PART 1

History and Identity

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The Origins of Projection Mapping

1.1. Introduction

Figure 1.1. *Evolution of the queries of the keyword "video mapping" in French on Google from 2004 to 2019 (source: Google Trends, 2019). For a color version of the figures in this book see, www.iste.co.uk/schmitt/image.zip*

When did projection mapping start? More than 10 years separate this text from the emergence of the key word "video mapping" on Google, but this criterion alone is not enough to capture its origin and requires a more distant archaeology. The materials that make up this chapter come from a collection of significant historical elements during a series of expeditions in the reflector that is the archived history of ideas and works of art or technology up to the 20th Century. Presented with a desire to go beyond the passive collection, these facts are ordered in such a way that one can understand how projection mapping can be understood as an instrument of vision comparable by similarities and differences to many other devices that

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preceded it, but also as an original way of seeing that has been maintained over time.

1.2. *Let's moonwalk!* A short crossing through time

1.2.1. *The emergence of the expressions "video mapping", "projection mapping", "spatial augmented reality" and "spatial correspondence" between the beginning of the 21st Century and the end of the 20th Century*

By literally writing "video mapping" on the Google Trends trend analysis tool, we can see that queries for this keyword increase significantly from a point of origin located in 2008. This information highlights the recognition of the unity of a concept based on Web searches for it and would make it possible to clearly date the birth certificate of projection mapping. Google and the use of this word alone, however, do not reflect what precedes them: before 2008, this expression was not used or very rarely used, whether written as one or two words, with or without an accent, and with or without the word "projection" instead of "video". This initial year would therefore be sufficient if it was not very clear that the technical device and its spatial writing logic were already well identified in the 1990s by technologists or artists. The often cited "spatial correspondence" was first mentioned by Michael Naimark in 1984 in Los Angeles, while "spatial augmented reality" was first mentioned in 1998 in North Carolina by Ramesh Raskar.

Between these two publications, Paul Milgram proposed in 1994 in Toronto a taxonomy of "mixed realities", and the first patents identified for digital video projections that match volume surfaces were filed for Disney Inc. in 1991 and General Electric Co. in 1994. Between these two patents, artist Tony Oursler exhibited *The Watching* in 1992. Later, in 1999, John Underkoffler, the designer of *Minority Report*'s famous interface, invented *I/O bulb* and *Luminous room* when the facade of Amiens Cathedral was painted. In 2004, choreographer Klaus Obermaier used infrared to divert the real-time video from the silhouette of a performer in the foreground of the stage and projected a video on his body that differed from the background. Johnny Chung Lee published his doctoral thesis on automated projector calibration the same year. The following year in 2005, Olivier Bimber planned to project onto a classical-age painting.

1.2.2. *From 17th Century magic lanterns to ancient camera obscura*

If we stick to the technical device and spatial writing logic, many artists, painters, visual artists, illustrators or directors have also used, since the beginning of the 20th Century, the unconventional image projected in relation to the reference that is cinema. They played with the image carriers and environments of their works in a way that projection mapping still offers today. Before them, in the 19th Century, it was travelling projectionists like Maximillian Skladanowsky who projected natural disasters, sometimes improvising projection spaces for storms, fires or earthquakes. These images are reminiscent of buildings that collapse with digital pixels. Savoyard lanternists brave the mountain slopes accompanied by marmots, monkeys, drums, or barrel organs like the contemporary off-road projection mapping projectionists do outside rooms.

At the end of the 18th Century, phantasmagorical spectacles such as those performed by Giuseppe Balsamo called the Count of Cagliostro, Johann Georg Schröpfer, Paul Philipsthal or Étienne-Gaspard Robert called Robertson used illusory projections of supernatural beings. They would double the projections of thunderous noises or the smell of burnt feathers. Between the 15th and 16th centuries, a magic lantern was designed by Leonardo da Vinci, but they were not made by Christiaan Huygens until 1659. Then they were carried around in 1664 by Thomas Walgenstein, at the time when anamorphoses were theorized. The lantern is widely disclosed by Johann Christoph Sturm and the Jesuit Athanasius Kircher. It was Milliet Dechales, in 1674, who produced a series of projected images approaching animation and, in 1698, Johann Christoph Weigel developed an overlay of images in the same way as a compositing of layers. This was shortly before the lantern was mounted on wheels and several were used to compose the same image, which today would be called stacking or shifting the image. Johannes Zahn, a Jesuit, also shows animated projections: he projects worms in a jar, the movements of a weather vane or those of a clock. Van Musschenbroek continued Zahn's work around 1730 by inventing animated plates that made it possible, for example, to turn the wings of a mill. As early as 1608, Cornelis Drebbel said he could change the appearance of his clothes and make giants appear.

In 1650, another Jesuit, Gabriel Magalhaens, reported descriptions of the use of oriental lanterns that he said were quite convincing. Chiang Khuei and

Fang Chheng, in the 13th Century, made animated projections on smoke. Sun Kuang-hsien, in 930, or Shao Ong the magician, as early as 121 BC, did comparable tricks. In the past, they would turn flying dragons. In the 16th Century, in the West, Giambattista della Porta described in his *Magie naturelle* how to reveal volumetric light in chalk powder. He provides a remarkable drawing of it. Girolamo Cardano and Benvenuto Cellini projected images for shows. In 1420, Johannes de Fontana produced a drawing of what he called the lantern of fear in the *Bellicorum instrumentorum liber*. Jokes and mysteries are played in the Middle Ages with these thaumaturgical lanterns. Arnaud de Villeneuve, from 1290, would have used it. The *camera obscura* was known to Aristotle and Mozi in the 4th Century BC, and even to Apollonius of Tyana, the miracle worker, in the 1st Century.

Contemporary archaeologist Matt Gatton argues that the *camera obscura* may have been used as an archaic projector to animate the faces of statues during the Eleusian feasts in ancient Greece – no doubt long before the use of 16 mm projector film from 1969 onwards to project on the busts sculpted inside Disneyland's *Haunted Mansion* and on their facades and other crystal balls. Contemporary authors Jean-Jacques Lefrère and Bertrand David have even put forward the hypothesis, with supporting arguments, that figurative shadows were projected using tallow candles as early as the Palaeolithic era.

1.2.3. *The screen as a material considered as a void: projection mapping in negative from the 15th Century onwards*

As far as we can go in the history of light or shadow projection devices, pinpointing a beginning seems complex. Would it be necessary to have a kind of visual antinomy of what projection mapping is in order to be able to record its beginning by way of a contrast? One can find an antinomy of this type in an asserted disregard for the medium receiving the image, since it is the interplay with the latter that gives meaning here to the words *mapping*, *correspondence* or *spatial*. One of the most important key points of such disregard is undoubtedly the explicit verbalization of Leon Battista Alberti written in 1435 in *De Pictura*. He presents the painting board as an "open window". Mapping on the void that is the open interior of a window is a misdirection: no more composition according to the medium is possible as soon as it is expressed as non-existent.

If we agree to consider the artistic movement that began with the transition to the 20th Century of so-called *modern* art – or at least one of the

most important parts of this movement – as a challenge to this Albertian representation as a visual screen form that has become hegemonic, the hypothesis is that projection mapping would only be one manifestation, among other types, of what happened as a result of this paradigm shift. Extension of the painting and access to new dimensions sought by painters, removal of the base in sculpture, total or synesthetic art, sublimation or enhancement of the material, background scenery becoming an actor in scenographies, etc., are all fine art studies whose origins can be traced to projection mapping.

1.2.4. *How far back in history can we go?*

Thus, the first image not to consider its medium as an "open window" is the one that took advantage of the formal specific features of its surface, considering the material nature or volume of the latter. We then find ourselves in the astonishing situation of having to bring together the origin of projection mapping with that of the images themselves at the current state of knowledge of the history of human creations: wall representations of the Paleolithic. Some of them undoubtedly play with the volumes of the cave walls, which is a form of *mapping* in the sense used in projection mapping: a set of correspondence between an image and the specific features of a heterogeneous medium. Some of these images could be animated with the moving flame of a fire, in a sense close to what can be understood as the feeling of movement caused by the video. In addition, some of them took place where acoustic games were played. Would a study on projection mapping help to understand this mystery? It would have been easy to conclude that projection mapping was anthropologically inevitable since it was so latent in humanity that it became confused with it. Everyone dresses, every culture transforms or disguises their bodies, makes them up or masks them. What is more than mapping if not disguising a surface by pretending to transform it by adding light? Exposing it, perhaps.

So, what alternatives occurred when the Albertian representation was set up? Was there any kind of projection mapping before it was designated? Would we have always done it? If so, the words *video* or *projection mapping*, *spatial correspondence*, *spatial augmented reality*, would use new terms to describe something old that does not have this name, and this would legitimize an archaeological expedition. But if we insist on going back in time, we notice that projection mapping becomes a concept whose strength, like any good concept, is to find many dynamic echoes in various contexts. The difficulty of such an undertaking, then, is to know where to stop the

investigations knowing that we will always find if we want a Greek, a Chinese, an Indian, an African tale or a disappeared civilization which will have made some initial progress. Or, at the very least, we could build a demonstration of it! The risk of seeing the new in the old is equal to the ambition when it comes to making the new from the old. Let's extrapolate, then: hardly earlier than the first shapes drawn in the caves, we would make the *White hole*, *White fountain* or *Big Bang*, the first "projectors" of light, cosmic! Are we living in an illusory *Matrix* projection? To pose this question, we must take a look at some media and philosophical doctrines.

1.3. Immersion in hallucinated worlds

It was shown in September 2017 that the resources of a conventional computer do not allow the known universe to be simulated. A few months earlier, an experiment was attempted with the Swiss supercomputer *Piz Daint*, which provides an image of the universe composed of 15 billion galaxies generated from two trillion particles in 80 hours of computing. This representation of a closed world is nevertheless in contrast to the infinitization of the universe that marks the 16th Century described by Alexandre Koyré, but the idea of the anthropocene today also brings us back into a relatively closed system. Sustainable development problems linked to climate change or access to natural resources thus tend to show us our contemporary artificial environment as an ephemeral illusion in view of the changes deemed necessary for the future. To get an idea of this, it is sufficient to look around you, identifying everything that has required oil, comparing predictive studies on its extraction and consumption with the materials that you imagine you could produce in its absence. This appreciation of a hallucinated world refers to an idea that is not new and crosses history along various multicultural traditions: living in a coma, a dream, as a living being, an egg or a seed that is virtually a tree, a computer simulation, being just a brain covered with electro-stimulators, being possessed, etc., are as many cases of the abyss of illusory worlds where parallel realities of a geometry that is not very Euclidean can overlap or intertwine with each other.

1.3.1. *Some films on the theme of nested or fallacious realities in line with the first digital projection mapping installations*

The novels *Simulacron 3* by Daniel Francis Galouye and *Simulacres* by Philip K. Dick, both published in 1964, are said to have founded the sci-fi

theme of the world viewed as a computer simulation. The first one became *Le Monde sur le fil* (1973) and then *Passé virtuel* (1999). The second author would give the essence of *Total Recall*'s schizophrenic scenario (1990). Although Adolfo Bioy Casares' novel *Invention of Morel* published in 1940 was earlier than them, it will not be part of the opuses that adapt this theme on the big screen. In the 1990s, there were *The Lawnmower Man* (1992), *Ghost in the Shell* (1995), *Jumanji* (1995), *Serial Experiments Lain* (1998), *Dark City* (1998), *Truman Show* (1998), the *Matrix* trilogy (1999) based on the novel *Neuromancien* (1984), *ExistenZ* (1999). It was also in 1999 that digital projectors were installed in cinemas, with the digital release of *Episode I* of *Star Wars* as a benchmark. Others followed, including *Avalon* (2001) and *Vanilla Sky* (2001). The latter is a remake of *Open Your Eyes* (1997), a Hispanic film that is itself part of the 17th Century Spanish tradition of playing with the rationality of perceived realities. The most important representatives of this tradition are the novel *Don Quixote* (Cervantes 1605), the play *Life is a Dream* (Calderon 1635) and the painting of *Ménines* (Velasquez 1656).

1.3.2. *Some philosophies of illusion*

In the East, in the Vedic texts, the *Brahmin* underlies the cosmos as a presence in all things and presents itself as the only reality whose manifestation named *Maia* makes us think of a world that we accept as real. But it remains an illusion to be overcome in order to see the transcendent realities. In Buddhism, which is most probably inspired by it, the ego projects an illusory reality onto a set of primordial laws called *dharma*. It is noteworthy that some Japanese Buddhist temples equipped themselves with projection mapping systems no later than by 2015. Chouang Tzu, in a Taoist fable, wonders if he is a man who has dreamed that he is a butterfly or if, rather, he is not this butterfly dreaming that he is Chouang Tzu. On the western side, the ancient Greeks put forward similar ideas. For the pre-Socratic Heraclitus, around the 5th Century BC, "nature likes to hide itself". The "kora" described in the *Timaeus* by Plato a century later is presented as a dream, both a print and a matrix of a *genesis* perceived also under a veil. Of course, his cave is even more famous, and Plato defended the Pythagorean ideal of an invisible world that could be described mathematically. Galileo summarized this in the 17th Century by saying "Nature is a book written in mathematical language". Shortly after Galileo, it was John Locke and Robert Boyle who imagined that they could bring

Adam and Eve's conditions in Eden back to heaven, thanks to exhaustive properties. Adam and Eve saw things as they *really are*.

The theory of emission, according to which visual perception occurs through light rays emitted by the eyes, has been debated since the ancient Greeks. For Lucretia, in the *De Natura rerum*, written in the 1st Century BC, there is a wandering sham crowd and the vision of the mind coincides with that of the eyes. The fable of the painter Parrhesias winning against Zeuxis illustrates this idea well. In the 18th Century, Francis Bacon wanted to inhibit the tendencies of the mind that he named idols and that distorted reality (*Novum Organum* 1620). Descartes, some 20 years later (*Première méditation* 1641), argues that he has sometimes experienced that "meanings were misleading, and it is prudent never to rely entirely on those who once deceived us". Newton then demonstrates in *Optics* (1704) that what we see is not physical reality. In the 17th and 18th centuries, Berkley, Hume and Kant were famous for their criticism of the idea that reality exists independently of its human representations, known as "realism". Hume, for example, argues that it does not matter whether impressions are produced by the creative power of the mind: what is important is that "we can draw inferences from the coherence of our perceptions, whether they are true or false, whether they represent nature accurately or whether they are pure illusions of the senses".

1.4. Examples of visual devices

Without having to dwell on other more contemporary thoughts, it is already remarkable that the philosophical traditions that characterize the illusory or incomplete state of affairs make it a subject that seems inexhaustible. If we see both too much and too little, if there are things behind things and we perceive only part of them, if we imagine artificial additions, etc., it would be appropriate to inhibit or subject to analysis what potentially deprives us of a proper appreciation. Jean Cocteau thus repeated Tchouang Tseu in his 1950 *Orpheus*: "Some say that we are just his dream", before adding "his bad dream". The idea of a Promethean transgression or *hubris* presents itself as a result, since the challenge of finding some ways to differentiate true and false is symmetrically launched. Should we show ourselves our own ignorance of a fake, hidden or perceived incomplete nature to which we add our own falsehoods? In this sense, Umberto Eco

advanced the idea that a process in man leads him to seek iconic processes that increasingly deceive his senses. The following few processes raise this question: would projection mapping answer the need to make reality habitable? With Aristotle, art in some cases completes what nature does not have the power to accomplish. According to Kant, only Art that is evaluated without criteria of utility makes it possible to exercise a free will, and thus to be free. "Augmented reality" would be the fruit of those ideas that have obviously crossed time and space: both an expression of perceptual limits and an apparatus of transgressive vision that tries to approach a beyond an imperfect illusion because it is incomplete and overdetermined.

1.4.1. *Two visual instruments: anamorphoses and X-rays*

The 17th Century Dutch man, living a golden age of painting at a time when we are perfecting the lenses of telescopes, the automation of calculation, the theory of anamorphoses and the diffusion of the magic lantern, does not hesitate to recall the dichotomy of the limits of our perceptions on which a set of devices emerge that aim to overcome them while being conditioned by them. The errors of our vision became a subject of representation for the Dutch of that time and it is in this prism that the theories of anamorphoses which were produced then can be understood. After about 1630, the complexity of the perspective play of the new optics, catoptric and perspective, devalued the human vision now perceived as a simple way of seeing the world among so many others. Jacob Leupold's "machine for anamorphosis" (1713) is an apparatus that shows this devaluation and perhaps even aims to prevent it. A probable high point came in 1895 when Wilhelm Röntgen accidentally invented X-rays. The range of colors whose painting had hitherto celebrated the variety is in fact only a window into the rays that escape our senses. This further mocked the tradition of representation that photography too had already dulled considerably. The mocked painter "can't see further than the tip of his brush".

1.4.2. *Immersive panoramas*

Cinema is this original and radical form of visual immersion that the themes of the nested realities mentioned above translate as a self-reference from its own operating mode. In favor of a certain captivity in the cinema,

the cinema does not allow *a priori* any floating attention or bodily mobility. This "immersion" is supported by renowned videographers: Bill Viola when he argues that to see a video image "you have to get wet" or Nam June Paik for whom it is "weightlessness". In both cases, we would no longer have our feet on the ground with the video image. For the theorist of computer graphics, Philippe Quéau, the reason for the enthusiasm for virtual images is also "immersion in the image".

The giant panoramas of the 18th Century precede this radical aspect of an exclusive image. They artificially stage and provoke the sensation of 360° immersion. Around 1779, the engineer of the Royal Corps of Bridges and Causes, Louis Le Masson, had a "great and new" idea "to show Rome as a whole". The device designed is a large circular painting where the viewer's eye finds the most complete pictorial illusion. It was patented in June 1787 by the Irish painter Robert Barker, who named it *La Nature à Coup d'Œil* in French. It is remarkable that the mausoleum of the philosopher Hume, mentioned above as going against the doctrines of "realism", is painted in this first panorama. The year before, the idea of *Panopticon*, Jeremy Bentham's "inspection house" was written, which conceived a circular prison project whose characteristics gave prisoners "the feeling of an invisible omnipresence". Jules Damoizeau (1890) is credited with the first 360° panoramic shot. In another field, Claude Monet began the *Water Lilies* project in 1918. He painted a whole that formed a surface of about 200 m^2 in eight compositions of the same height suspended in a circle.

1.4.3. *Augmented reality and low-tech virtual reality*

These panoramas place their observers in a portion of an imported or imaginary landscape. They are large in size and contrast with smaller portable objects such as Martin Engelbrecht's "perspective boxes" from 1730 or the trompe-l'oeil painter Samuel van Hoogstraten from 1656. In a way, they anticipate today's virtual reality (VR) headsets, as well as Charles Wheatstone's two "stereoscopes" produced in 1838. Brunelleschi already proposed with his "experience" in 1415 to look, through a hole drilled inside a painting, at the reflection of this painting which made it merge with its unframed frame. In the 18th Century, *Claud's Glass* turned its back on what was observed in a tinted mirror to give it the calibrated shape of the chromatic canon of landscape representation of the time. These mirrors

prefigure as glasses described by L. Frank Baum in The *Wizard of Oz* (1901) or ocular lenses described by Isaac Asimov in the *Foundation* series which is now called "augmented reality".

1.4.4. *Some visual sequences spatialized since Antiquity*

The history of the first sequences of images placed in space dates back to the images drawn or painted on the walls of caves in the Paleolithic period. Some of them evoke a movement in a succession of simple strokes or poses. The Knowth grave constructed around 5000 BC in Ireland, has symbolic representations engraved on the peripheral stones around its perimeter and may have given rise to circular processions punctuated by visual sequences. A cup found in Iran represents a goat in five different positions around its circumference and dates back to the same period. In the second millennium, in Egyptian-Mesopotamian cultures, frescoes and bas-reliefs by wrestlers were composed of successive poses. In the necropolis of Deir-el-Medineh in Thebes around 1250 BC, the peaceful life in the afterlife is recounted in the style of the characters seen in profile. In the life of the 6th Century BC, Persepolis also had regular sequences of images engraved in bas-reliefs.

Greco-Roman antiquity offers many examples of graphic narrative on various media, whether objects of movable art or real estate architectural art: vases, temple pediments, murals, mosaics. The *Vase François*, which dates back to around 500 BC, is painted with mini-stories that largely refer to mythology. The Trajan column, almost 40 meters high and erected around 110 is also remarkable: nearly 200 meters of bas-reliefs wind around it to tell the story of the conquest of present-day Romania. The Achilles shield described in the Iliad also prefigures for some the discs of 19th Century optical toys, even if it probably never existed.

Pre-Columbian art provides other remarkable bas-reliefs in the Mayan, Aztec or Olmec cultures. Mochica ceramics between the 1st Century BC and the 8th Century break down the rites of this society into graphic sequences. Around the 6th Century BC, after the death of Gautama Buddha, the "stupas", a kind of mound containing his remains, appeared in India. They are first decorated with motifs that meet the need to impart the Buddha's teaching and reveal a true graphic narrative system. This tradition of Asian narrative relief would be expressed in a spectacular way in Angkor, built in the 9th Century.

Projection mapping is sometimes compared to digital wallpaper or tapestry. The *Bayeux Tapestry* was created in Europe in the 16th Century. A long narrative stretching over nearly 75 meters, it is a true documentary that goes so far as to use flashbacks. The oldest example of tapestry is found in the Siberian steppes and dates back to the 5th Century BC. Microcosm representing a garden where the whole world comes to achieve its symbolic perfection according to Michel Foucault, the tapestries of nomadic peoples are mobile and we walk through them in both mind and body. This double practice, the nomadism of its authors and the microcosm represented there, are probably at the origin of the idea of the flying carpet. Far too expensive to be placed on the ground, they are put on objects or walls.

1.5. The agencies

The few visual devices listed above translate what the ancient philosophical traditions have to say about the illusory nature of our perceptions into images. They also inform us that these same devices can be used for a variety of purposes. How do these devices work? What can they produce and what roles do they play?

1.5.1. *The arts of memory*

A structural link seems to combine memory and spatialized images. György Buzsáki and Edvard Moser, in January 2013, in the journal *Nature Neuroscience*, presented the hypothesis of an evolutionary continuity between our cognitive processes for orientation in space and the mechanisms underlying declarative memory. The visual forms of immersion seen above thus evoke another one of a functional and utilitarian nature. A history of images in relation to spaces cannot forget to mention the *arts of memory* that in its palaces or gardens deliberately distribute images in space in a composed way. They were first strictly imaginary before taking shape in concrete achievements. Among the ancient Greeks, the art of memory consists of building a mental architecture that must be populated with characters, objects or scenes that are preferably striking or strange. These images are linked to ideas or words related to what one wants to remember. Subsequently, seeing what happens while walking mentally in this imaginary landscape will bring revive the memory of what is inscribed there.

After Saint Augustine and the 5th Century, there is no longer any explicit reference to this process. It reappeared with scholastics around the 13th Century and cathedrals. We then move from an inner art to a monumental art. In 1534, a simple use of "natural" memory was advocated, although in the 16th and 18th Centuries, Giulio Camillo's *World Theater*, Robert Fludd's *Memory Theater* and Tommaso Campanella's *Sun City* turned the arts of memory into concrete buildings. Its controlled use could give its user supernatural powers. The magician of the time prefigured the modern scientist according to historian Frances Yates. It is Giordano Bruno's task to synthesize this system of place and image with another system, Raymond Lulle's *Ars Magna.* Some people see this as a prefiguration of the animated discs preceding those of the optical toys prior to the cinema. Thirty-four years after Bruno's death, John Bate gave a description of the *Zootrope* in *Mysteries of Nature and Art*. The revolutionary Bruno would not escape the stake in 1600; his system was considered a tool that manipulates phantasms.

1.5.2. *Feedback, or the chicken and the egg problem*

The fact that visual devices can be used in a utilitarian way makes it possible to implement the idea of these devices having a capacity to act. This will vary according to who owns them, the interest found in shaping perceptions, and undoubtedly the social ground suitable to welcome or not and to transform or not a device or other, or even probably what these devices will generate *by themselves,* if we can say so. It is not clear, for example, who initiated the other from the printing press or the Protestant reform. And if it is clear that Copernicus' heliocentric ideas only caused their upheaval once they were taken up by Galileo's commitment to using telescopes to pass them by, is it not more obvious that it is the telescope itself that pushed Galileo in this direction? The Albertian perspective and its framework screen, which will be discussed again below, raise the same question: does it establish itself by changing its context or did its context establish it?

The visual tool gives a new meaning or sharpens sensitivity, such as the blind man's cane that allows him to imagine a space. With the anthropologist François Sigaut, the tool is also a medium for differentiation with the exteriority and, in this sense, it does not present the tool as an "organic projection" in the manner of Ernst Kapp, whose theory has become so classic that Leroy Gourhan tacitly refers to it. Sigaut, on the other hand,

prefers the role of transforming something in us. As Oscar Wilde says, life imitates art much more than art imitates life. Or, to cite Augustin Berque, our technical externalizations come back to us, at the very least, in a symbolic form.

1.5.3. *Some practical uses of the magic lantern*

Developing the concepts of *techno-mimicry* or *technesthesia* in more detail would be welcome if the framework or rather the focus of this text were not the historical contextualization of projection mapping. This text is therefore limited to not developing them and asks us to accept at this stage that projection mapping can change the way we look at objects, or at least to recognize that we can produce new ideas from projection mapping especially for things that are not projection mapping. For example, using a metaphor to illustrate a complex concept or phenomenon. The *camera obscura* reported on the functioning of the eye for Descartes by going beyond the simple metaphor. In a concise summary, it is suggested that if the image of projection mapping is an image transformed and/or composed to match a "reality", this "reality" also comes to match and transform itself according to projection mapping, in what we want to be a virtuous circle. It then finds common origins with visual tools that, from X-rays to spectroscopy or radioscopy through microscopy or film in slow-motion, etc., have played their role in making knowledge accessible or have been diverted to other areas of interest. Sigismund, the central character of Calderón's *Life is a Dream*, reached a form of wisdom through the ambiguous relationship maintained with the disturbed meaning/feeling of the states of awakening and dreaming. Science became recreational and fun thanks to the magic lanterns of the 18th and 19th Centuries which were used as a teaching aid. They are also used to better understand different scales of life through the magnified projections of microscopic animalcules. They are used as drawing machines and are described in science.

Without modestly dwelling on licentious plates used by the British prostitutes or at the court of Louis XV, it can be noted that the propagandist use of the magic lantern is also remarkable. The Jesuit Kircher proposed using it for religious preaching and the propagation of the faith. "We can demonstrate what we want," Kircher said; projection can be used as a political and social instrument or as an instrument for building identity. To a completely different degree, it was also used for military purposes, particularly during the French Revolution, when projectionist revolutionaries

used lanterns to frighten nobles who were being pursued at night in the woods. It was, in this regard, an Austrian with a dual qualification as a military artificer and image projectionist named Uchatius who would be the first to couple a projector and an animated optical disc in 1853 with his *kinetoscope*. This one would then be part, in addition to the lineage of spectacular fireworks, of *Greek fire* projectors and *fire hoses*, and like mirrors that became "ardent" by Archimedes' trick that made them become legendary weapons. It is not unimaginable that the witches' bonfires during the Inquisition needed some optical devices to legitimize themselves through projections of filthy beings coming out of the fumes emanating from the burning evil bodies. The authors of the 18th Century phantasmagoria criticize their "necromancer" predecessors who were called charlatans and would abuse the credulity of the spectators. Inasmuch as is not the walking lanternists who are accused of pick pocketing in the 19th Century.

1.6. A figure of transgression and juxtaposition with a beyond

1.6.1. *Unconditionality*

There is, however, a use that does not find a temporal framework once we recognize what Kircher called the *summo stupore*: the visual devices that translate the philosophical traditions of illusion and that were used for different purposes all ultimately present a transgressive process that aims to see a *beyond* causing the "greatest astonishment". And, according to one hypothesis, it's probably one of their most timeless features. The desire to innovate, to experiment with new forms and to see oneself as a pioneer has a lot to do with the development of projection mapping. In the late Middle Ages in the 14th Century, Nicole Oresme acknowledged the pleasure of research and discovery in the face of knowledge which has come to a standstill, arguing that it would be better "if something always remained hidden, so that it could be the subject of future investigations". Any attempt at rationalization would itself lead to a chaotic emergence or resistance of the incoherent forms driven out by the same rationalization, surely? A primitive and ritual suspension of the world order could thus be at the root of the video projections transforming the gaze and the expected. At least if we agree to consider projection mapping as a medium that opposes the norm thanks to its ability to shape the pre-existing signifying perception. It will then be placed in the extension of the romanticism movement which is seen by some as a reaction to the philosophies of the Enlightenment that have

failed in the attempt to access the ultimate truth and which aims to rehabilitate the irrational as a means of complementary knowledge.

The 17th Century saw the emergence of various attempts at global systematization at the risk of standardization. But when we chase away the representations of monsters in the so-called major art paintings of this classical period, we find them in the so-called minor framing and arts. It was in this context that Pierre Corneille became interested in the mechanical scenographies of the *Pièces à machines*, which allowed him to escape the control of the theatre practices imposed under Richelieu. This invites us to present projection mapping as part of the forms of artistic renewal that artists will seek and develop to escape the formalized and unsupported codes of their time. Another example: the grotesque Rabelaisian develops in an eschatological context. Thus, despite all the historical investigations undertaken in this text, we could wonder what an art without tradition would represent as a field of freedom! Walking in the green grass of the nearby garden, which no one can claim as his own, is always an ideal.

1.6.2. *Magic image imagery*

But is it always a question of fleeing from a world that is too bland, banal or suffocating with rules, or on the other hand, too little or badly stabilized? It would be wrong to stop at an exclusively emancipatory assessment of "chaos". It is understood that it may be at the opposite end of the spectrum to formalized codes by rejecting the standard, to see itself as a true superior order. Cultures thus value the "world of dreams", which is difficult to control and considered as important as that of awakening. The most famous on this subject are probably the Australian aborigines.

Since Mircea Eliade, shamanism has been recognized as an original form of religion based on a central pillar, namely the belief in a "world-other" inhabited by "spirits". Its access is reserved for initiated characters who can ensure intercession with the "common world". The shaman embodies the figure of transgression and this resilient practice is combined with contemporary and vernacular elements to the point of making historical and geographical specific characteristics a neutralized material. In the Middle Ages, for example, ancient Celtic traditions were extended and disseminated in the 13th Century in particular: they attest that the afterlife is among us, that the space of the dead coexists with that of the living and that both are intertwined despite appearances.

Divinatory practices using the "vision" are therefore also Shaman-like, this term being understood here in the double sense of ocular vision as well as ecstatic vision. Crystal balls, coffee grounds, screen-reading that enable us to read the future in the water or oil of a dish, extispicin or hepatoscopy looking at the entrails of animals are all sacred spaces of revelations and screen protoforms. Some of these can be likened to pareidolias. The Etruscan haruspices looked through the butt of a stick called the *lituus* to interpret the content of the gaze and thus deliver omens. This *templum*, framing a portion of celestial space, would give its name to the sanctuary of the temple that projects it onto the ground. Much later, in the 19th Century, the emerging possibility of remote communication with power tools led some to believe that it would be possible to communicate with the dead using these same tools. Technological spiritism then developed the fashion of magnetism and hypnosis in 18th Century Europe and gave itself the appearance of scientificity by taking inspiration from the establishment of telecommunication networks. These spiritualist phantasmagorias seemed to be accredited in 1895 by the already mentioned fortuitous invention of X-rays revealing the invisible bones of the living.

Seeing living skeletons does not fail to remind us of the phantasmagoria of the 18th Century, but we must also not forget that light already makes objects visible and recall that contemplating light in medieval times is an experience of Truth. In Strasbourg, one of the stained-glass windows projects a green ray precisely on the crucifix of the flesh at each equinox. The projection mapping that sublimates its medium in a luminous material is in harmony with the idea that any element perceptible in the Middle Ages is the luminous mark of an element to which Man cannot have direct access and implies the idea of (internal) harmony between things. The human spirit that offers itself to this radiance called *claritas* goes towards its transcendent cause, which is God. Father Suger was inspired by this anagogical approach in his conception of the cathedral by dazzling the senses of Christians with stained glass, candles, the sparkling golds and stones on which they are reflected. These lights were likely to cause ecstasy according to Suger. Erwin Panofsky would say that he prefigured the exhibitionism of today's film producer or fair organizer.

Luminous glass paste mosaics, some of which contained gold leaf, illuminations in manuscripts or religious icons are other luminous objects preceding the use of projectors. The analogy between projected pixels and the mosaic is quite obvious, but the analogy between projection and religious

icons covered in part with gold may be less so. The icons would have given Véronique's first name from *vera icona* or the "true icon" since, according to the legend, she wiped the face of Christ with a cloth during the Way of the Cross. The icons then form the prototype of holy images from which the invisible but nevertheless luminous puts pressure on the visible.

1.6.3. *Anima*

The Greek word *anima* gives the root of the word animation. It is the art of making a soul or a spirit perceive in objects, drawings, why not groups or spaces: spirits of places or *Genius Loci* as the Romans called them. A German festival in Weimar bears this name and displays projection mapping. In the same category is the legend of the Golem: a mud being is animated by a phylactery on which the word "life" is written and placed in his mouth. The famous legend evokes the way in which an inert thing comes to life thanks to a code extract, just as the programmed digital computer image animates its medium. This legend can be found in the Bible during the creation of Adam and from the *Epic of Atra-hasis* or the *Poem of the Super-Wise* written in about the 18th Century BC.

The Greeks left several legends of animated artificial beings: the giant Talos and other statues of servants of Hephaestus, the sculptors Daedalus and Pygmalion giving life to their sculptures, and the legend of Pandora or that of Prometheus inspiring Frankenstein and Pinocchio. Today's generative electro-informatics systems are also digital environments that make it possible to cause things to emerge and create astonishment thanks to a behavior reminiscent of living things, beyond the mere automation of image creation that they optimize.

1.6.4. *See from a distance*

To close this mystical-magical field and its devices of vision of a *beyond*, it remains to tackle the suppression of distance. Lucien de Samosate, considered as the first author of science fiction, mentions the Selenite people in *Verae Historiae* who have existed since the 1st Century, and who have a universal sound and visual observation system. The latter consists of a well and a mirror above it. In *Alexander Romance*, the medieval bestseller probably written around the 2nd Century, the pharaoh Noctanebo could see

the movement of the ships that came to attack him in a magic cauldron. He could also plunge figurines into the cauldron to sink the ones they represent *in real life* – this probably concerned lecanomancy.

However, lenses and their power to transform vision were known at that time. The oldest found to date is the *Bayard lens* dating from the 8th Century BC. Another one dated 79 BC was found at the Herculaneum in Pompeii. In the 20th Century, Ibn al Haytham spoke of the magnifying power of lenses. His work precedes that on the optics of Robert Grossetete or Roger Bacon which, in the 13th Century, described the telescope. The father and son Jansen would have built the first microscope in 1590. However, the telescope was not marketed until 1608 by Hans Lippershey before being made famous by Galileo in 1609. Would fantastic literature be inspired by it? *Le Berger extravagant*, which could be defined as the French equivalent of the Don Quixote written by Charles Sorel in 1627, presents two "magic mirrors" allowing one to see from a distance and to spy on the private life of his neighbors. He also describes surprising "recording sponges" of sounds. In the 18th Century, Charles-François Tiphaigne de La Roche wrote the novel *Giphantie* in which a people had a globular system with small imperceptible channels connected to the rest of the earth. You can listen and see universally thanks to a wand and a mirror reflecting portions of air reflected by spirits. Jacques Cazotte describes in the *inimitables Prouesses d'Ollivier Marquis d'Edresse* a character who helps the hero by showing him what is happening at Château de Tours at the bottom of a glass of water. Shortly afterwards, Goethe found a magic mirror (*Zauberspiegel*) in *Urfaust*. Then, in a 19th Century that still mixed technical patents and poetry, various authors imagined devices for transmitting images in fantastic stories: Charles Cross, Albert Robida, Edward Bellamy, Didier de Chousy, not to mention the famous Jules Verne.

1.7. The invention of an "empty box" as an image container

Among the optical devices of history, there is one that had a considerable influence on several others that preceded it, to the point that they were devalued or even made almost obsolete when they did not hybridize. This device is the screen, understood as a homogenized, quadrangular, flat and mobile opaque space. One could insist on the format or proportions that have become standardized. How old is it? The question could be just as thorny as the one about the origins of projection mapping, but we cannot avoid it if we

want to understand how it can be considered as a specific medium that has been built or developed over time. It is now appropriate to focus on image carriers with a lack of meaning or expression when no image is apparent.

1.7.1. *Any precursors?*

In mortuary and religious art (altarpieces, stelae, tombs, etc.), in decorated "movable" objects such as tapestries and other decorated or painted sculptures (vases, masks, statues, pirogues, etc.), in architectural ornament known as "real estate" (frescoes, mosaics, bas-reliefs, stained glass windows, etc.), graphic compositions dress or disguise themselves by matching like costumes or masks the material and formal nature of their support, whose function always exceeds the reception of the image, whether they are painted, engraved or sculpted. We will probably find the first occurrences of the mediums strictly dedicated to visual content in the fabrics like banners, coats of arms and blazons. Or in tablets (clay, wax, stucco, wood, stone, etc.) or silks, papyrus, parchments, rolls, codices, books, cards, etc. Were these media nevertheless meaningful, like the Tuareg who use techniques related to the nature of the media to write, while they come from a choice in a range of materials defined by the meaning of the message? Has there been an emergence of what can be described as a neutral container with decontextualized content, such as the museum *white box* or the gallery criticized by *land artists* and conceptual artists?

1.7.2. *Alberti and the invention of the screen*

In the theory of the painter Leon Battista Alberti and his book *De Pictura* dated 1435, there is a description of a "first act" which consists in "drawing a rectangle, of the size that [he] is comfortable with as an open window through which [he] can see the subject". In the Albertian model, the world must be divided into a portion that can then be taken with you: the painting painted on a medium considered as a void. An "intersector veil" structured by a regular orthonormal grid is placed between the observer and what is represented on the board. Alberti reasons that perception is reduced to a pyramid, which reduces sight to a single Cyclops point from which all spatiality receives its determinations. With this observation point and the leakage points of the construction in perspective, it is abstract mathematical entities without surface or thickness that become both the origin and the

horizon of the image. Thanks to this mathematical systematization, we obtain a representation that is intended to be faithful to what is perceived, since "what cannot be grasped by the eye has absolutely nothing to do with the painter". This sentence underlines that for Alberti, no ambition seeks to go beyond the visible. Alberti theorizes a type of image that deliberately ignores its medium by making a nothing or a hole which becomes an "open window". Visual heteronomy then gives way to the abolition of the expression of the medium and the perspective is then imposed in other genres: politics, science, literature, theatre, etc. It determines the relationship to authority and truth. The 15th Century, later described as "modern", produced the visual device that this modernity took as a model for seeing the world. The Albertian window becomes the dominant or even totalitarian visual construction. Until the questioning of this type of construction becomes the basis for a whole section of what will also be called, but in a self-proclaimed way this time – is it ironic? – "Modern art", from the end of the 19th Century and the beginning of the 20th Century.

1.7.3. *The humanistic context of the disruptive object-subject disconnect reified in and through the image*

Behind this somewhat abstruse subtitle lies a hypothetical deduction inspired by speeches by historians, anthropologists or sociologists, on the pivotal moment that saw the screen system unfold. The *modern* inflection in the course of history from the *quattrocento* allowing the Albertian model to develop invites us to consider projection mapping according to the axiological character of this period during which an original framework of thought was built and developed. This framing completes the pictorial framing, forcing nature to flow through an inflexible grid into a preformed conceptual box; Renaissance humanism, built in particular on a base of Greek aesthetics and hermetic esotericism and then marked by the philosophy of enlightenment, leads to a form of devaluation of *non-humans*. In the 16th or 18th Centuries, during the transition from a closed world to an infinite universe, Man came to consider himself as a center, no longer defining himself by links to space or to the objects that surround him. Then, after losing interest in its medium, the image excludes the subject himself on a Cartesian basis of rationality of the "real". Space or objects take place on the other side of a conceptual dividing line drawn between "subject and object" as Bruno Latour says, or between "nature and culture" in Philippe Descola's words. What is not considered human, whether it is of "nature" or

artificial, is seen from the outside which tends to make it a simple source of potential and availability. The asserted rupture with a devalued past doubles this ideology which claims to be progressive. The psychological mode of expression of things is refused as old beliefs to be overcome. The lack of a historical perspective in favor of a predominant understanding of the space of so-called "traditional" cultures, for example, is seen by the West – seeking a pretext for colonization – as a feature of primitivism. This reading in turn generates the contemporary myth of the space devoured by time, or that of the mechanization and objectification of space in an exclusively quantified model that leads to the neutralization of perceptions since it refuses its heterogeneity by arguing the equivalence of the points of which it would be constituted. If the Albertian framework and the theory of perspective develop in this context of "separation" and feed it, today's screen has its origins there and projection mapping would be opposed to it.

1.7.4. *A hypothetical starting point*

Projection mapping could not therefore exist without the institution of the screen perspective which would give it a negative starting point ensuring it is positive. That is, if we agree to put aside what, before the Renaissance, leaves us to suppose predecessors to the Albertian model. The *emblemata* in ancient Greek mosaics are an example. Pliny the Elder also tells us in the 1st Century that the only real painting was wood paintings, and that it had almost disappeared in his time in favor of mural paintings. The well and the mirror of Lucien de Samosate's *Vera historiae* or even the aruspices stick could in turn challenge the idea of an Albertian revolution based on a symbolic disregard for the nature or shape of the painting canvas. It must also be admitted that a totally decontextualized media remains difficult to define theoretically: can an image do without a corresponding surface or a consideration of its space? If it must necessarily agree, this would suggest by pushing the reasoning that projection mapping is nothing more or less than a pleonasm playing the game of an imposture characteristic insofar as everything could be considered as contextual and relational, therefore using "correspondence"! Rem Koolhaas' caricatural aphorism *fuck the context* probably sums up that such an idea is not conceivable. Without further evoking the shared intuition that not every projected image is necessarily projection mapping: what remains to be determined if we want to define clear outlines?

1.8. Modern inflexions: obsolescence of old visual devices and tacit challenges to the Albertian model

We could therefore assume as a prerequisite to defining projection mapping that there is, on the one hand, a visual object that is opaque, closed, folded up on itself, and on the other hand, a transparent, relational or heteronomical object. It is now the dynamics of mutual influences of these two forms that must be observed in terms of the history of their development.

1.8.1. *Obsolescence*

According to the medievalist Paul Zumthor, manuscript painting in the Middle Ages remained "unframed" by remaining "on the same level as the surface on which it was inscribed and could only be understood (even when a decorated line encircled it) in relation to it". The "under-frame" painting, he argues, which covers a visibly delimited geometric surface and separated from the surrounding space by a line, a border or any other linear boundary, will realize its latent values with easel painting in the 14th Century.

It was no different with the wall paintings that punctuate here and there with a significant difference in the regular quadrangles of the frescoes. After having been one of the most practiced modes of expression from Antiquity to the 18th Century, with a passage through a 13th Century which was its most fertile period, the fresco was in turn abandoned in favor of easel painting. From the 17th Century onwards, monumental wall decorations were preferably made on panels or large canvases in frames. The realists and impressionists did not accept this medium, which regained interest in the 20th Century with Masson (Odeon), Chagall (Garnier opera), and Braque (Louvre).

The same applies to sculpture in the West in the 11th and 12th Centuries, which is integrated into the architectural structure of religious buildings. Details and characters are strictly subordinate to its primacy. It took four or five centuries, from the 11th to the 15th Century, to ensure that the sculpted figures had their full tridimensionality, the substantiality of their own space. The sculptor's work will only really break the ties that bind him to his background in the 16th Century. What the base will provide.

It was also at Christmas 1492 that the first confined space theatrical performance took place, to the detriment of processions and outdoor

demonstrations. The live show is then transformed into an animated painting. The mosaic, on the other hand, declined after the capture of Constantinople in 1453 by the Ottomans. As for stained glass, while it became grey in the 14th Century under the influence of Cistercian and Franciscan thought, the search for clarity from the classical period to the 17th and 18th Centuries would lead to its decline after a peak in the 13th Century with the development of the Gothic style and its large bay windows.

1.8.2. *Challenges*

Nonetheless, in a movement that goes beyond Italy alone, mannerism in the 16th Century played very early on with Albertian landmarks in a set of codes and symbols that are often murky, mixing borrowings, quotations and distances with the new humanism. By producing new emotional and artistic effects, this movement deliberately sought to break with the exact proportions or reality of this new Albertian space. Still famous are the *Self-portrait in a Convex Mirror* by Parmigianino (1524) or *The Ambassadors* by Hans Holbein the Younger (1533) which depicts a homographic-type anamorphosis hiding in the foreground, like those commonly used in projection mapping. The meaning of these anamorphoses is probably different from those theorized in the 17th Century by Jean-Louis Vaulezard, for example, which aimed more at highlighting the inaccuracy of the human gaze than at questioning the relationship to authority and truth that the central perspective establishes or supports. From mannerism, the medium no longer seems to make sense beyond its dimensions, except perhaps in still life without great depths that will open the way to trompe-l'oeil where play then fully assumes itself with the medium on which the image is presented. Take, for example, the *Reverse of a Frame Painting* by Cornelis Norbertus Gysbrechts. In Tuscany, from the 12th to the 14th Centuries, the council chambers of municipal palaces and private palaces were enriched by numerous decorative cycles. Giotto provided some of the most beautiful frescoes of this time and the Mannerist movement brought a renewal by treating the frescoes for themselves. By turning towards an unrealistic art such as that of Pontormo, he offered the most elaborate examples of compositions where separately applied paintings, false columns, niches and fictitious openings blended together. In the 18th Century, work on Father Andrea Pozzo's perspective and trompe-l'oeil influenced the whole of Europe. Painting now gave the illusion of sculpture and architecture.

Yet in Baroque, Classicism, Rococo, Neoclassicism, Romanticism, Naturalism, Realism, Pre-Raphaelitism, etc., as well as in Symbolism and Impressionism, framed painting is a reference. From the 17th to the 18th Centuries, painters such as Piranese or Turner brought down the perspective before the Viennese secessionists from Austria at the end of the 19th Century, such as Gustav Klimt and the Symbolist movement with Jean Moréas, reacting against naturalism and academism. In an art that moves away from the description of the material world to devote itself to the sensitive representation of the *Idea* through words, images or sounds, symbolism engages in such a project that it goes hand in hand with a need to decompartmentalize the performing arts that it strongly marks at the turn of the century. The modernity of Cézanne or van Gogh, of impressionism, then changed the artistic scheme so that the coexistence of the various vision regimes of the 20th Century and the various transgressions that followed would take place. Sublimation of matter from a Hegelian perspective on the one hand (Kandinsky, Malevitch, Moholy-Nagy) or materialistic valorization on the other (Masson, Tinguely, Gutaï). Extension of the limits of the table and accession to new dimensions (Tatline, De Stijl, Lissitzky). Fusion in electro-mechanized (Loïe Fuller, futurism). Synesthetic art in order to find a universal language (Bauhaus). Or the search for a *totality* to the point of flirting with the common banal, at the price perhaps of one of the specific features of art. These aesthetic and plastic investigations are as many questions about the Albertian window as we could place in the family tree of projection mapping. Many painters have taken up the medium of animation in order to give their paintings the dimension of time (Léopold Survage, Walter Ruttmann, Hans Richter, Berthold Bartosch, Alexandre Alexeieff, Lotte Reiniger, Oskar Fischinger, Viking Eggeling, Stan Brakhage, Man Ray, Len Lye, etc.) and many stage directors have aimed to give space a plastic presence and autonomy vis-à-vis the text (Adolphe Appia, Caspar Neher, Jo Mielziner, Christian Bérard, Josef Svoboda, Ezio Frigerio, André Acquart, Oskar Schlemmer, Alwin Nikolais, Vsevolod Meyerhold, Edward Gordon Craig, Tadeusz Kantor, etc.).

Just as the details of the 18th Century projective systems that were scientifically described in academies and used as machines to automate drawing or as a pedagogical support were kept aside, it is unfortunately not possible to immerse oneself more in the history of modern and contemporary art here if we want to achieve a reasonably sized text.

1.9. Parastatic scenography

Part of the art history that followed the Renaissance, which began with mannerism, can be read through the prism of the questioning of the codes that Alberti theorized. At the same time, its new screen is spreading in many fields of modern society. The impact is such that other art forms are gradually transformed or lose interest: mosaics, stained glass, wall or manuscript painting, sculpture. The theatre, for its part, locks itself inside and puts itself in perspective, to become the equivalent of a painting, although animated and lively.

1.9.1. *For the eyes: the uncomplicated image*

The words video, projection and mapping do not reveal what the discipline of projection mapping owes to the worlds of entertainment and scenography, which today use it as part of an ancient tradition of dramatic effects. To illustrate the ride of the tetralogy *Der Ring des Nibelungen* in 1876 in Bayreuth, the painter Carl-Emil Doepler, responsible for the costumes, suggested painting glass discs to be projected using a magic lantern. In Paris, they are clouds projected from a transparent disc. The poet Aeschylus, born around 525 BC in Eleusis, where Matt Gatton imagines statues animated by *camera obscura* projections, already introduced the idea of the *Deus Ex Machina* bringing the gods by mechanisms. However, it was in the 16th and 17th Centuries that the original form of the *Pièce à machine* was invented. Pierre Corneille finds with this theatrical type a good alternative to the politically imposed constraints: he wrote in 1650 in *Argument d'Andromède*: "My main goal here was to satisfy the view with the brilliance and diversity of the show, and not to touch the mind with the force of reasoning, or the heart with the delicacy of passion. ... this show is only for the eyes."

The expression "sound and light" is sometimes used today as a clumsy synonym originating from mannerism and is not hesitant to compare it to a renewal of traditional fireworks. Spectacular pyrotechnics appeared in the West at the end of the 16th Century in England and in the 17th Century in France. In the 18th Century, Handel caused traffic jams on carriages for fire and music. In a field close to these sets of lumino-chromatic and sound correspondences, other artists have interpreted or imagined colored music that prefigures the sublimation of the material medium of certain projection

mapping into an intangible visual sound: the mannerist Arcimboldo, followed in the 16th and 18th Centuries by Louis Bertrand Castel, Philippe Rameau, Philipp Telemann, Karl von Eckartshausen, Johann Gottlob Krüger, the Kircher harmony organ, not to be confused with the cat organ, etc. The study of synesthetic experiments continued in the 19th Century with various devices: the psychedelic *kaleidoscope* which became *kaleidophone*, or the *chromatrope of* the 1850s. Thanks to its crank handle, it rotates two metal crowns in opposite directions and projects abstract psychedelic images. It would be followed by *Astrometeoroscope*, *Eidotrope*, *Kaleidotrope*, *Cycloidotrope*, etc. The *Liquid light show* of the 1970s then marked the *New Age* period.

1.9.2. *Living presences and images*

Sebastiano Serlio, born in 1475, is said to have been the first to use the word scenography. From the 16th to the 18th Century, Niccolo Sabbatini, Giacomo Torelli and Ferdinando Galli da Bibiena were names that marked this art form in its early days. Galli da Bibiena designs sets whose piranesian vehemence proposes vertiginous abysses, in infinite corridors that raise doubts about a total mimetic subjection to an Albertian rational perception. On stage follow the famous phantasmagoria of the 18th Century, in which the dead appear as skeletons or ghosts. They are part of a long tradition of thaumaturgic performance, including Chinese shadows that are at least 15 centuries old. François Dominique Seraphin, around 1772, is said to be one of the first to produce this type of "Chinese shadow" show in France. Félicien Trewey between 19th and 20th Centuries would follow the same tradition.

After the introduction of shadow shows by Seraphin, the escape point immersed in infinite optical feedback proposed by Galli da Bibiena would turn like a glove from the 1780s onwards into immersive panoramas. They updated the large format architectural ornament of the spatialized visual sequences contained in the tapestries, mosaics, wall paintings, sculptures or low reliefs mentioned above in a radically concave and curly form. In 1781, Philippe-Jacques de Loutherbourg animated what are still called panoramas, but they were framed and in a more modest format: paintings were presented successively accompanied by plays of light such as the small mechanical theatre of mirrors and pulleys that he called *Eidophusikon*. Louis Daguerre, in 1822, created the "diorama" which developed this principle in a show of

skillful combination of painting and lighting. They produce a striking illusion on the viewer. Other "myorama" or "moving panorama" were produced between 1810 and 1880. John Banvard, with his "georama", and Moses Gompertz remain prominent names for these scrolling paintings, as is the *Grand Moving Panorama Of Pilgrim's Progress* of 1850, which is 800 feet long by 8 feet high.

In the engravings that represent these moving panoramas, we notice men who manipulate the images in public view or who bring a vocal complement. This was also done in Japanese cinemas from the early days of cinema until the 1930s with the *Benshis*. The latter commented, repeated the dialogues, and read the title cards to the illiterate public. The well-known and acclaimed benshis attracted more crowds than the actors, directors or films themselves. As early as the 18th Century, the great organizer of the Duc d'Orléans' celebrations, Louis Carrogis, known as Louis de Carmontelle, played improvised and interactive comedies before taking his characters for a walk in projections from transparencies. We can also recall that until about 1907, the system of representation of "primitive" cinema was based on the presence of actors. They performed for an audience as if they were in the theatre and the style was strictly frontal. At that time, the space between the cinema and the screen was so separated that viewers could react, come and go while keeping a psychological distance from the cinematographic narrative.

In the same vein, the word *cartoon*, which means "caricature", reminds us that many of the animators at the beginning of the cartoon come from the press cartoon: Georges Méliès, James Stuart Blackton, Émile Cohl, and others. The press demands a clear line and a speed of execution that has allowed them to weave a link between animation and the world of live performance to give the *chalk-talk* or "talk with a chalk" and the *lights sketches* or "flash drawings". During these shows, a cartoonist on stage caricatured people on a blackboard with chalk. Winsor McCay performed on stage in vaudeville like this and invented *Gertie*, a dinosaur projected on a scale of 1:1 with which he showed himself in a trick training sequence.

1.9.3. *From the screen to film*

Although Émile Reynaud invented "optical theatre" in 1889 and its multiple manipulations of images that are performative in nature, he did not

inspire many of the animators who would follow. The latter are more influenced by *flip-books*, which are more widely distributed. These small objects, also called "folioscopes", extend a line of screen objects. Smaller in size than the large moving panoramas, Chinese illuminated scrolls were imported to Japan in the 6th Century. They take the name of *emaki*. Long strip of 50 centimeters high and proto-animate which are then unrolled, they gave the famous scrolls of the *Qing Ming Ming Festival*, that of the *Birds and Animals* or that of *Grand Councilor Tomo no Yoshio* in the 13th Century during the Song dynasty.

Another plausible ancestor of the *flip-book* is the book of Heidelberg illuminations painted in 1558: it preserves an identical framing throughout its pages. The sequences of narrative images then took the form of discs of optical toys: the "thaumatrope" (John Hershel and John Ayrton Paris 1825), "phenakistoscope" (Joseph Plateau 1832), "zootrope" (William George Horner 1834), *flip-book* or "flipbook" (Pierre-Hubert Desvignes around 1860), "kineograph" (John Barnes Linnett 1866), "chorentoscope" (Lionel Beale 1866), or finally the "praxinoscope" (Émile Reynaud 1876) to which Émile Reynaud added a projector in 1880.

These images became the film space in the cinema. But after about 1907, this space no longer functioned as a backdrop for the theatre. The viewer was then placed in the fictional universe of the story: he or she is asked to identify with the characters by living the story from their points of view, having the best possible distance and angle in each shot. The spectator then finds himself inside a space that does not really exist, or rather that no longer communicates with reality, but becomes so through a skillful play of variations in the frame and the temporal montage of images. Paradoxically enough, however, the editing theories of the Russians Koulechov and Eisenstein in the 1920s were influenced by dance for the former and probably by the stage director Meyerhold for the latter. The living spectacle, problematizing in a living way the relationships between humans, had begun to question and integrate within itself what the techniques generate in these relationships. The cinema projector has not escaped this; and as a fair return, the fixed shot theatrical form abandoned by cinema would see a return 100 years later with projection mapping, whose material device, however, differs very little from that of cinema.

1.10. From expedition to investigation

1.10.1. *Resilience*

Projection mapping often bears the hallmark of innovation and technological progress. It is sometimes used to stage the idea of modernity or a vision of the future, and it does so in contrast to traditional screen writing such as cinema, television, or computer and phone screens. However, these latter can be seen as more recent devices than the projection mapping device. If it is sometimes described as avant-garde art or exposed to stage rhetoric of openness to the future, would it be described as hyper-modern, alter-modern or pre-modern when combined with a historical study? Is projection mapping an innovation or a redesign of a type of image that had been devalued? From our expedition, we learned two contradictory things and tried to solve this problem by presenting a figure of timeless transgression. This recognizes both the historical continuity of a practice through the renewed rupture that allows otherness and astonishment.

Would projection mapping be able to synthesize the Albertian window with the above? On the one hand, it contests the Albertian construction in its exclusive graphic elaborations while refusing, in favor of visual heteronomy, the autonomy of an image inaugurated in the modern paradigm of nature/culture or object/subject divide in the West. On the other hand, however, it also extends this construction by being part of a contemporary proliferation of screens and by using the perspectivist theory used in some trompe-l'oeil plays.

Looking too much at changes, evolutions or differences, the risk would be to neglect invariants: it is perhaps not the many innovations that matter in history, but why one or the other has managed to maintain prominence and how it has spread. Projection mapping confuses its origin with that of known pictorial representations and with the human predisposition to transform bodies. It is part of the traditional ritual space-time inversion to be observed in the light of post-colonial anthropology. It would therefore be a living and resilient form that suggests that by repeating itself it has returned in an original form, or will do so again in the future. Following this hypothesis, projection mapping would be a cross actualization with the digital and electronic technologies of the timeless spectrum of the median and moving figure that marks the passages from interiority to exteriority and vice versa. This figure, nourished by the field of tension caused by a desire for

emancipation that is sometimes incompatible with attachments that contrast with it, has never ceased to produce hybrids, of which projection mapping is a part, as soon as it is studied in its aesthetic dimensions. And projection mapping would then in turn configure the sensitive experience, which remains to be studied.

1.10.2. *Ongoing investigation*

After moving from X-rays or micro/tele/scopes lenses to the automation of figurative image production, from the worlds of personal or collective dreams to data visualization or science didactics, it emerged from the understanding of this collection that projection mapping is more than an expression tool and can also be considered as a visual device that has developed, and which promises in this form to show new things. It now requires a detailed and methodical analysis beyond this speculative basis.

This chapter of history did not cover ethnographic discourses, nor the development of projection mapping from the perspective of the fairground equipment, which, nonetheless, as with cinema, was of considerable importance. Many details on the movements of modern art during the transition to the 20th Century are also lacking, as well as the so-called post-modern movements from the 1960s onwards such as land art, street art, contextual art, the psychogeography of situationism, the art of installation, etc., which nevertheless find their place in a projection mapping genealogy. We also did not focus on the encounters between electronic devices and artists starting from the same period: cybernetic art, video art, digital scenography, etc. Finally, we would benefit from retracing the way in which the expressions "video" or "projection mapping" were claimed after the 2000s, in particular through tutorials, *software* or *hardware* tools, distribution spaces and creative bodies. We therefore leave the matter, which questions the reasons for the rise of "video mapping", open as of 2008.

In addition, from a desired second part to this historical introduction, beginning in the 20th Century, the three axes envisaged for the extension of our work are as follows: first, to identify and define as best as possible what projection mapping is in terms of the realities it covers today. Second, describe what it consists of and how it is produced from a systemic perspective. Third, what are and how can we describe the original phenomena it produces? The contributions to be followed in this book cover some of the issues raised by these three axes.

1.11. Conclusion

To approach the answer to the question of the origin of projection mapping one last time, I will confine myself to repeating what the new media theorist Lev Manovich noted, for whom the industrial production mode would have meant that cinema has replaced other spatialized narrative modes with a sequential narrative. It is the fact of obeying the logic of breaking down a task into a series of elementary operations performed one by one, says Manovich, that has meant that the coexistence of images has not been systematically explored from the very beginning of cinema, with a few notable exceptions, such as the *splitscreen* used by Abel Gance, the *expanded cinema movement* of the 1960s or Émile Radok's *diapolyecran*, on display at the Czech pavilion of the 1967 World Expo. With Edward Soya, Manovitch notes that "the decline in the imaginary conception of space and the spatial conception of social analysis coincides with the rise of the paradigm of historical consciousness in the second half of the 19th Century. It was only with the rise of ideas such as "geopolitics" and "globalization" that these approaches were able to return during the last decades of the 20th Century". But with the computer and screen as it has been designed since 1970, each pixel corresponds to a memory box that must be activated by the program. The logic of a single image/screen breaks down and the computer interface then begins to use multiple visualization windows from which Manovich draws perspectives that we can take for ourselves: "We can logically expect computer-assisted cinema to follow this path", and "when it happens, the tradition of spatial narrative that 20th Century cinema had suppressed will be reborn".

1.12. References

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