

A VIRTUAL ITINERARY FOR A REAL EXPERIENCE. THE FRESCOES OF THE CHAPEL OF THE MAGI IN PALAZZO MEDICI RICCARDI, FLORENCE

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Abstract

A Virtual itinerary for a real experience is an idea based on the virtual reproduction of the fresco of the Procession of the Magi painted by Benozzo Gozzoli in Palazzo Medici in Florence, in its original dimensions and spatial configuration, which was presented at the Digital Heritage International Congress in Granada in 2015.

The installation stems from an approach to Cultural Heritage communication, that sets the visitor at the centre of the design process, as both recipient and agent of cultural transmission. In this vision, cognitive science and the concept of affordance play a crucial role in defining a multimedia set that promotes a primary mechanism of cognition embedded in the human beings, the perceptive-motory method to help visitors approach and understand art through a natural form of integrated aesthetic experience.

Keywords

Multimedia, Design, Cognitive Science, Affordance, Perception



Fig. 2: The Chapel of the Magi in Palazzo Medici Riccardi, Florence

1. *The enlightened Medici patronage*

The enlightened Medici patronage on works of intellect, poetry, painting, music, architecture and scenic design, nurtured a skilful use of the arts, which have always also been a means of communication. At that time, the chapel of the Magi in Palazzo Medici Riccardi (Florence) was the heart of the palace, chosen as the ending point for the most illustrious guests and a worthy introduction to the powerful Medici family and the city of Florence.

Currently, while working on the multimedia transmission of this information, we can exploit recent studies on cognitive sciences, with the support of psychology and neurophysiology.

Moreover, Medici court attracted the best minds of the period, intellectuals of all kinds as well as artists who, working in liaison on human cognition and perception, gave rise to the Renaissance. A new cultural field, that became a *morphic* field, capable of transforming those who enter in its sphere. Every work of art has its own *morphic* field – made of systems of relations



Fig. 2: Palazzo Medici and Palazzo Medici Riccardi in the seventeenth century (top); The original volumes of the Chapel (bottom)

among elements, nodes, formal and semantic structures on different planes of storytelling – which tends to set up a subject/object relation. We can move through the work of art, following the movement that guides us in that field, coming into contact with the elements that allow us to “recognise” something and stir our emotions¹, triggering a cognitive process.

For this reason, a virtual set experience is proposed. In this virtual set, standing observers are on a level with the frescoes – about 1.5 m from the ground – enabling them to feel that they are part of the magnificent cortège. This fosters a better contact with the work of art and transports us from the sacred subject to the reality of fifteenth-century Florence, where we can indeed recognise portraits of the Medici and of their famous guests, allies and associates.

¹ An *affordance* is an action possibility formed by the relationship between an agent and its environment. The term was coined by the perceptual psychologist James J. Gibson. The *perceptive-motory* mechanism is without doubt the one that has been around the longest and is the that becomes the most wee-developed over the course of our lifetimes, and in this sense the most powerful. F. Antinucci in *eCulture: Cultural Content in the Digital Age* (Alfredo M. Ronchi ed.), Springer. Daniel Goleman, cognitive psychologist and Professor of Psychology at Harvard, has elaborated the theory of “Emotional intelligence”

1.1 The Chapel of Palazzo Medici Riccardi

The chapel of Palazzo Medici is one of the most evocative places of the Florentine Renaissance. The area is divided into two almost perfect square rooms; the main room walls are covered with the frescoes by Benozzo Gozzoli, portraying the *Procession of the Magi*, while the wooden choir stalls are attributed to Giuliano da Sangallo. The *scarsella* is at a higher level and contains the altar, with a panel painting of the *Adoration of the Child*².

The reconstruction of the original spaces is conceived to take into consideration and work with the bodily movements favoured during the experience of the volumes. This relates to the original symmetric structure of the Chapel and the clockwise rotation of the body, as Benozzo suggests in the main aula, with the procession of the Magi, which develops over three walls from left to right with a linear progression. The first panel on the east wall shows the beginning of the procession with the king Gaspar. He represents

² The *Adoration of the Child* that can be referred to the workshop of Filippo Lippi, a contemporary copy of the original altarpiece by Filippo Lippi himself, is now in the State museums of Berlin.

youth and the dominant colour is white; in the landscape are scenes of hunting with prey that flee and hide. The second king, Balthasar, on the south wall, represents maturity; the cortège unwinds in the foreground and the dominant colour is green, with woods and well-tended, cultivated landscapes. The third king represents old age on the west wall and his colour is red. The cortège winds up steeply on the right, and features a quantity of baggage which did not appear at the beginning, while certain actions appear to come to completion, such as an animal succumbing to the hunt.

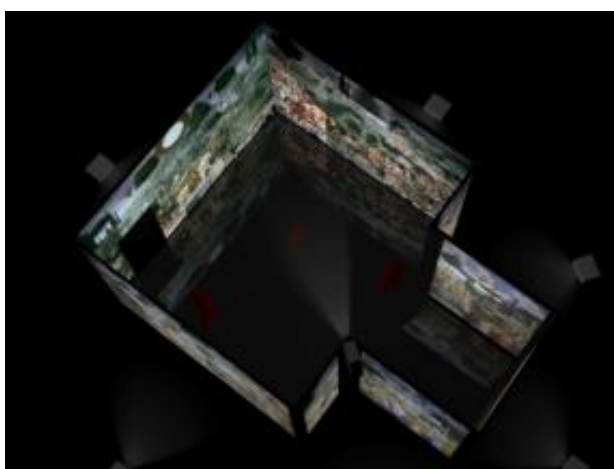


Fig. 3: The original configuration

1.2 *The Chapel, nowadays and once*

The project also shows how the Chapel was transformed in the Baroque period. After the palazzo became the property of the Riccardi family (1659) the renovation and expansion of the residence which was undertaken involved demolishing part of the chapel to create a monumental staircase designed by Giovan Battista Foggini. To gain this space, and build the top of the staircase on the first floor, the western front of the vestibule was knocked down and the wall structure of the chapel in the main aula was altered. Part of the frescoed plaster from the western wall (comprising the hindquarters of Melchior's horse and several squires) was transferred to the new wall. The portions of the fifteenth-century fresco, that were lost, were replaced by a pictorial integration by an unknown artist, who imitated the landscape by Benozzo Gozzoli.

The virtual installation is designed to show how we see the fresco today, after these

traumatic alterations and how it appeared at the time of the Medici splendour.

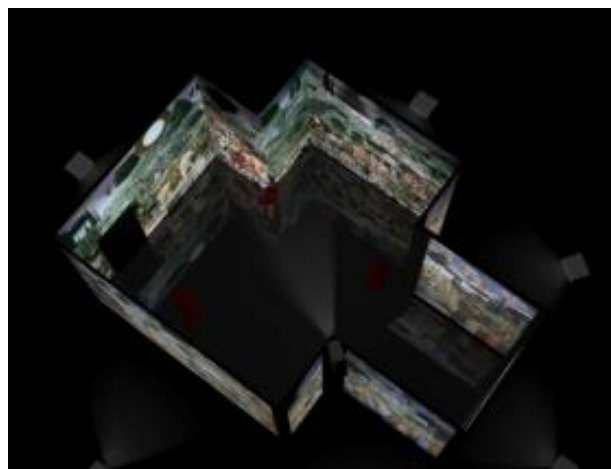


Fig. 4: Today configuration

2. *Virtual itinerary of Benozzo Gozzoli's frescoes in the time*

To support this work of art, a specific technological and immersive setting has been planned. A full-ranged video projection and a dynamic interactive narration are the core content of such multimedia experience. The immersive video projection is managed by an interactive playback system, made of multiple projectors, that allow users to virtually enter the fresco and look around themselves, admiring the Renaissance atmosphere.

The software developed has a powerful and personalized panel that controls the system effects, the timing, volumes and others parameters that manage the interactivity of this virtual environment. Furthermore, the software has included all the features for multi projectors calibration (such as geometrical and softedge blending in the overlap areas).

The software permits an efficient and flexible manipulation of multimedia contents. It is also possible: to integrate different interactive devices, as infrared sensors (like Microsoft Kinect or Leap Motion), aimed at providing a multi-scaled effect; to work with the audio/video data flow, at the same time (for this reason, one simple webcam can become a helpful device for a complex interaction). Ultimately, the flexibility of the software guarantees a wide range of scalability, both in terms of modularity and adaptability of the overall installation to various environmental solutions. In the full-equipped solution (fresco's

virtual reproduction at 1:1 scale), the projection runs all around the user and the virtually painted walls are rear projection screens.

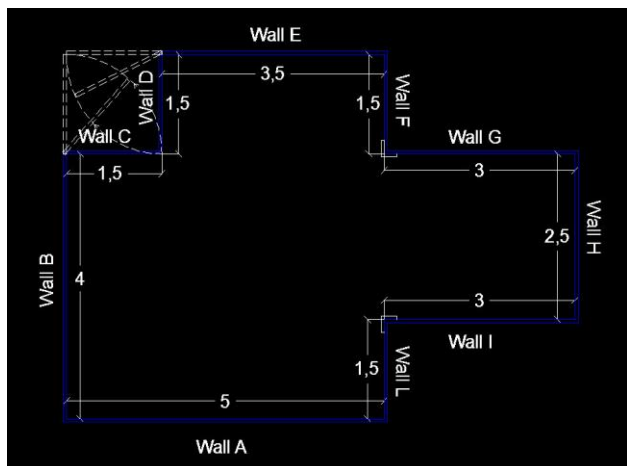


Fig. 5: Plan

The dimension of the complete projected surface is around 100 sqm. Three different interactive systems, are placed into the interactive area together with the devices, located all around the upper border of the structure and invisible to the user. Only the audio/video feedback of the scenography announces the connection among the user and the artwork. The following solution can be even foreseen with other special configuration, according to the space availability, the available equipment and its characteristic, the budget and the immersive effect we want to reach.

3. The full-ranged video projection: three interactive installations

3.1 First interaction system: user action / 3D inverse mapping on moving surface

The first interactive system is a 3D inverse mapping on moving surface. The user is invited to move the wall D e wall E, changing the configuration of the angle. The projected images are connected to the movements of the walls and the software operates a blending between two images recomposing the fresco in two different time periods. The combination of movements' detection and the inverse mapping technique is a innovative way to project contents onto a scene in motion.



Fig. 6: The angle in change by the users in the virtual set

3.2 The original sound

The realisation of the music for the exploration of Benozzo Gozzoli's chapel is based on the general consideration that the sound structures, used to underscore the perception of the different parts of the fresco, should contain certain features related with the image content. Lelio Camilleri of Tempo Reale composed five soundtracks specifically for the Chapel. The five musical tracks are divided into three profane and two sacred, following the pictorial cycle itself, each being proposed during fruition of the part it refers to.

3.3 Second interaction system: user presence / Sound

The second moment of interaction is located in the area dedicated to the "angels' adoration". Here is located a second sound system that is used to play the dedicated audio. More are the users and highest is the volume and therefore the perception of the angels. The presence is linked to the number of the users attending the scene, the timing of the visit and also the "sound" of the silence (signal of attention and interest) of visitors. A webcam with a microphone is used to create this effect. The use of Kinect could increase the precision of the estimation.

Thanks to a background "suppression effect" and using a simple webcam, it is possible to evaluate the space occupied by visitors and their persistence. The presence of the users in the area is connected with the volume of a dedicated sound system.

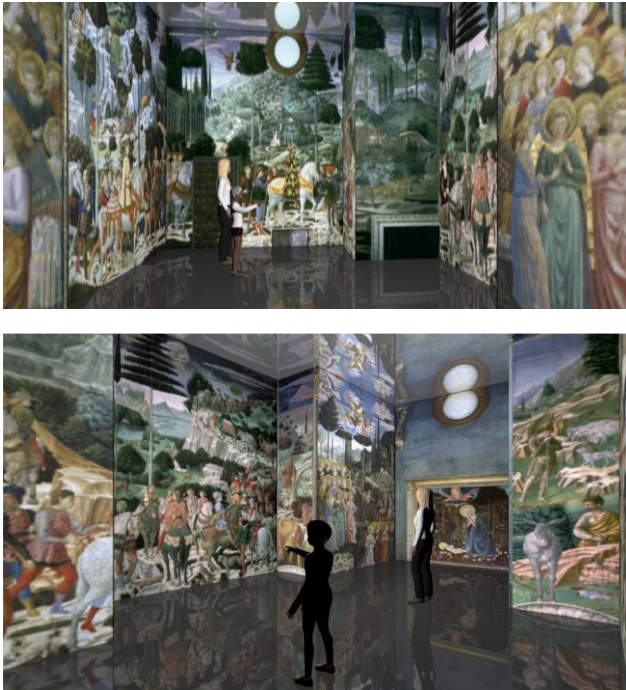


Fig. 7: The designed virtual set

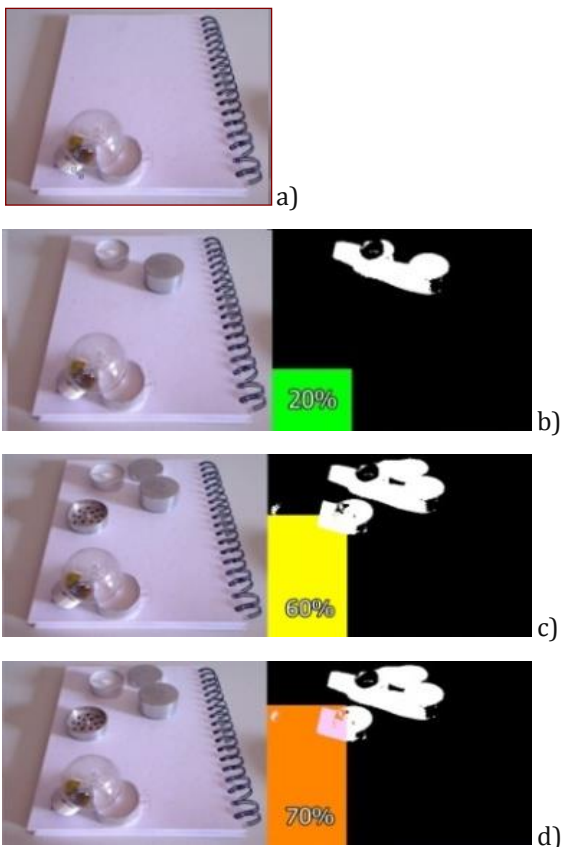


Fig. 8: Users/Sound Interaction using a webcam: a) Empty Area (background images); b) c) d) the % of volume is linked to the user presence



Fig. 9: The Sacello

3.4 Third interaction system: user's Gesture / Real-Time Video mixing

The third interaction system is activated by the presence of a user in front of the wall and it becomes an interactive video wall: a real time video mixing of the contents is activated through simple gestures. Starting from the image of the original fresco, the user can activate a series of animation or zooming on the images, making the storytelling a real personalized interactive experience. As to obtain this effect, a Kinect (or a Leap Motion sensor) is positioned in the upper part of the wall to intercept the users and to recognize their gestures.

The feedback here is divided in two parts, initially the user is intercepted and invited to interact by some animations and sounds. The second part of interaction takes care of the switch among the videos, following the action and the direction of interest suggested by the user. In this way, the participants have the chance to become part of the magnificent cortège, implementing their own modes of perception in natural way.

3.5 Immersive and interactive video-projection: Space/Structure Requirement

The walls are rear projection screens and they are supported by a dedicated structure. The devices and the tracking systems are located on the upper border of the structure. One projector is located above the structure, the others are on the ground. The dimensions of the interior space (solution with scale 1:1) is 8 m x 5,5 m and 3,7 m height. In order to enable the movement of the walls C and D, two different mechanisms can be chosen: a) hinges (Fig. 11) to rotate the walls around the pivots or b) rails to slide them. (Fig. 12).

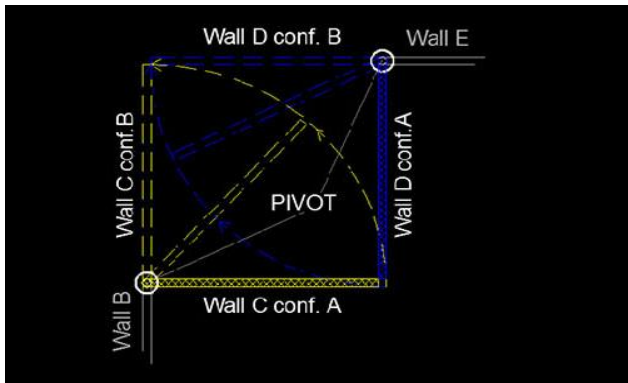


Fig. 10: Wall movements - sol. A

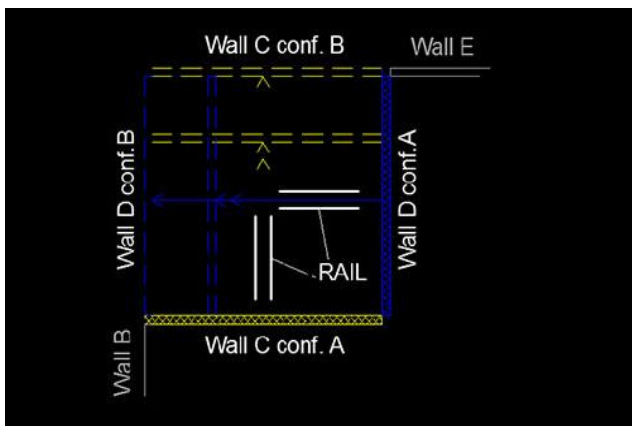


Fig. 11: Wall movements - sol. B

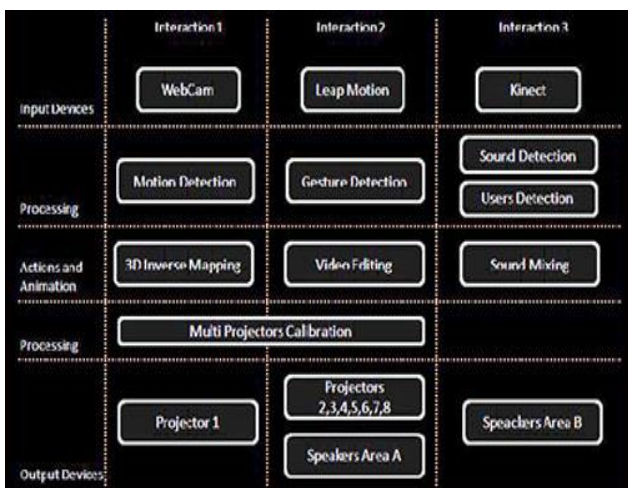


Fig. 12: Possible combination of technologies to used in the interactive applications

3.6 Software Requirements

The system has the following software requirements:

- OS Microsoft Windows 7 or next
- vvvv³ (32 bit)

3.7 Hardware Requirement

The system requirement consists of the following hardware components:

- #2 PC, with NVIDIA graphic Card, Surround 5.1 Sound Card, LAN Ethernet
- #1 Microsoft Kinect v.1/v.2
- #2 Webcam HD
- #1 Leap Motion
- #6 Projectors - Ultra Short Throw Lensm
- #1 Projector - Short Throw Lens
- #1 Router Wireless m
- #1 Surround Sound (5.1) Speakers
- #1 Stereo Sound Speakers

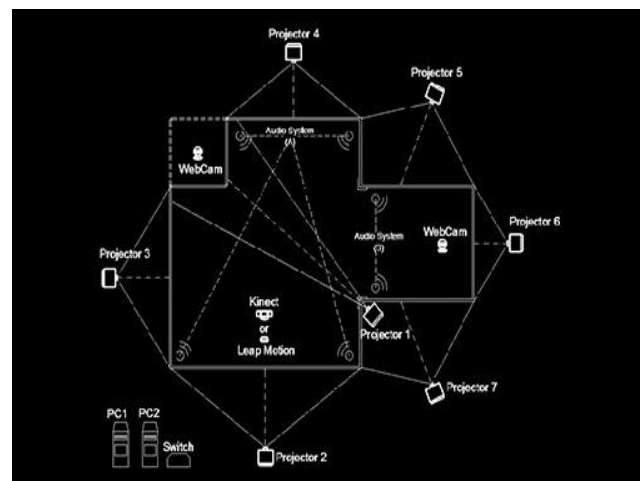


Fig. 13: hardware components

³ vvvv is a hybrid visual/textual live-programming environment for easy prototyping and development. It is designed to facilitate the handling of large media environments with physical interfaces, real-time motion graphics, audio and video that can interact with many users simultaneously. Responsible for its development is the vvvv group. (<http://vvvv.org/>).



Fig. 14: The first king Gaspar in the Procession of the Magi

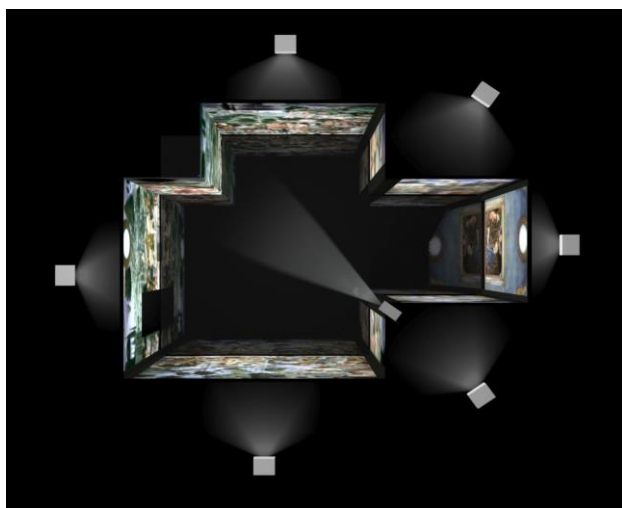


Fig. 15: scheme projectors

4. Procession of the Magi

The Procession of the Magi develops in a temporal continuum of cause/effect that generates a series of reflections and resonances with individual experience and guides our perception in the “field” of the artwork. Through the movement of our eyes and the bodily reaction the artist conducts us physically towards the relation between the elements that make up the work, as endorsed by contemporary psychoneurophysiology⁴. The recent discovery of mirror neurons⁵ is also particularly illuminating, if we

⁴ Psychoneurophysiology analyzes the relationship between body and mind

⁵ Mirror neurons are a class of neurons that are selectively activated both when we perform an action and when we

focus on the phenomenon of relation between the subject and the observed datum. We can therefore replicate the posture, the expressions and the looks. In this way we draw information from the work of art that we are contemplating and “...this comprehension appears to be devoid of any reflexive, conceptual and/or linguistic mediation, since it is based solely on that dictionary of actions and motor knowledge on which our very capacity for action depends.

According to psycho-physiological studies: “space [...] does not exist in itself but is the product of an active process of organisation of all the sensory information.” We can therefore see “how space derives from posture and how posture is organised in relation to a series of spatial, structural operations, such as the organisation of the visual space. [...] then [...] the organisation of the sensorial experiences is connected in a circular manner with the organisation of posture and [...] the concreteness of sensory-perceptive events does not relate solely to corporeal events but to events proper to a body in spatial relation.”

observe it, while performed by someone else. The neurons of the observer “mirror” what is taking place in the mind of the person being watched, as if the observer himself were performing the action, the motor areas corresponding to those muscles are activated in our brain. In 1995, using transcranial magnetic stimulation, Vittorio Gallese, Luciano Fadiga, Leonardo Fogassi, Giovanni Pavesi and Giacomo Rizzolatti demonstrated that the motor cortex of man is stimulated by observing the actions and movements of other people.

5. Conclusions

With the proposed Virtual Installation, visitors have the chance to become part of the magnificent cortège and identify themselves in the elements relating to the time, implementing their own modes of perception up to the point of finding themselves in the presence of their relation with the epiphany -the intuition, the new information that emerges for everyone in a special way, which is independent of religion but connected with human life.

Benozzo Gozzoli's work, acts as a diachronic and synchronic time machine in a guided perception of the chapel that explores the uniqueness of the relation between the different subjects perceiving the work of art and the way in which they become an integral part of its meaning in relation to human life.

In the main aula, where the human space and dimension are represented, the procession of the Magi develops over three walls from left to right with a linear temporal progression.

Having reached the space of the altar the dimension changes, everything happens at once. The choirs of angels are facing towards the altar and celebrate the Epiphany; here visitors are in the dimension of the spirit and there is neither itinerary nor cause-effect. Synchronous and one. In the same way, in a phenomenological relationship with the work of art, what we recognise in it is revealed in ourselves.



Fig. 17: The Epiphany

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