In that year, VJ Suave was called to participate in the art residency. In reality, VJ Suave is not a single person but instead a duo of Brazilian artists – Ygor Marotta and Ceci Soloaga – who do video mapping and other kinds of performances. To do some special video mapping shows, they took advantage of the beauty of the local nature of Azores and decided to project on them their animations. They usually project onto buildings or streets, so that they transported their animation from the streets to forests, cliffs, and shores. They used stop motion techniques to merge all the images and make them move, then they recorded for nights and the result is a

series of moving images on natural surfaces. Considering the simplicity of VJ Suave's animations, it is possible to claim that nature helped a lot. Another time, though, the simplest images astonished the audience. It is not a matter of how complicated and structured a projection can be, but it is a matter of how people interact with it and how the artist intends to give his or her works to the public. For this reason, simplicity is again one of the inspirations, as VJ Uliarud.

Moreover, but this time different from liquid analogic visuals, is that this simplicity can be projected everywhere. Surely, animations or outcomes have to be changed in order to fit in different and irregular surfaces, instead of walls and buildings. But the final result is that trees, cliffs, and waterfalls came alive for a night and brought those natural surfaces to be something completely different for a while.

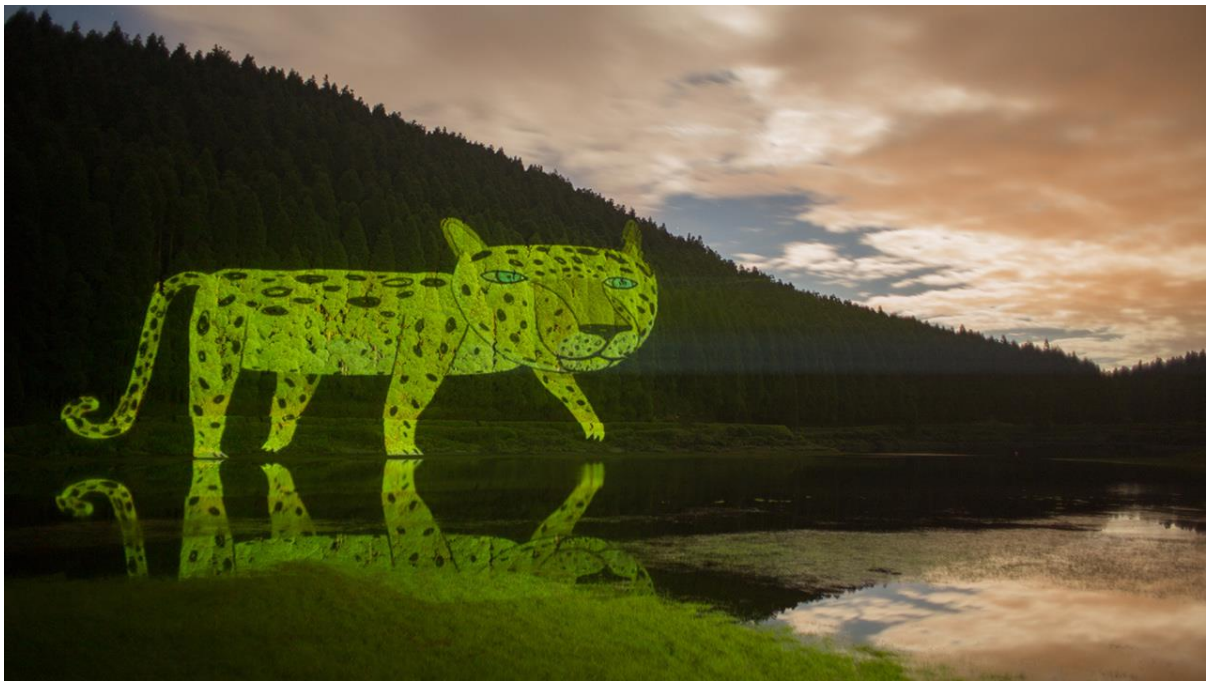


Figure 70. Projections on natural elements in Anda&Fala Festival in Açores by VJ Suave, 2016

3.1.2.5 Rainbow Roads

In the winter of 2018, in New England, US, Daniel Mercadante was inspired by cold winter evenings and forests to experiments with lights. In this particular case, Daniel Mercadante has nothing to do with video mapping or visual content, but he is a filmmaker and artist. His project consists of creating roads made of rainbow lights throughout the forests or any other place. *Rainbow Roads*, which is the name of the installations, are created thanks to a device that was built by Mercadante himself. He uses this device with colored lights attached to it and runs into

forests to create Rainbow Roads. Actually, those roads can be visible only through long exposure photography, with a time of exposition between 30 seconds to 2 minutes for each shot. The result is magnificent, it seems to look at a real path made of a rainbow. One could imagine how beautiful it would be if it was real.

Mercadante is inspiring in this field because his works are the right example of land art applied to digital art. Or better, digital art applied to land art. Or better again, digital land art. Land art, indeed, is an art movement that utilizes natural elements to create pieces of art. In the beginning, rocks, woods, or other materials were used to create art that was eco-friendly but mostly at zero impact on the planet (Figures 71 and 72). Recently, as seen with Mercadante, digital art merged with land art in order to create another level of land art. Nothing is ruined, moved, or changed, but rather is illuminated, transformed for a little time, and then left as it was found. This is the beauty of land art and simply art able to interact with natural landscapes /Figure 73).

This latter, along with the reasons and considerations above mentioned, represents the main inspirations for the final project *Rendering the Reality*. They can be summarized as respect for nature, the ability to use less technology, to keep it simple, to make the audience speechless, and to mix nature and art in the best way possible. Those are the starting point of what will follow in the next pages.

Figure 71. Spiral Jetty, one of the first outcomes of land art made by Robert Smithson in 1970, in Great Salt Lake, US

Figure 72. Example of land art in Arte Sella, Italy

Figure 73. One of the Rainbow Roads created by Mercadante

Part 4

PROJECT

4.1 PROJECTION MAPPING ON A MOUNTAIN'S CLIFF FACE FOR MUSIC FESTIVAL

Briefing, contest and location

I have nature and art and poetry,
and if that is not enough, what is enough?
Vincent Van Gogh

4.1.1 Trekking & Techno

Trekking & Techno is the outcome of months of research about what could merge festivals of lights, music festivals, and events in nature. At the beginning of this journey, the idea was very flimsy but over the course of time, it has become more and more solid and accurate till now. The project of the festival itself is still in progress, and every time and every new experience can help to improve. The process is still long and hard, but so far there is a written project of a festival to realize. A project that will be explained in the following lines, and which is still in evolution.

4.1.1.1 Grounding of the festival

Trekking & Techno is a music festival, but it is also an art festival, and a way to be surrounded by nature. All together. Organizers have united what they most love to do in their lives and have created a festival in the forest. Making music, making art, having fun with friends, walking, and camping in the woods, they focused on what they like, intending to involve a large number of people who, like them, love these things.

The festival has *trekking* in its name, and trekking is one of the fundamental parts. For this reason, one of the goals is to become a traveling festival. Over Italy, but also Europe, and perhaps over the world. They are intended to start from the place they know best: the Apennines of Romagna. It is precisely here that all treks start, and also end. It is a cycle, a journey, which gives new experiences each time. Staying away from home for two days, sometimes sleeping

in camps, sometimes in a comfortable refuge. And then going home exhausted and regenerated: two days to be reborn.

The festival lasts two days. It starts with walking and ends with partying, all together. All at the same rhythm and everyone at his or her rhythm. This is what unites people, being different but being so similar. After the trek, there will be the music on, on the first day techno, on the second day rock music.

This is the summary of the first part of the official project of Trekking & Techno. The aim here is to explain in few words what the festival consists in. To better understand the context, the project will be explained in more details. Trekking & Techno is a 2-days festival in the middle of the forest. Day 1 starts in the morning when all the participants arrive at the festival area. That is also the area where the campsite will be placed, along with facilities and restrooms. In the same festival area will be placed: campsite, the stage, food and beverage, and relax area with creativity zone. After having set the camp, participants will leave for a loop trekking starting from and ending back at festival area. There will be three different hiking paths, each a bit different from the others, and – most important – each will have a theme. In each path, there will be a rest stop in the middle to have a break with snack and a little show, different for each theme. Ideally, hikes will last till around 7 p.m. and from that time, deejays and bands will start playing music till late in the night. The day after will start with a rock alarm at around 7 a.m., indeed it will be called *Rock Break* – the rock breakfast. In any case, day 2 is to restore energies and minds, it will start with a rock alarm but there will be a relax and wellness area where massages by experts and yoga class will have place. In addition, there will be a creativity area where pieces of art will be exposed but it will be also possible to create art thanks to various workshops. There will be a lunch for who wants to stay, and after lunch everything will end.

4.1.1.2 Concept and ambition

Trekking & Techno arises from the need to bring together some passions, common to many people.

Spending time in the forest, under the trees, among the greenery. It helps to forget the hustle and bustle of everyday life, phone calls, commitments, traffic, or stress. The forest allows

people to forget the time that passes, everything is stable, even if the wind blows, or a wild animal passes by.

Walking alone, at the preferable speed. Staying in the forest gives time to stop and think, or even stop thinking completely. Staying in the forest is having the ability to stay in perfect balance between all the comforts people are used to, all the needs they think they can have, and the complete elimination of all this. In this way, everything is turned into a well-being atmosphere that only Mother Nature can provide.

Fatigue, sweat, pain in the feet: everything is forgotten in a simple moment. For example, when stopping to rest and breathe the fresh mountain air. Love for trekking comes from this, from all the well-being that such a simple and slow activity can give, which inevitably contrasts with the speed and problems of *real* life.

Art and music. They are the human products that come closest to the psychological dimension of the forest. With music and art, it is possible to forget everyday life. The secret, then, lies in trying to bring these elements into daily life. And more, to build daily life around these elements, to discover, to produce, to create, every day, something that makes one happy and proud to live on this planet.

Trekking & Techno was born from the need to create a *bubble of wonder*, where people can find refuge. And it wants to grow and become a habit, a different habit to never get used to. This is why it is important to keep in mind what to do to go on: changing, discovering, and adapting, in a cycle that repeats itself to bring Trekking & Techno to new and beautiful places.

The main goal of the festival is to re-establish the connection between humans and nature, without forgetting that the world is almost completely technological. This connection will not be completely linear, but circular where all the factors are intertwined and give rise to a sort of web consisting of human beings, nature, music, and art. The festival is called Trekking & Techno and contains the two main aspects on which it is based.

On the one hand, the word *trekking*, it comes from Afrikaans and was used to indicate long journeys made with oxen-pulled wagons (Vocabolario Treccani, 2020). Later, it began to be used to define long journeys in difficult conditions, such as walking on mountain trails and forests, with all the necessities to survive for several days on the shoulders. Currently, the term continues to indicate the latter meaning, different from *hiking*, trekking is a walk in the mountains with everything one need to camp along the way.

The term *techno*, on the other hand, derives from the Greek word *tekhnē*, which means "art, ability, craftsmanship, method, system; an art, a system or method to create or do something" (Online Etymology Dictionary, 2020). Later, it acquired the meaning of techniques and technologies. Moreover, techno is also a type of electronic music born in the late 1980s.

Trekking & Techno, therefore, merges different aspects, the most varied, and tries to create a web of connections that will allow people to re-establish the primordial connection between man and nature, from which the well-being of both derives. Walking in the midst of nature, music, art, and handcrafts.

4.1.1.3 Manifesto

Figure 74. Manifesto of Trekking & Techno festival

4.1.2 Location and surface

The main idea was to locate the festival into an area characterized by a green flat valley where to set the festival area, and a cliff face where to project a video mapping show during the festival. For this reason, a couple of locations have been analyzed before the right one was chosen. Places and cliffs were all located in Emilia-Romagna and were analyzed about the conformation of rocks and the possibility to locate a festival venue nearby. Pietrapazza valley and Monte Aquilone (literally translated as Kite Mountain) (Figure 75) are stunning and beautiful, but they presented details not in compliance with what was needed. In particular, Pietrapazza valley presents lots of ravines and green areas but those ravines are too enclosed by vegetation, for this reason, it resulted not possible to use this area for the projection mapping. Concerning Monte Aquilone, the cliff of that mountain is beautiful and really steep, indeed it is usually used for climbing. Sadly, there is no green area in the surroundings, but instead, the little village of Perticara rises at the foot of the mountain. For those reasons both of the places resulted not ideal for Trekking & Techno, but another place was found in another valley, not far from Pietrapazza (Figures 76 and 77).

Trekking & Techno will be held there, in a little town on the border between Emilia-Romagna and Tuscany. Bagno di Romagna lies on the Apennines of north-central Italy, and part of its territory is inside the magnificent National Park of Casentinesi Forests, Monte Falterona, and Campigna.

In the heart of the Tuscan-Romagna Apennine, Bagno di Romagna is exactly the border town between Tuscany and Emilia-Romagna. It has always been on a border position, belonging to

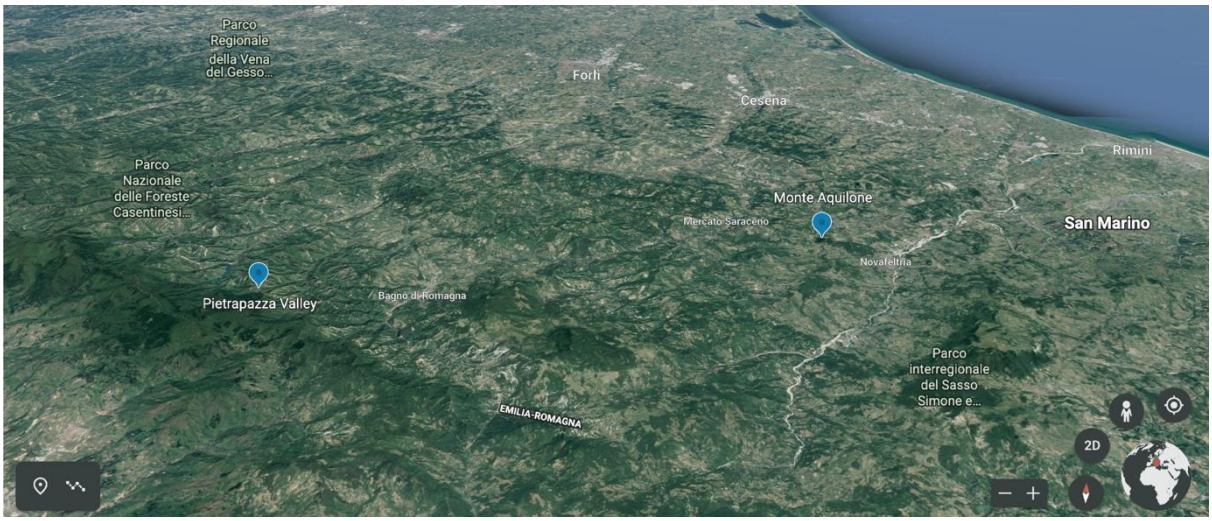


Figure 75. Location of Pietrapazza and Monte Aquilone in Italy, via Google Earth

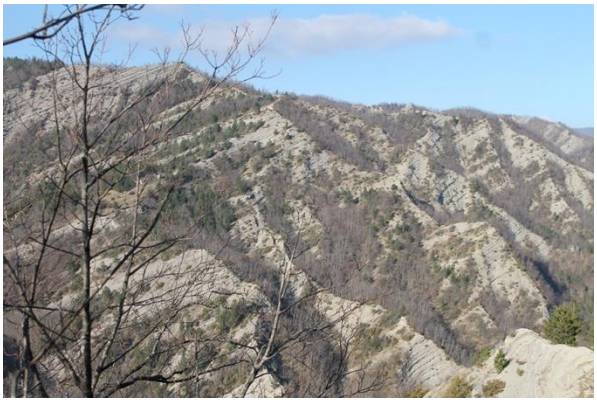


Figure 76. View of Pietrapazza ravines during the inspection in January 2020

Figure 77. View of Monte Aquilone during the inspection in January 2020

Tuscany and just after 1923 to Emilia-Romagna, which has meant that the population acquired the language, traditions, and urban planning typical of the Tuscan culture. The municipality covers an area of 233 km², and rises from 400 meters above sea level up to 1600, on Monte Penna. Much of the territory of this locality is part of the National Park, including the Integrated Reserve of Sasso Fratino or the dam of Ridracoli. The Forests are home to several km of trails for both trekking and mountain biking, but also horse riding. But here, in addition to sports, one can have the opportunity to relax in natural thermal waters or enjoy some typical food.

Divided between Tuscany and Romagna, the National Park of Casentinesi Forests covers an area of 36 thousand hectares along the Tuscan-Romagna Apennine ridge. This is the area where two of the most important rivers of Italy have origin: Arno and Tiber, which respectively give birth to Florence and Rome. The landscape of this area is characterized by sedimentary rocks, mainly sandstone interlaced with marls. This peculiarity is more frequent on the Romagna side where it appears as stratified slopes or bare ridges. These characteristics are exactly the ones of our surface for projection.

Moreover, the National Park of Casentinesi Forests is one of the most prized forest areas in Europe, homeland to the Integral Nature Reserve of Sasso Fratino since 1959 (still inside Bagno di Romagna). It is rich in flora and fauna and it boasts a wolf population in the northern Apennines. This wonderful natural setting is also rich in historic, artistic, and architectural heritage. The park has always been inhabited by mankind, up to an important exodus that took place after the Second World War, which left traces through ruins and abandoned villages. Currently, all these elements can be visited along about 600 km of paths that can be traveled on foot, on horseback, or by mountain bike.

As the poet Dino Campana wrote:

> *"Here are the rocks, layers over layers, monuments of solitary tenacity that comfort the hearts of men." (from Canti Orfici. Parco Nazionale Foreste Casentinesi, 2021)*

The territory of National Park is characterized by a homogeneous geological structure, called marly-arenaceous formation, on the Romagna side. At the end of the millennium, a census of Park's sites was carried out, and this led to the identification of 86 sites in the whole Emilia-Romagna region. 60 of those 86 are located inside National Park's boundaries. In particular, two sites have been selected as the location of Trekking & Techno. One of them is where people will be, the place hikers will reach while enjoying the mapping show. The other one is exactly where the projection will take place. Nasseto is the first one, Le Scalacce is the second one.

4.1.2.1 Nasseto

One of the most popular hiking trails in Bagno di Romagna is the *Gualchiere Ring*. The trail is marked by CAI (Club Alpino Italiano) with numbers 177 and 181, during the Middle Age, it was a pilgrim route from northern Europe to Rome, crossing the Apennines – better known as *Via Romea di Stade*. Parking the car, a couple of meters away from the little village of Gualchiere (520 meters a.s.l.), the hiker starts walking on no. 177 trail crossing two rivers till the spot where a mule track begins. This mule track "once paved and for the entire Eighteen century the only connection between this part of Romagna and Tuscany – climbs through sparse low vegetation making use of natural steps on the layers of marl and sandstone" (Bagno di Romagna turismo, 2021). After almost 3 km of climbing up, the mule track levels out into Nasseto Plateau (899 meters a.s.l.).

> *"Medieval pilgrims on their way to Rome who traveled "Strada dell' Alpe Serra" (Serra Alps road), were amazed when they found themselves before the undulating Nasseto grassland, a green oasis on the hillside of a desolate arid slop known in remote times as "Biancheria di Romagna" because the layers of marly sandstone made it a ghostly white." (Bagno di Romagna turismo, 2021)*

Currently, modern traveler is less amazed because the mule track passes through luxuriant vegetation in many points. Up there, however, Nasseto farm is documented since the 15th century, later abandoned during the 1970s, now is turned into ruins except a small section which has been turned into an open bivouac. The shelter along with the farm, a fire pit, and a lawn where it is possible to light up a fireplace is enclosed by a perimeter of barb wire. This place is perfect to spend the night while hiking, even because there is a source of water not far from there.

From this plateau, but even from some spots along the mule track, it is possible to admire the outcrop of Le Scalacce in its entire magnificence. Here participants of the festival will lie, sit, and watch the video mapping show.

Further on, trail no. 177 continues toward the Serra Pass on the Apennine ridge, between Romagna and Tuscany. To close the Gualchiere ring, instead, hikers have to take trail no. 181, which brings them to the left and back to the starting point after another 4 km.

4.1.2.2 Le Scalacce

Le Scalacce is an outcrop on the SP 142 road, which is the connection between Bagno di Romagna and Mandrioli Pass. This road brings people to Tuscany, indeed at the top of the pass, 1178 meters above sea level, there is the border dividing Emilia-Romagna and Tuscany. The road was built between the 70s and 80s and nowadays it presents a variety of scenarios while driving. On Romagna's side, it climbs up for 11 km “along a road carved into steep rocky slopes, which unfolds smoothly over twenty-seven hairpin bends and short straight sections” (Bagno di Romagna turismo, 2021).

The landscape on this side is terrible and fascinating at the same time, where rocky outcrops and deep ravines are layered with sandstone and marl in literally horizontal steps. This is the reason why the selected spot is called Le Scalacce, which literally means rough steps.

Geologically speaking, this area is the whole marly sandstone formation of Romagnolo Apennine. On the one hand, sandstone is a sedimentary rock composed of sand grains but not carbonic ones. On the other hand, marl is a clastic sedimentary rock (originated from fragments) consisting of a carbonic part and a part of clay. Percentage of carbon amount and clay can change and modify the final product. As the percentage of limestone increases, clay

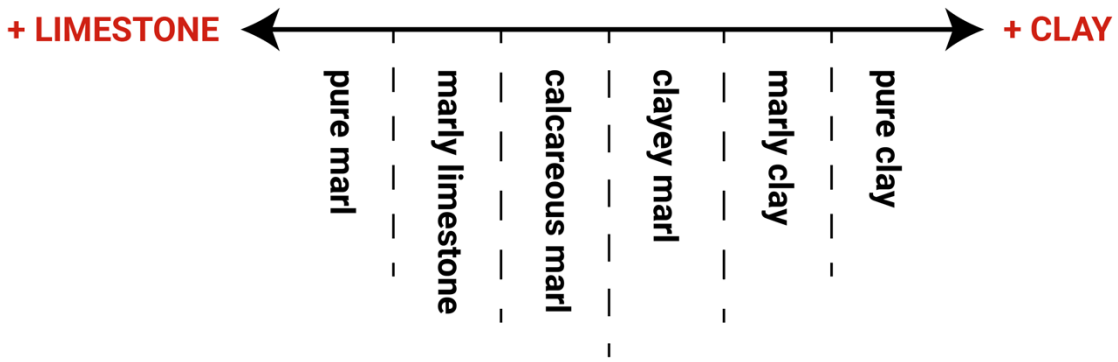


Figure 78. Diagram of rock composition due to amount of clay or limestone

decreases in amount. Consequently, the resulting rocks can be pure limestone, marly limestone, calcareous marl, clayey marl, marly clay, or pure clay (Figure 78).

Layers of marl and sandstone, here, settled in deep ocean floors during the Miocene, from 23 to 5 million years ago. Miocene is the geological era in which many of the marine transgressions and mountain formations present in Italy occurred. During the Miocene, however, the raising process of Apennine was already in the making but it has not emerged yet. For this reason, sedimentation had been characterized by violent underwater currents, better known as turbidity currents. Those currents were able to move a huge amount of sandy and clayey debris. Due to turbidity current, layers still visible today were formed: on the base, the sandy and rough debris form the sandstone, whereas, on the top, thinner debris create the marl layer.

In addition, it is interesting to remark that most of the debris was coming from alpine rocks, that were already emerged mountains at the time of the Miocene. Mountains with rivers that brought debris into the oceans where the Apennine were submerged.

Le Scalacce is characterized by the regular geometry of its flat and parallel stratification. Rocks' erosion, also, shows the endurance of sandstone layers, which are more protruding than marl. The name Scalacce comes exactly from the sandstone's protrusion. In conclusion, the outcrop of Le Scalacce is crossed by a tree-covered furrow. This fissure was formed due to the detachment towards the valley of a part of Le Scalacce. The block landslide in question is a slow and continuous movement of lots of cubic meters of rocks sliding on the weaker layer, sandstone ones, in this case.

Considering the magnificence of this outcrop, and its verticality in many points, it has been chosen as the surface for the projection.

4.2 UPHILL STRUGGLE TO THE WONDER

Methodology for the production of a video mapping show

In order for the light to shine so brightly,
the darkness must be present.
Francis Bacon

In this context, all the steps and attempts to conclude this project will be presented. The main aim of this work was to develop and to prototype a video mapping show in the context of a music festival. Since the festival has been described in the previous chapter, here all the process to produce a projection mapping will be taken into consideration. Starting from the analysis of the environment that was chosen and related constraints due to the difficult positioning of the cliff. It will be shown how a 3D model of the cliff was produced. This latter was fabricated to obtain a scaled model more easily to use to try the projection. The process of mapping this model will be also identified, keeping in mind that if the scaled model perfectly matches with the real surface, the mapping will be only enlarged to fit on. Moreover, all the processes and the production of the visual content itself, which can be considered the most important to the public, will be analyzed in all its parts. In the end, the final results will be shown and discussed.

4.2.1 Analysis of the environment and constraints

The first time the place was analyzed in January 2020, the team went there and produced a series of photos from the street (Figures 79). It was a winter afternoon on a sunny day. There was no vegetation and the cliff appeared completely clean. The inspection was made in order to understand the context, how vertical is the cliff, how the projection can be set, and where the projectors can be placed. On that occasion, photos were taken from the ground with a reflex camera. From the ground, the distortion was at a good level, but it has been worthy to try to work on such materials in any case.

Another inspection on the place was made in June 2020. In June the situation was totally different from January, it was summertime, and vegetation was luxuriant. On that afternoon,

Figures 79. View of Le Scalacce from the ground during the first inspection in January 2020

the sky was cloudy, and pictures came out with no shadows on the cliff. The real upgrade of that second inspection was the drone DJI Mavic Mini to shoot from different angles and most of all from a perpendicular point of view of the cliff. It has been analyzed that, over there, there is no spot to place projectors. The only way to set the equipment is to set projectors at the border of the street, pointing towards up to the cliff and distorting the image in order to cover as much space as possible.

In addition to that, the team has noticed that the whole cliff is suitable to be projected since it is concave and really vertical. By the way, the most interesting point is the most on the right – being in front of the cliff. This right part is shaped by interesting triangles and curves which can be really inspiring for the show (Figure 80). In addition, this is the part where the old house is placed, which can be really useful to set equipment and projectors. The cliff examined has been divided into three main parts, in order to understand which could fit the best for video mapping. Parts have been defined following the curves and the conformation of rocks, not

Figure 80. Aerial view of Le Scalacce during the inspection in May 2020

suddenly cut. This was decided in order to give the audience a better appearance of the show, even without recognizing that there is another piece of the cliff where the show could have happened. Considering that the public will stand on the other mountain to watch the show, this fits perfectly to have a more fluid appearance. Concerning this topic, moreover, the projection will be made considering part of the cliff and working on that part. The final result would be a seamless video mapping show on the mountain, without any limitation given by the real geometrical properties of the cliff face.

4.2.2 3D modeling and maquette

Apart from the final show itself, the process to develop a video mapping show is long and difficult. First of all, it was intended to create a 3D model of the mountain, in order to have a scaled model where to train and realize the show. The 3D model has resulted to be very usefully, in this way it was possible to have a scale model to map and to evaluate the entire final result.

4.2.2.1 Possible approaches: software and attempts

Building the 3D model of the mountain has been a real challenge.

First of all, with the exact location, the team went to City Hall's urbanistic office. Over there, they were asked for the land contours to have all the data to build the 3D. Along with it, the

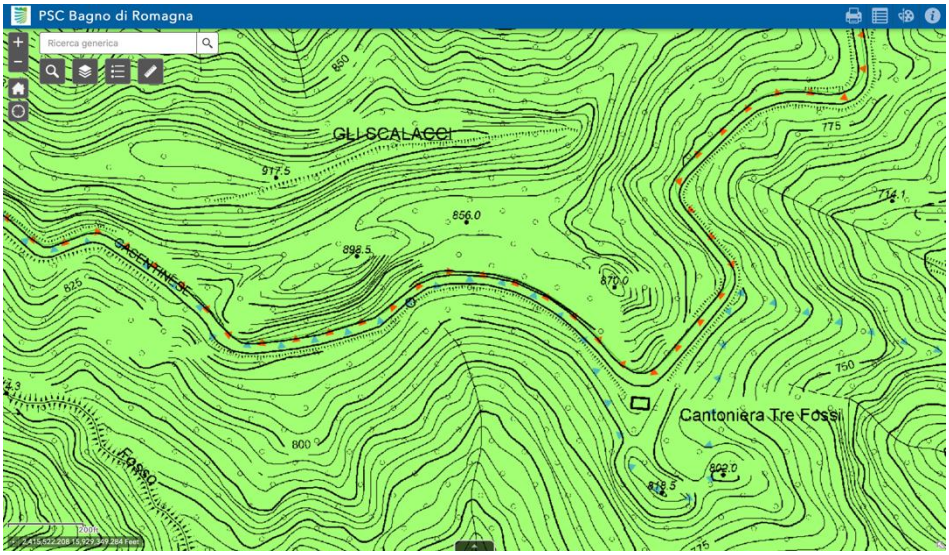


Figure 81. Land survey retrieved from the official website of Bagno di Romagna in which elevation of the area of Le Scalacce is displayed

vector graphics format of the piece of terrain was obtained to open with AutoCAD. No result was reached with those files because contours were too approximate. The result was that the software created the line of the mountain's slopes but did not consider the cliff. This happened because the selected cliff is very vertical, and contours cannot properly define the cliff shape (about 20 meters tall) by having a 5m step accuracy (Figure 81).

For this reason, another solution was tried. The second attempt was made using Blender and SketchUp. With Blender, it is possible to open a location directly from Google Earth and create the contours and the 3D automatically. Again, with the section of terrain comprehending Le Scalacce, it is not able to create the 3D because the system cannot read the verticality of the cliff. Not even with Sketchup, which has got an internal system to import location and create terrain into the software. This option is called *add location* and it opens a window where the user can find any location in the world and directly import into Sketchup a grid where the terrain will be created. It is very simple and fast to use the add location option in Sketchup but, again, with the defined area it did not work.

At this point, considering all the attempts that went wrong in building this 3D model. Side methods have been analyzed.

- Panorama with Photoshop

What was noticed was that it could be possible to create a panorama through Photoshop and have in this way the material needed, or at least a view of the cliff. To do this panorama, it was not possible to use photos from the ground, because they were too distorted since taken from the bottom. For this reason, the team went back to the location and took pictures with a drone. In this way, the pictures resulted taken from the front of the cliff, not distorted, and creating a panorama is very simple. Indeed, once took the right pics, they were uploaded on Photoshop through the *photo merge* option.

Figure 82. Panorama built with Photoshop using the aerial pictures taken during the inspection of May 2020

- Sloped surface with Sketchup

A surface following the trajectory of the road was drawn – that curve drawn by the road on which the rocky wall faces. This surface has been slightly inclined following the approximate average of the various slopes assumed by that part of the rock. Once done this, what it is got is the outline of the rock face, completely free of imperfections. The considerations regarding this work did not allow the team to continue the project with a simple smooth inclined surface since it absolutely does not reflect the reality of things.

- Sculpting with Blender

The last option was to sculpt directly the cliff. First, an attempt was made by attaching to the smooth surface some imperfections with sculpting brushes. Later, another idea was to sculpt from a sphere the entire rocky cliff. Everything was made with a total approximation of measurements and sizes, so it was confirmed once again that approximate 3D modeling was not the right method to follow.

4.2.2.2 Turning point and related constraints

And so… I – as Elisa Mariotti – spent more than five months in trying any option I got in my mind to realize the 3D model of this cliff. I could not reach the correct way and a final result. I spent hours and hours in front of my computer, in front of tutorials on *how to create a mountain in 3D* in every existing software. I also spent hours and hours asking myself why I did choose this subject, why projection mapping of a cliff face of a mountain. And I was not able to find a solution. At all.

But as all creatives know, inspiration does not come from the screen. Inspiration comes from the surroundings, from fresh air. It comes from a couple of beers with friends, from a night out when the last thing to think about is that problematic project. And so, it did.

I was at Quetzal bar with some friends, in reality, Quetzal bar is a kind of second home. It is where I go when I want to forget for a couple of hours what happened during the day. There, it is where I always find friends. So, it happened that on that night I talked with a friend of mine, Daniele, telling him that I could not find a way to build the maquette for my final project. We spent hours talking and, at the end he told me that he knew a method to build up a 3D model directly from drone pictures, and this method could be used even with large-scale objects, such as a mountain.

After this inspiring night – which I love to call the *turning point* – the following steps were to meet another person, who already used the aerial photogrammetry method to shape a statue and even a scaled model of a mountain. Photogrammetry works by scanning photographs of an object and making applicable measurements to create a scaled and realistic representation of the object in the issue. This person, Bruno, explained to me how to take pictures with my DJI Mavic Mini drone to start modeling.

The first constraint of this new method has been that the road where Le Scalacce is located was closed to traffic due to landslides, crumbling of the rocks, and the process of securing the whole passage. For this reason, it has been possible to go there just on Sundays or before 8.30 a.m.. I did it and after three or four tries I obtained all the pictures needed. Pictures were taken on October 17th between 7.30 and 8.10 a.m., at the exact time when the sun rises. For this reason, pictures were half with typical faint lights before dawn, and half illuminated by the sun. It could be considered the second constraint of this process: pictures should have been taken during a cloudy day, not windy, not foggy, not rainy. Just light clouds covering the light of the sun to avoid shadows on the rocks. This was not possible to reach, due to restricted possibilities to go there with the right weather, so that some of the basic parameters for best photogrammetry were not accomplished – weather, shooting time, size of subject or area, light, and shadows.

In any case, my teammate Bruno tried to use those pictures and uploaded them on Meshroom to create a 3D model. Meshroom is open-source and free software for Windows or Linux, it

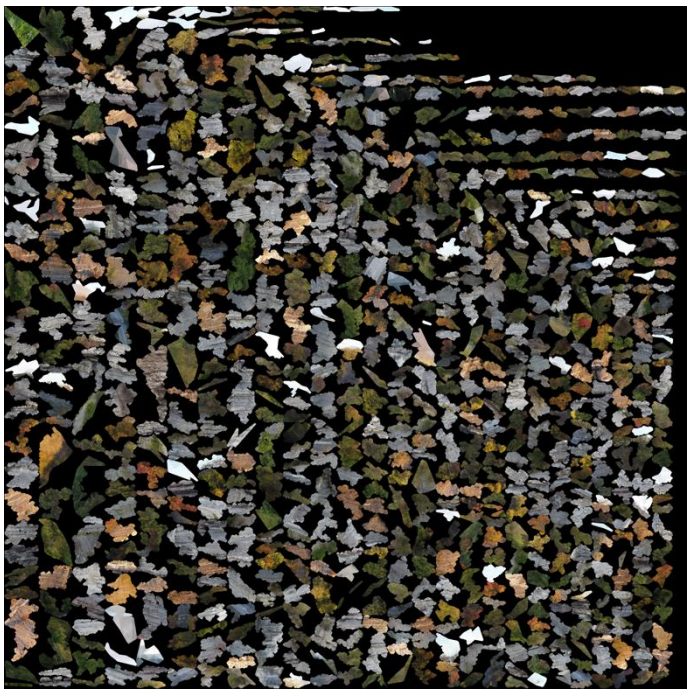
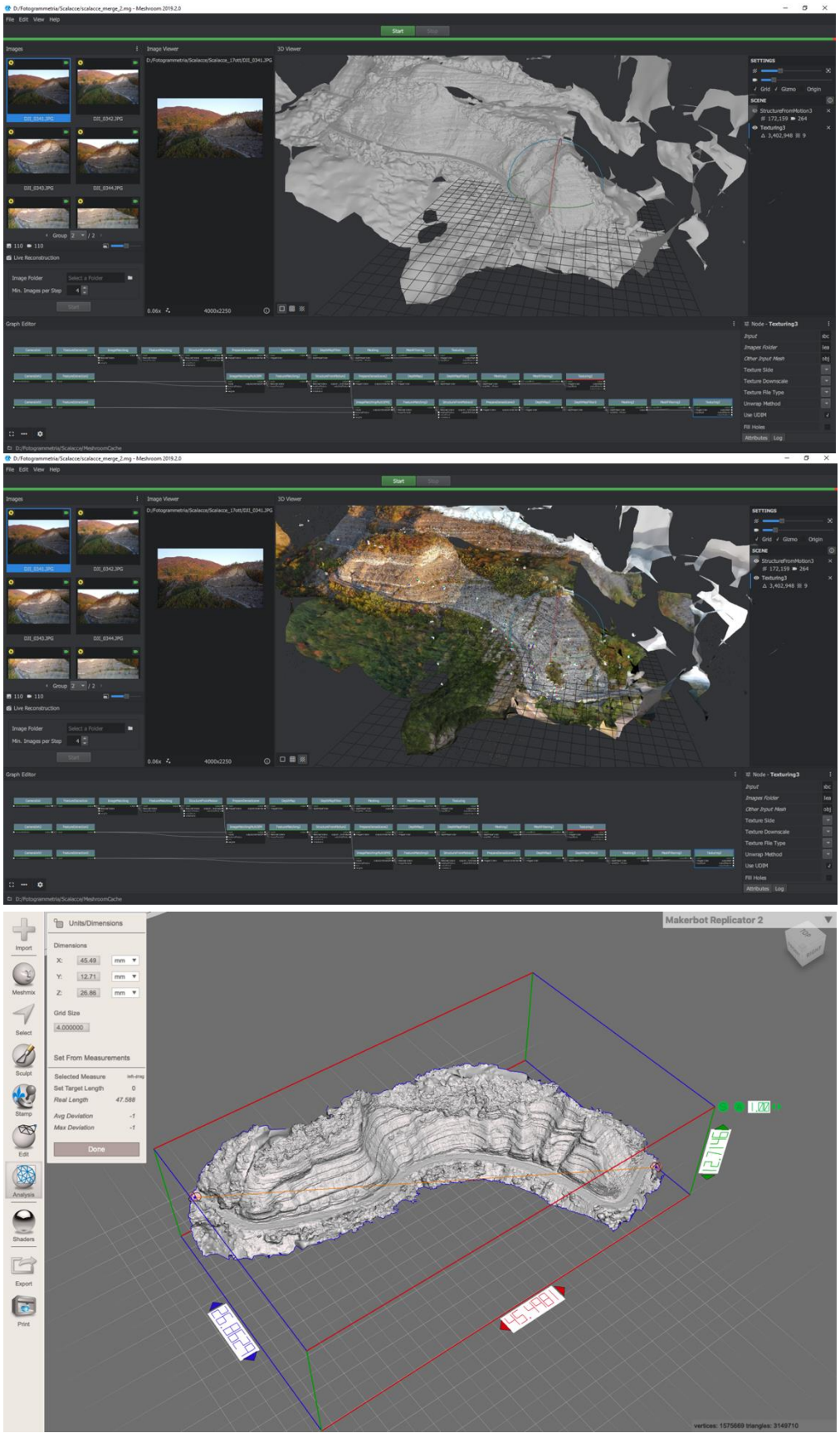


Figure 83. Pack of textures to fill the 3D model in Meshroom

works best with aerial pictures and close-range objects. No problems concerning aerial pictures, but Le Scalacce has nothing to do with close-range objects. To make Meshroom start working, it is just needed to drag and drop photographs from a folder into the software. Meshroom operates through nodes and it is quite simple to understand the whole process even if a person never saw before its interface. The process starts with the analysis of all the pictures and it automatically selects what is useless and what is useful for a 3D model. After having analyzed the images, Meshroom merges the images uploaded and builds up an entire scene matching various common points of all the pictures. Meanwhile, the software identifies also each location of the camera when the photo was taken. This latter process is called *structure from motion*, and it recreates the whole object positioning the camera for each shot. The result of this reconstruction is a set of calibrated cameras with a sparse point cloud. After that, the software begins to model the 3D through a dense reconstruction. It uses the cloud of the camera from the structure of motion to generate a dense geometric surface. As a final step, it textures the whole model, with pieces of pattern taken directly from the pictures. The pack of textures looks like a real jigsaw-puzzle to complete (Figure 83). As a final result, Meshroom's interface presents the various steps it followed below, the set of imported pictures whether if it used them or not, and the final result. It is possible to change the view of the final result to a textured one or having the model only with a white and clean shader (Figures 84).

Once Meshroom has made its job, it is possible to export an OBJ file to be opened with another software, Meshmixer, which is open-source software for working with triangle meshes and it is very simple and intuitive to use. Opening the 3D model with this software allows to clean all the useless vertexes of the mesh, deleting the parts not needed for the printing. Meshmixer simply permits to select with a brush tool all the parts and choose to delete or execute any other control. Once a sort of contour has been established, the following step is to smooth the mesh. The *sanding* process is mandatory to proceed with the extrusion. The team noticed that Meshmixer has no chance to extrude a mesh full of little triangles placed at different angles. For this reason, it has been preferred to lose the resolution of the model, to be able to extrude and create a base for the mountain. This base is necessary to realize the 3D printing because the mountain needs support on which to lie.



Figures 84. Screenshots of 3D model created in Meshroom, without texture and with texture (top)

Figure 85. Screenshot of Meshmixer with sizes of the 3D model imported from Meshroom and cleaned (bottom)

4.2.2.3 Maquette production

Once the model has finally a base to lie on, the first printed model was made. The first try was realized on a really small scale. The scaled model was made of a length of 15 cm and a height of 3.5 cm. The resolution was reduced to work faster on Meshmixer, and this showed no problems in the printing step. The little model seems to be perfect for what is needed.

However, the 3D printer has a plate of 30 x 30 cm. So that a bunch of calculations to obtain the optimized format have been made. As it is possible to see in (Figure 85), the sizes of the model are almost on a 1:2 format, but – most important – really short on the y-axes. In this image, sizes are:

- length 45 mm
- height 13 mm
- depth 27 mm

The first hypothesis to follow was to reach a good height to produce a model as big as it would be enough to project on it. Supposing a height of 40 cm, the following size would have been: length 143 cm and depth 85 cm. It resulted clear that a 1.5-meter-long 3D model was not possible to be made. A solution to this could be to divide the prototype into pieces in order to create a sort of jigsaw-puzzle to assemble once printed. But then the problem of having a model that big was also the weight and the portability of it. Indeed, even if the material is very light, a piece of more than 1 meter could weigh a lot and it would be transported only separated and reassembled every time needed. For this reason, the model was analyzed to eliminate the parts that could result out of the projection area. This part has been selected and deleted from the model, this process permitted to have a shorter model in length, and the format resulted handier.

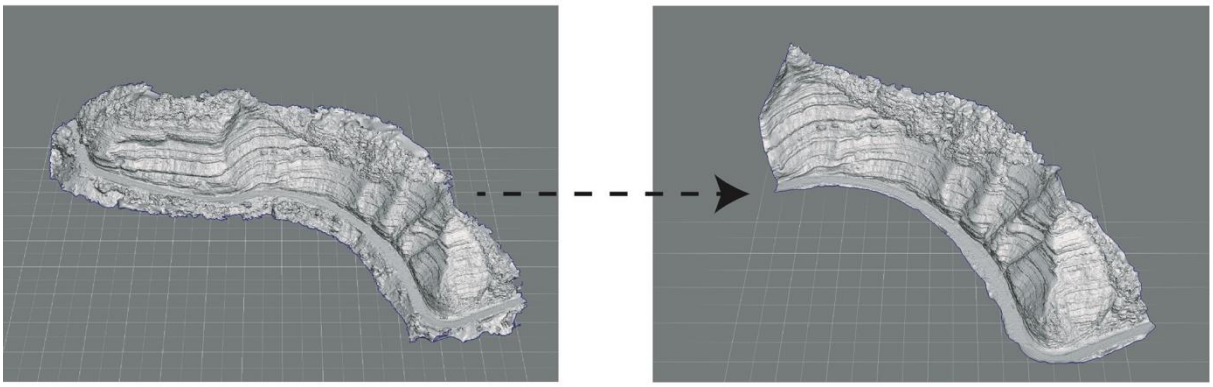


Figure 86. Process of cleaning the maquette into the final model to 3D print

Once obtained the cut of the model as wanted, which proportions are 1:1.25 (length:depth), now it is possible to scale the prototype to the right sizes, ready to be printed. The printing plate measures 30 x 30 cm so that the model must fit in it. To create a model with good size, in reality, it has been chosen to divide into two parts the model and print them separately. In this way, the final result would be about 60 cm long, 50 cm deep, and 20 cm high. This resulted to be the best option because the two pieces perfectly fit in the printing plate.

This division was made in Meshmixer. Firstly, the model has been scaled to the right size with command *units/dimensions*. After that, with *plane cut* the model has been split into two halves, which were almost the same size. At this point, two STL files were exported from Meshmixer. STL is a file format used for rapid prototyping, 3D printing, or computer-aided manufacturing. The acronym STL means Standard Triangle Language, indeed, this format approximates every 3D shape in several 2D triangles. It describes just the surface of a geometric shape, with no color, texture, or other parameters typical of CAD. The surface used for this project was particularly complex and for this reason, the conversion was very slow.

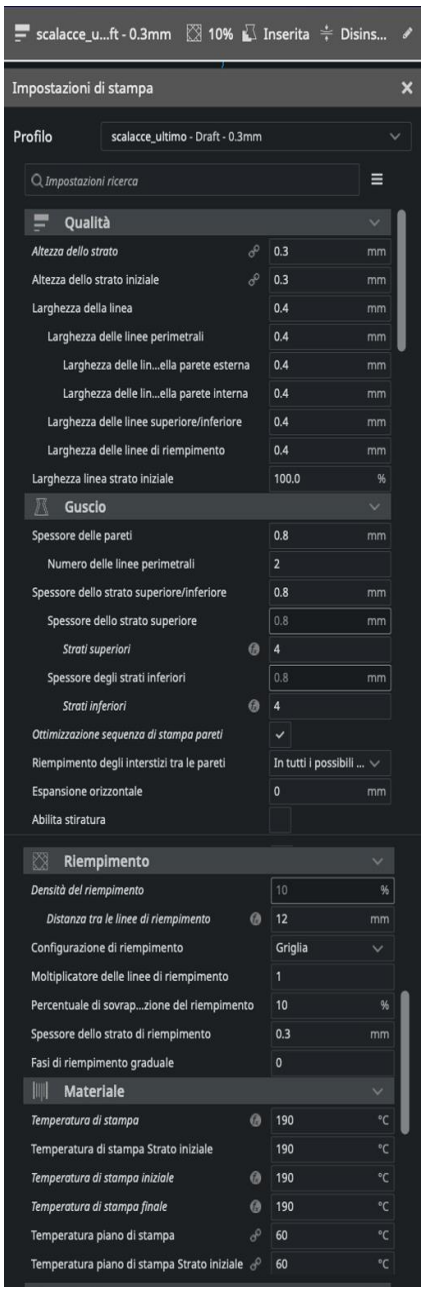


Figure 87. Parameters given to Ultimaker Cura for 3D printing (part 1)

After this process, the STL file was opened with Ultimaker Cura. Cura is a slicing software that converts a 3D model into specific instructions for the printer. This conversion is needed since the printer works transforming what people see as a 3D object into a series of 2D layers made by the fiber. This is possible since Cura produces G-code coordinates to make the printer work. The G-code sequences are automatically produced by Cura and are the information needed to tell the printer how to move the print nozzle in the exact points and ensure that the object comes out as displayed. 3D printers produce hundreds of layers one above the other to obtain the object as a final result. Besides, Cura software allows specifying manually some

important 3D printing parameters such as layers' height, printing speed, percentage of filling, printing temperature (Figures 87 and 88). Each of these modifies the final amount of time needed to print and the resolution of the object.

A 3D printer must get modified parameters depending on the complexity of the sample to print. On this occasion, the object is very complex, and it was necessary to establish some specific criteria.

As visible in the image, important parameters are:

- height of printed layer: 0,3 mm
- thickness of outer faces: 0,8 mm
- filling degree: 10%
- space among inner lines for filling with grid: 12 mm
- printing temperature: 190° C
- printing speed: 40 mm/s

As it can be observed, those parameters permit to obtain a very defined print as final result. Indeed, a layer measures 0,3 millimeters and this is a really small size, considering that the sample is almost 20 cm high. This means that the final prototype will have about 500 layers. Moreover, those parameters were decided considering the final amount of time the printer would need to print the entire model, and each piece outcome took more than a day to be printed.

After the set-up of the printer and all the printing guidelines in Cura, it is possible to launch Octoprint. Octoprint is an open-source program that is connected to a Raspberry and it simplifies a lot the use of a 3D printer. Indeed, with Octoprint it is possible to control and monitor very easily and, most of all, remotely, the printer before and while printing.

Figure 88. Parameters given to Ultimaker Cura for 3D printing (part 2)

At this point, the printing process could be initiated. Once on, the 3D printer needs to get to the given temperature, and it takes a dozen minutes to reach 190°. At this stage, it sets up itself, and then it is ready. Here the process took a bit longer than how estimated before by Cura, indeed it took 25 hours instead of 21. This was caused by the fact that at the beginning the printer was slower because layers are thicker and larger to make. After the process was done, it was possible to print the second piece, which took about the same amount of time. With Octoprint it is possible to use a plugin called Octolapse, which allows creating a time-lapse video of the printer working and the development of the printing. Octolapse plugin needs a camera to be set up in a selected position by the user, once the camera is connected to Octolapse, the software gives specific rules to the printer to move away every time a layer is complete. In this way, the nozzle moves in a corner for two seconds and the plugin shoots the photo. Once finished, Octolapse produced itself a video made of each photo. It is possible to see some pictures of the process and the final result in the following collage.

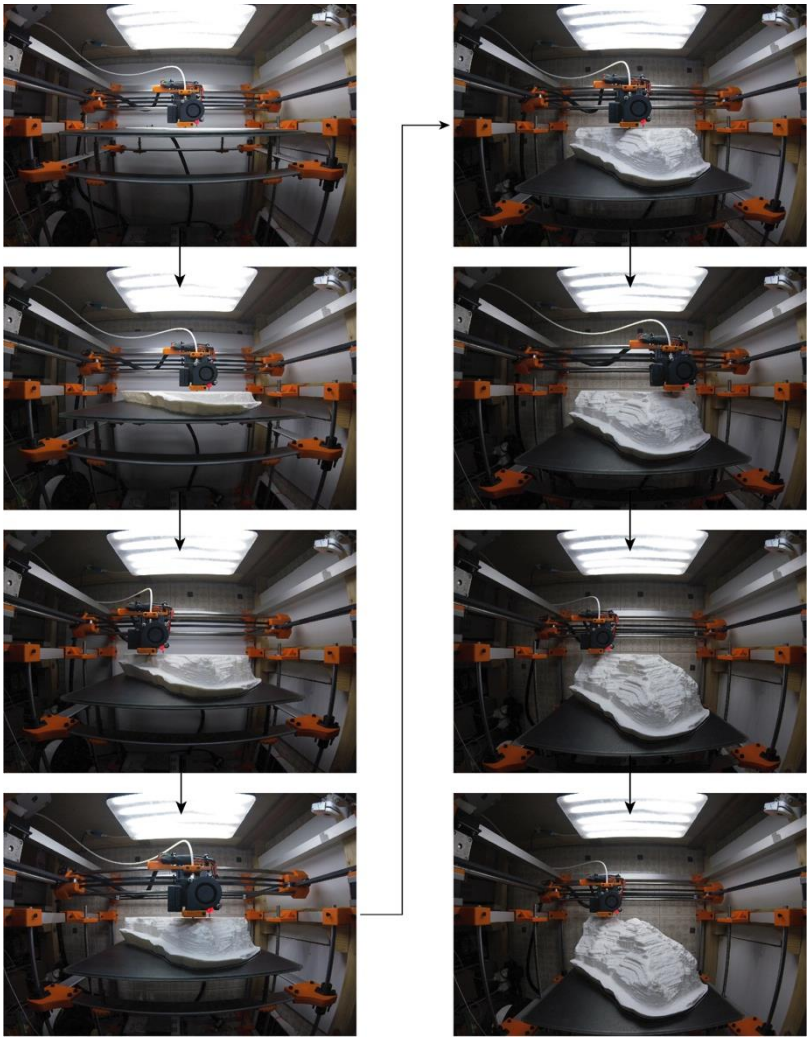


Figure 89. Collage of the 3D printing process of the first piece of the maquette

4.2.3 Projection mapping

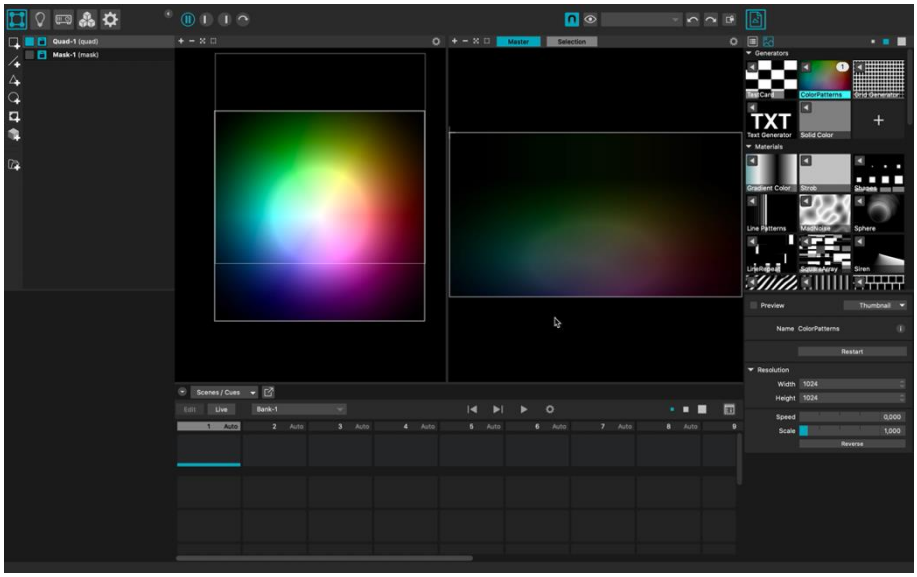
Once the model was made, the following step was to map it. The mapping process is fundamental to video mapping, as it is easily understandable. To do so, one must have a projector and specific software.

The projector used for this project it is a mini projector APEMAN LC450. This projector has a resolution of 1080 px and a ratio of 3000:0 contrast. These parameters are really important since they imply and determine the outcome of the final image that will be watched by the public. In this particular case, those restricted parameters have been enough to accomplish the goal. But, of course, in reality, to project on a cliff face of a mountain, those parameters – along with others – should have been completely different.

Once positioned the projector in a point in the room, it has to be connected to the computer to start working. To do so, a specific software aimed to do video mapping has been rented online for a month, Mad Mapper. This latter is a really user-friendly tool useful for video and led mapping. The interface of Mad Mapper is very easy and well done, it is intuitive even for a first-experience user.

A consistent portion of the user interface is dedicated to the masking process, where it is possible to see the content itself (on the left side) and how it appears on the mapped object (on the right side). Below this main section, there is a grid of spaces where it is possible to create and archive contents for the projection. Those contents can be selected, edited, and added in Mad Mapper through the right column which occupies the screen. In that column, it is possible to select default content such as grid, rainbow, waving clouds, or noises, but it is also possible to add videos or other content to be played. Elements are divided into groups to keep everything in order, and a group is dedicated to live contents – which result particularly important during the latest steps of the project. Lastly, the left side of the interface is occupied by the management of masks. Indeed, that is the part where it is possible to select which kind of masks the user wants to create and how he or she wants to use them.

Once understood the functioning of the software, it is just needed to select the projector and to set the projection to be seen outside the interface. This allows to have a complete view of what is projected on the object to be mapped and, simultaneously, to modify and manage masks and output.



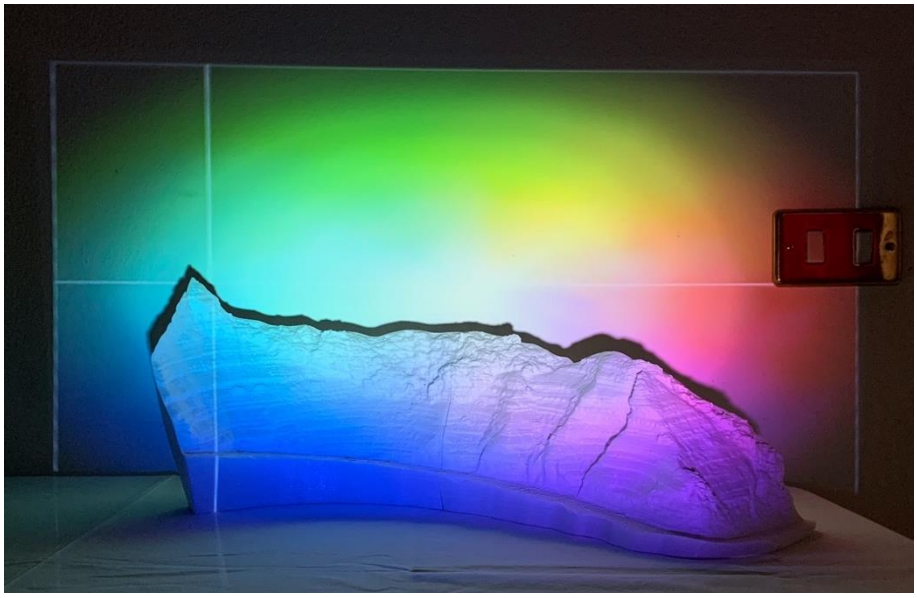
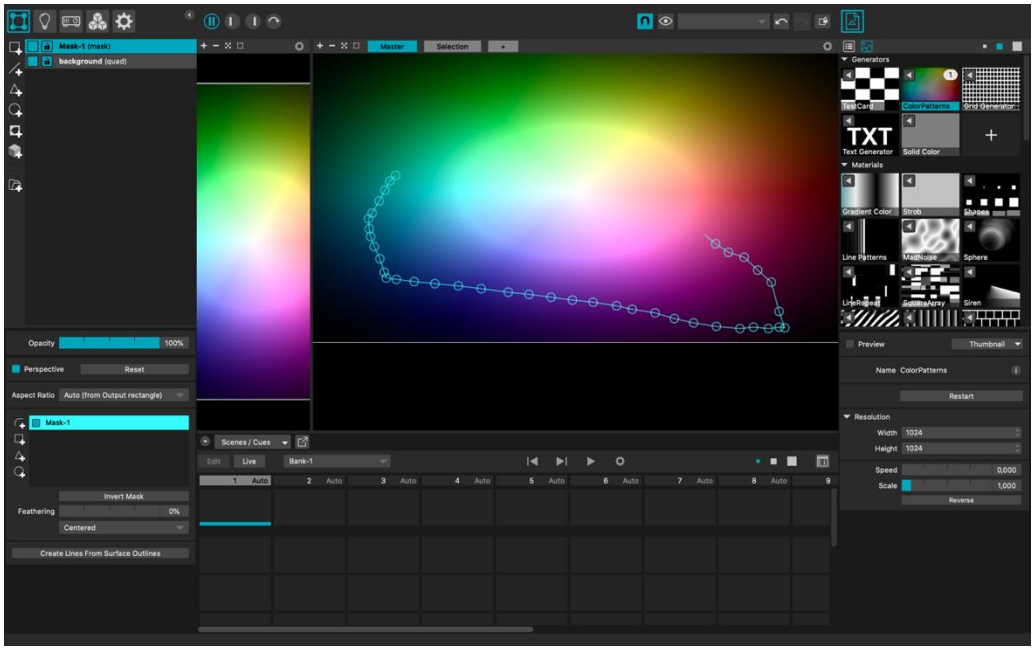


Figure 90. Screenshot of the view in Mad Mapper (top)

Figure 91. What appears out the projector simultaneously (bottom)

Once the commands have been set, what appears on the screen and what come out the projector are visible in the images above (Figures 90 and 91). With this projection on the wall and the visible cursor, it is possible to map the object directly *on the object*. Usually, to make everything inside the screen, it is advised to take a picture of the object and upload it on Mad Mapper, so that to map directly the shape from the software. On the contrary, it was preferred to map the cliff directly through the projection. The process took about half an hour to be ultimate, meanwhile, the interface appeared as a totally abstract shape inside that rainbow gradient (Figure 92) but on the projection all the dots were appearing on the borders of the object (Figure 93).

Once finished the mapping process, it comes out that only the 3D model of the mountain is illuminated by the projector, because only the selected areas corresponding to the 3D model are affected by the light, whereas the rest of the projection rectangle is eclipsed by the mask. (Figure 94). At this point, it is time to create the content itself and to do this another software has been used, Resolume Arena 6. To create the visual outcome on Arena and project it through Mad Mapper, it is just needed to select the live input source from the right column and the preview of Resolume will appear on the mapped object.



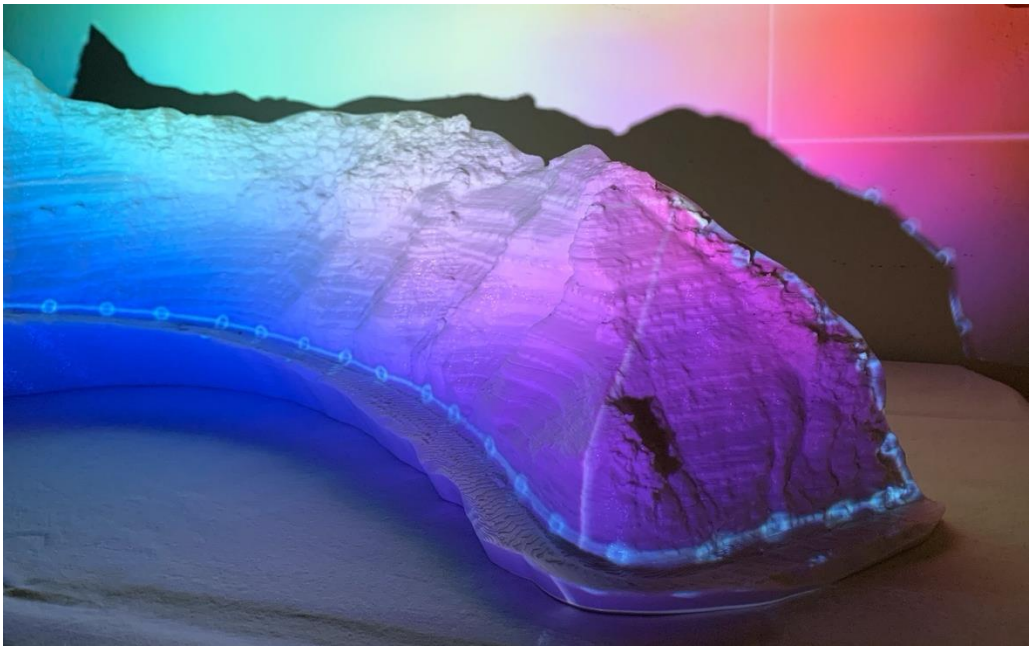


Figure 92. Mad Mapper while mapping the object (top)

Figure 93. Borders drawn by Mad Mapper on the maquette (bottom)

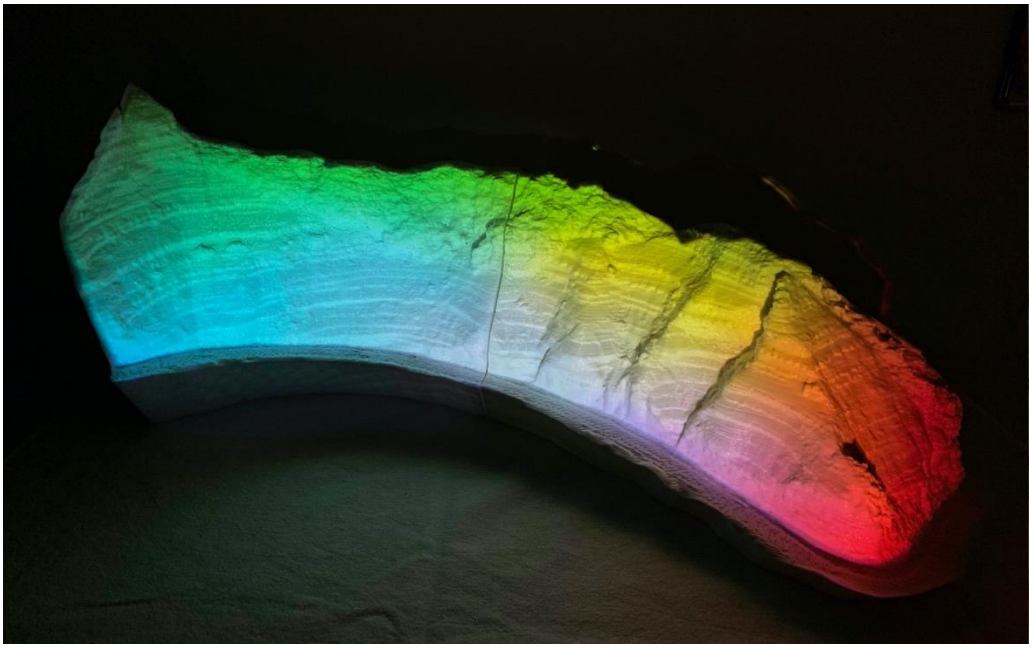


Figure 94. Final appearance of the mapping

4.2.4 Visual content

Resolume Arena is one of the most used software for VJing. It has been programmed at the end of the 20th century by a team of specialized Dutch freelancers who were already VJing with VHSs and old video mixers. As they state on the official website "Resolume was born because [they] wanted to VJ. But [they] wanted to do it better". (Resolume, 2021) And they did. Truthfully, Arena is really intuitive and easy to use if the user has a minimum of experience with video editing software. The main task of the software is to have as many moving contents as a user wants and make him or her able to mix those contents as needed. The interface to do so is separated into two main parts: the upper one and the lower one, which is then divided into subparts. The upper part is where layers and clips are located, where it is possible to select various clips to mix and choose various parameters to made content appear. The lower part, instead, is divided into four more sections. The first one gives to the user two previews to understand what is sent to the projector (output preview) and also a clip preview. The two central boxes are destined for the management of effects of composition, layers, and clips. And the last section contains all the sources accessible to create new content and modify them.

On Resolume Arena 6, it is actually needed to enable the output *network streaming*, in order to be able to select the icon in Mad Mapper. Once did this, everything it is created in Arena will be displayed in Mad Mapper, too. To be clear, what in Arena is shown as a screen, in a

rectangular shape, in Mad Mapper will appear in the mapped surface, so that the projector will cast a merged flow taken from the two outputs.

Video footages were recorded and uploaded by taking into consideration the presentation summarized in the previous chapter. Natural elements and human details were the most inspiring items. In this software, it is not important the quantity of footages because VJing is not about how many contents one has, but instead in how many ways those few contents can be presented to the public. Effects are various and also parameters of each effect so that outcomes' variety is almost limitless.

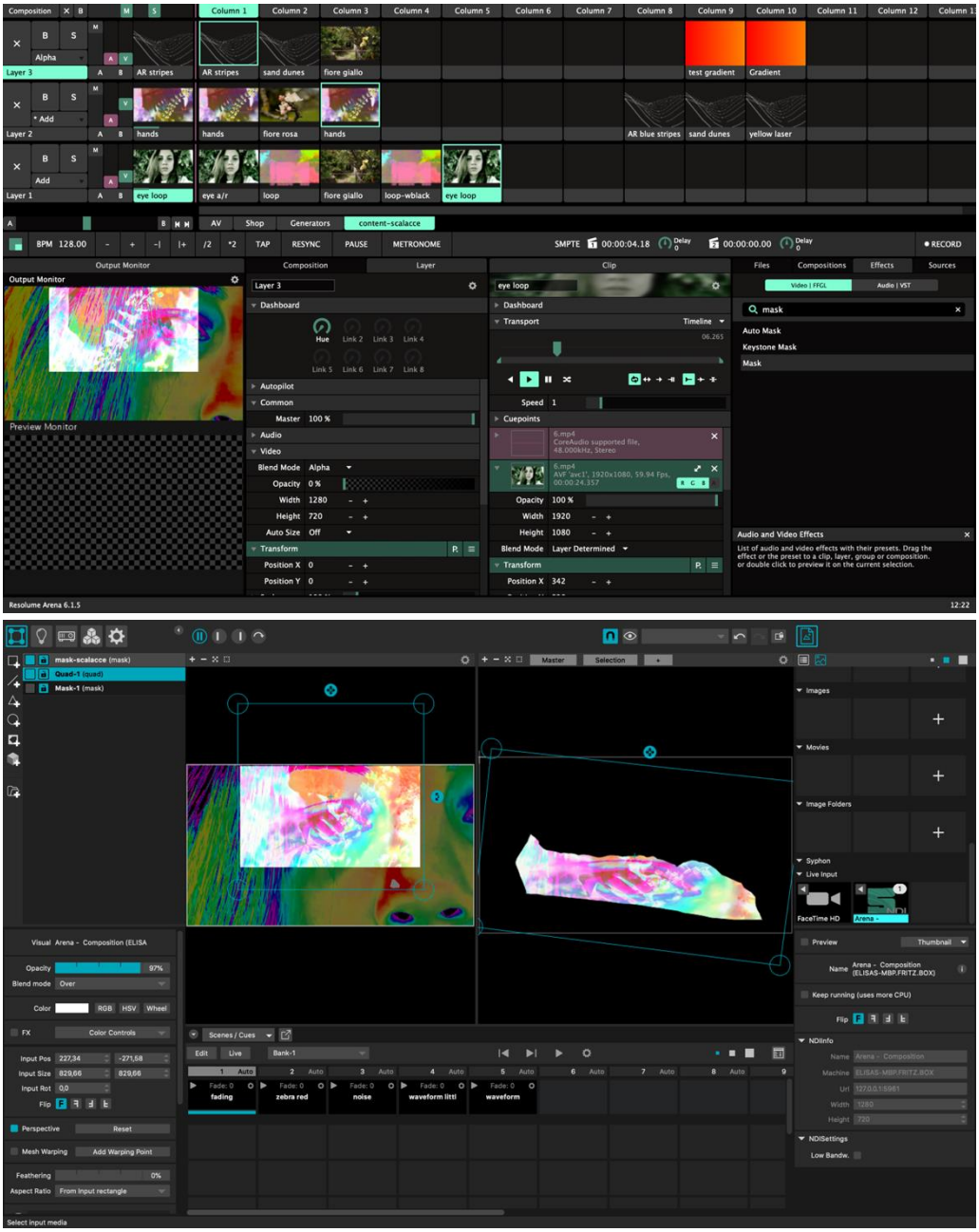


Figure 95. Screenshot interface Resolume Arena 6 while doing the video mapping on the cliff face (top)

Figure 96. Screenshot interface of Mad Mapper while doing the video mapping on the cliff face (bottom)

Apart from uploading video footage on Arena and apply effects and different parameters, one of the interesting things about the software is the possibility to generate and animate geometries. To better explain, in the section *sources* of Arena, there are several of different shapes and structures that can be used to create content. The most famous one is the *shaper*, which is a blue and white static circle. To this source, it is possible to apply some effects that make it move and it can literally be transformed in any moving shape. Interesting option is coming from the *line scape*, which is divided into subcategories of different lines. Those lines are waving already at the moment that are selected, but again, it is possible to edit all the parameters of the oscillation, in terms of size and frequency rate. In particular, the tilt and height of the waves have been set to be audio reactive. Audio-reactive is an effect that can be set up in any shape and it allows that shape to move in time with the music. The software gets the input of the audio from a microphone that oftentimes is the computer's one. Once got the input, it releases the visual output of the wave in time with music, so that to make it possible to watch the sound, and not only listen to it.

Set up of Arena for the show is visible in (Figure 95) and it is possible to see what the various footages are used for the performance. Simultaneously, the output of Arena is directly sent to Mad Mapper, where the result has to be adjusted on the mapped scene. To do so, it is possible to move the vertexes of the mask and change the perspective and the appearance of the visual content. It is possible to modify every point since the image appears not distorted, and even if it is not that easy to watch the final result on the mask on Mad Mapper, it is instead easily and promptly verifiable directly on the 3D model (Figure 96). After having set vertexes and perspective, the interface in Mad Mapper basically remains static and the artist works just on Arena, mixing the video sources in order to obtain a mesmerizing and meaningful show.

4.2.4.1 Themes

After analyzing the guidelines of the festival, a brainstorming was done to decide what to represent as visual content inside the video mapping show. The cliff face of the mountain is *sublime*, and several striking ideas surfaced during the various inspections. The inspiration, then, came not only from the concept of the festival and the values that the organizers want to convey with it, but also from personal inspiration given by the feelings that the place itself gives when one is there. This is what is called *Genius loci*, from Latin literally the genius that comes from the place. Actually, in Ancient Rome religion it was considered the divinity related

to a place. Currently, it can be explained as the certain impulse given by being in a certain place. It is for this reason, driven by *Genius loci*, that the content used for the video mapping was all created ad hoc on site and recorded solely for the purpose of that specific show, and aimed to be projected just on that mountain.

The inspections and the analysis of the location have therefore led the artist to dwell and think about certain contents that directly convey the feelings aroused by the place where Trekking & Techno is located. In addition, the festival has still its main topic concerning the connection between nature and human beings. So that, the main goal is to give importance to those elements and also to the surrounding environment. To do so, it has been done a brainstorming to better focus on specific elements and items, and the results are the following:

- Natural
- Humans in contact with nature
- Plants
- Hands
- Fragility
- Flowers
- Landslides
- Rebirth
- Human eye
- Audio reactive
- Waveform
- Lights
- Collapse

Those are the main topics on which the video content will focus. It is considered important to mention that contents were not found in stock websites or archives, but they were recorded directly on site. Specifically, footages of plants and flowers represent flora species typical of this Apennine, not any other place. And those footages were then mixed with other kinds of content in order to produce the show. The final result is a mosaic made by identitary elements that gives back the deserved significance to that landscape and location.

4.3 WHEN IT COMES TO THE END

The final results

Tutto ciò che era importante nella vita
l'avevo imparato in maniera non convenzionale.
Provando, sbagliando e riprovando ancora,
finché non trovavo il giusto modo per fare le cose.
Mauro Morandi

4.3.1 Final result of this project thesis

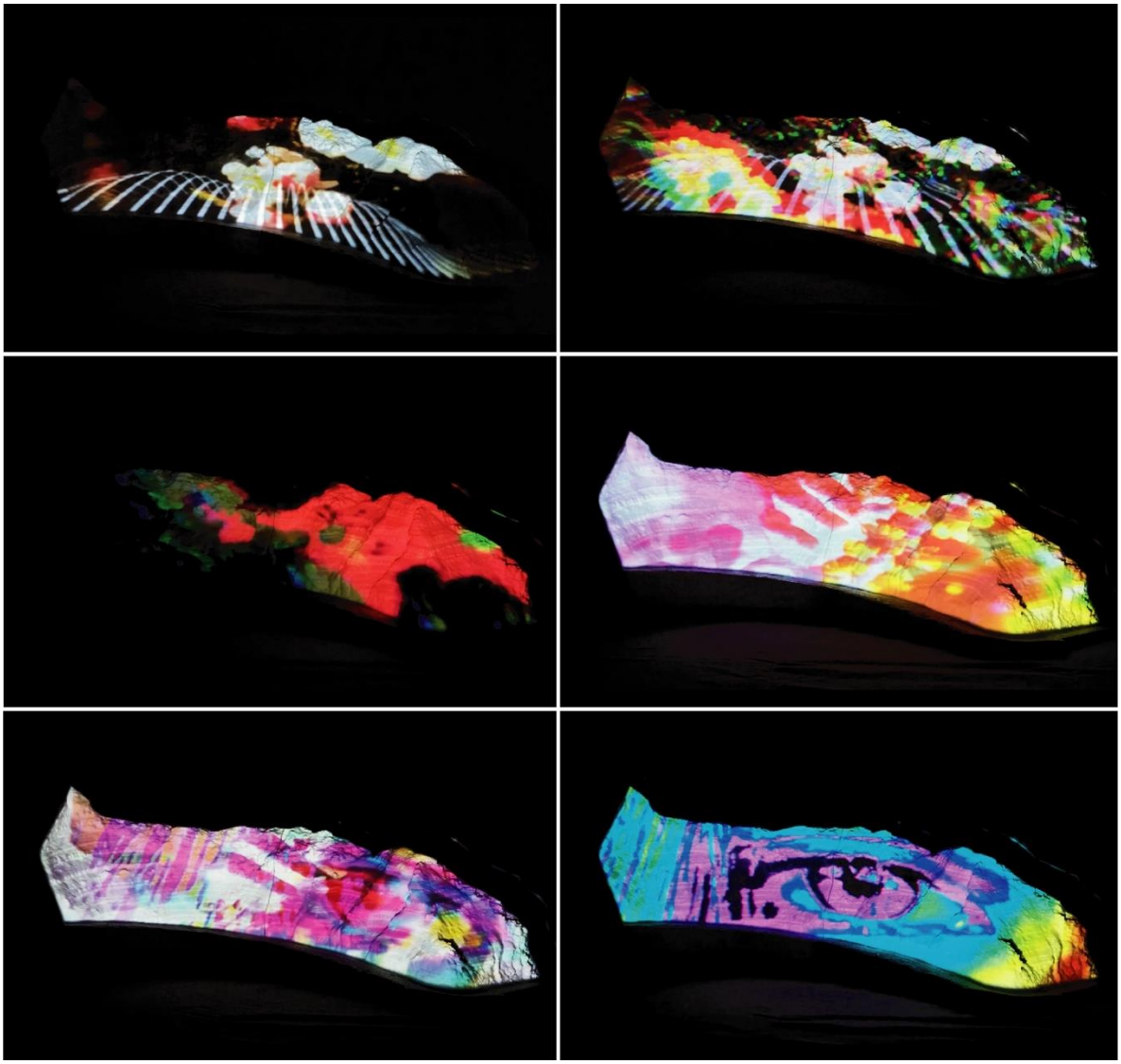
To accompany the visual content designed with Resolume Arena and Mad Mapper for the prototype of the video mapping, a music base created ad hoc for this project was used. The show, therefore, follows the notes of the audio track, about 3 minutes long, called *midnight x project*. The song was created specifically to be used for this project, it was created during the first lockdown due to covid-19, and it was a sort of escape from reality during that moment. It is interesting to notice that the entire video mapping show wants to be an escape from reality, even though far from covid-19 lockdown. In light of all this, the result is a live mixed visual show on that song, for about three minutes. The outcome on the maquette has been recorded in order to be presented. But here it is going to be described it in every step.

The video contents used for the mix are:

- White audio-reactive waveform,
- Masked footage of a flower,
- RGB delayed footage of other flowers,
- Loop footage of a hand brushing plants (in two versions), and
- Colorized footage of an eye watching directly to the camera and closing.

Those five elements have been mixed playing basically with the opacity of each content. For the first 15 seconds, only the waveform is visible, and it follows the beats of the music. The waveform has been set to react to music by two parameters: tilt reacts to low beats, heigh reacts to medium beats. At minute 00.17, the first flower footage appears. The mask of this footage

has been made in order to make just the flower visible and not the background of the video. In this way, the wall of the cliff is not entirely perceivable yet. This composition of the two first contents permits the viewer to see the lower border of the cliff and random parts of the upper borders. At minute 00.42, it flashes into the composition of a second yellow flower. For the first 5 seconds, just the flower appears, and it is possible to see already the RGB delay effect, applied on this footage. At about 00.50, the opacity goes to a higher percentage and even the background is visible. The three layers stay together on the music for 25 seconds, when the waveform gradually disappears. At 1.22, the white flower gives the scene to the first hand-footage. Here, it is difficult to perceive that it is a hand because is enlarged and a mask was used to leave just some details colored and visible. Anyway, these two contents keep looping in a wonderful mix of merged saturated colors for about 20 seconds. Then, at 1.44, the whole scene is suddenly occupied by the second hand-footage which is less scaled and more colored.



Figures 97. Series of shots of the video mapping show on the cliff face

It is actually bright and glowing loop footage which gives a completely different aspect to the cliff. This footage keeps looping till the end of the song, for about one minute, and it is alternated with the last content, which is a big colored eye moving in the whole surface. The eye is hidden behind the hand and the two videos alternate constantly till the last 10 seconds of the track, when the focus is on the eye and it remains the only visible content, and finally closes the projection (Figures 97).

The above described contents are the artistic answers to the aforementioned brainstorming. Having set the main contents and footages, then it was really pleasant to play with effects and distortions. Some choices need to be explained. This particular waveform has been chosen to transmit the idea of line coming from far away and going towards the public. It can also be intended as starting from close to the public and going to the unknown. In both cases, the path is on time with music and the path should be during everyday life. The flowers, then, give the idea of the purest and simplest thing of nature. Flowers are the symbol of the blossoming of life and with flowers the message is just to try to always keep a spring on. Spring as a synonym of rebirth and constant empowerment. Just after the flowers, a hand starts touching plants and other natural objects. This is the first attempt of transmit the connection between humans and natural elements. The lightness and tact which the hand caress the plant with gives space to the kind movement of an eye looking directly to the public. This eye is big enough to cover the entire cliff face and it gently moves from one side to the other and closes in the end. This eye could represent the final transformation from a flower to a human, but even it could be the depiction of Mother Nature.

An important portion of the content is full by the colors of the visuals. In particular, only the first part is not entirely occupied by colors, due to the choice of leaving part of the cliff in the darkness. The colors are fundamental in the process of arousing emotions in the audience. Single and definite emotions are associated with certain colors, in general, but it is also possible that a color can trigger completely new feelings in a particular viewer. Nothing follows strict rules, in this case. The reason is that already explained in the previous pages, that is the free interpretation of the content by the audience. Indeed, there are not clear boundaries among what can be achieved through those colors and those contents, but they can be interchanged and modified, in order to reach a different outcome every time. This versatility also reflects the versatility of the cliff face itself, or rather its vulnerability to atmospheric and natural events in general. Once again, therefore, the craftsmanship differs from the natural but also blends with it, in order to create an ever new and fascinating spectacle. Just as the cliff face can vary in its

appearance due to nature, then the visual content and colors can vary due to humans. The latter can be both the artist, who decides what to project, and the spectators, who decide how to interpret what is projected. In addition to their very personal interpretation, moreover, the spectators will also be those who spread by word of mouth what they have seen and enjoyed, so that it is passed on and transmitted.

All those elements above mentioned are what the artist intended to visually transmit. In any case, the public can interpret what it is watching in its favorite way. Borders are not defined, exactly in the same way that the borders between nature and humans are personal and subjective. Everyone can understand anything and at the same time the values of Trekking & Techno are visually shared.

4.3.2 Final result as it should have been

What is presented in this final project is the projection on the prototype. To conclude entirely the project, after the prototype, the projection should be transferred onto the real cliff face. To tell the entire truth, the first goal of this project would have been to present the real projection mapping show. This prototype, however, ended up being the final result because this journey has lasted long than expected, and meanwhile a lot happened. Everything started from a dream which was resolute to become true, but it is not yet.

It was almost two years ago when Trekking & Techno was born as an idea. That idea was to create for a couple of days a magic place, where people could manifest their art in different ways and could have a good time with good people. The projection mapping would have been one of those pieces of art in connection with nature, and for this reason, the projection was meant to be on a cliff face of a mountain. That is the use of natural landscape without damaging it, as it was mentioned when writing about digital land art in the first part of this final work.

This surface where to project could be any natural surface when the location of the festival would change. It will happen, one day. The idea is still to imagine people trekking and having fun while watching a projection mapping show, all together, in that *bubble of wonder* called Trekking & Techno. It will happen, for sure. And it will appear like the picture below.

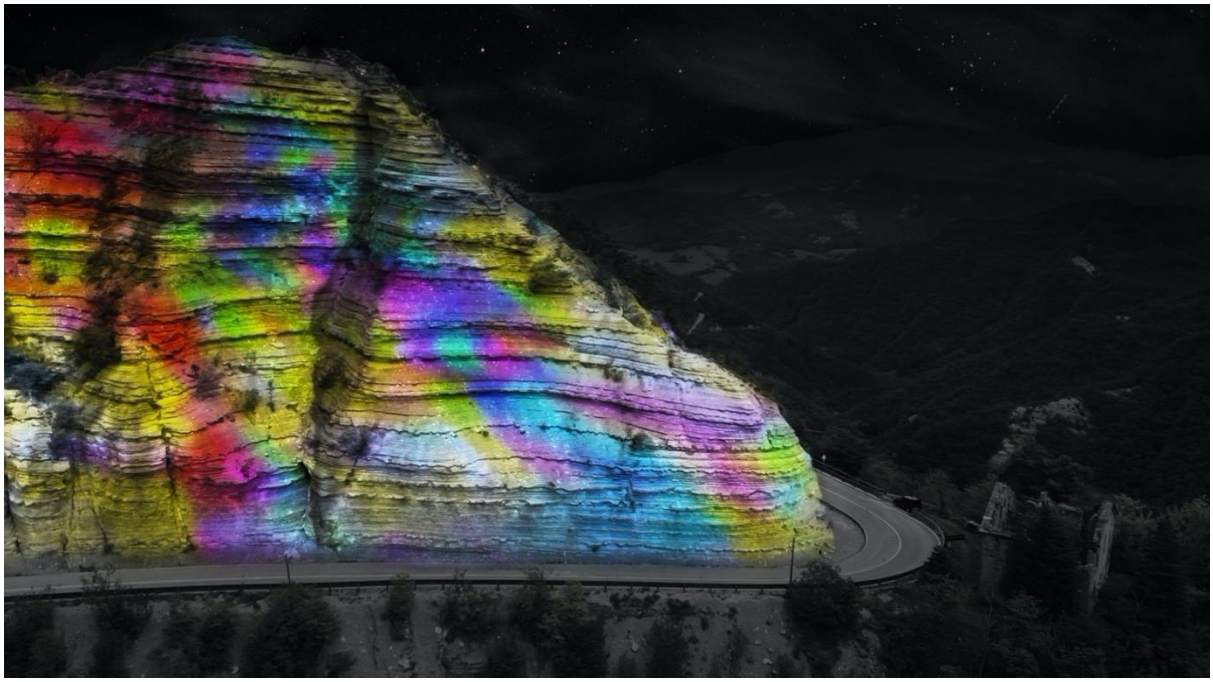


Figure 98. How the video mapping show on a mountain cliff face would appear in reality

Part 5

CONCLUSIONS

5.1 THE END OF AN AMAZING JOURNEY

Drawing a necessary conclusion

Sempre chegamos ao sítio aonde nos esperam.
José Saramago

After analyzing the result obtained, and the result that could have been obtained, it is appropriate to make some considerations about the totality of this project.

It has been a long journey, both in terms of time and content. Definitely not linear and sometimes really full of obstacles. The main topic of this project is the audiovisual projection and in order to fully explain the context of this topic it has been tried to give an overview through the historical context. The intention was to start from the primordial inputs of the history of cinema, visual music, and projection mapping, to try to arrive at a common point. In fact, these three sections certainly have different origins in time and space but analyzing and studying them it can be seen that in some cases they intersect and sometimes cooperate for the same purposes. The objective in question, in this case, is the production of a video mapping show. For this reason, just about the projections, it was decided to go a bit beyond what is the mere historical declination of the facts. Thinking of Plato's Cave, it is easy to understand that the projection of something is nothing more than a visualization of reality, which sometimes is anything but real. The visualization of something, in fact, derives both from the content that is projected, and above all from the perception of that content by the audience. Therefore, the relationship that the spectators have with the video mapping show itself, intended as a homogeneous compound made of audiovisual content but also – and above all – of a surface on which this content is projected, was reasoned upon. The work to be done to obtain the result is wide and complex, but it is also wide and complex what is perceived by the audience. The taxonomic division presented in chapter 2.3 intends to subdivide the projectable surfaces and consequently the relationship that the viewer establishes with video mapping.

The personal relationship with video mapping is then proposed in new terms in part 3, concerning inspirations. It is exactly here that all the historical background converges in

understanding what, in a couple of years of research, transformed pieces of a primordial idea into a concrete project to be realized. The described shows and installations led to the construction of an idea that was increasingly rooted in the heart and mind, and increasingly solid on a creative level.

This idea became concrete first in Trekking & Techno, and then in *Beyond Rocks*. Trekking & Techno, on its side, is an art festival where music, visual arts, nature, and fun come together to create something completely new, what has been called a *bubble of wonder*. *Beyond Rocks,* on the other side, is the video mapping show that has been presented to be projected inside the festival.

The realization of both met different obstacles in different situations. On the one hand, Trekking & Techno was born not really as a context for a video mapping show, but as a festival to be realized in a specific place. Once the location was identified and every detail of the festival specified, the organization started. The refinement and the attempt of its realization have therefore occupied most of the time and energy until September 2020. This latter was the moment when it was realized that this festival could not be done as it was intended because of covid-19. Until that moment, however, I and the entire team of people, who had dedicated themselves to the organization and realization of this festival, had believed in it so much. In parallel, the video mapping show was trying to take shape. And in parallel, other and completely different obstacles were looming. The difficulties of making a video mapping show were overcome thanks to the fact that, at some point, it was understood that this project could not be done completely on one' s own. The 3D prototype of the facade of the mountain, as well as all the on-site inspections, the photogrammetry, the design of the audiovisual content for the projection, but also the use of some software were made with the valuable help of other people. And through this project I have been able to understand that no matter how dedicated a person may be to the realization of a personal project, he or she will hardly realize it entirely alone. This is not meant to be a statement of weakness towards the project in question or any other project that will come along in the future, but instead it is meant to be a proclamation of how fundamental a working team is to the successful accomplishment of something.

In this project work, all the creative ideas and thoughts that are usually never expressed during the creative process have been uncoiled. It was complicated to do so but this allowed each line in this thesis to make sense. It was also necessary for my personality to split, literally. It was needed to separate the festival organizer from the video mapping designer. Each role had to be

clearly delineated and defined in order to be able to set goals and try to achieve them without compromises. The risk was that, if the two figures combined, the difficult goals to achieve would then be smoothed out once the project was completed. The two figures tried to be split until the end, yet they were within the same brain. They would dialogue with each other only as much as necessary, and then each would continue on their own way.

It was quite a challenge, and a beautiful journey. The results achieved by the budding artist met the expectations of the novice festival organizer. Both learned something from the other, and both were confronted with so many other people, relatively experts in fields that were relatively inherent to the two projects. In this time spent together, they have been able to exchange opinions and grow together, and now they are ready to cohabit in the same person.

To conclude, it is fair to say that the result obtained on the cliff face prototype can certainly be improved. The world of VJ has opened its doors and is ready to be explored, as well as the world of video mapping. But every detail was relevant as much as possible and designed through the creative impulses given by the *Genius loci*. Nothing has been left to chance, and this is a source of creative pride. Nevertheless, the personal satisfaction will be real when every line of the festival project will become real. When there will be smiling people watching live visuals projected on a mountain while dancing under the Trekking & Techno subwoofers.

Part 6

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