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Augmented Heritage for enhancing the cultural assets: Lights and sounds for the Nijmegen's Königorgel

Augmented Heritage per la per la valorizzazione dei beni culturali. Suoni e luci per il Königorgel di Nijmegen

This essay wants to deal with the well-known potentialities of augmented reality — as video mapping — for the requalification of the cultural heritage thanks to the "Augmented Heritage" of a case study promoted by Studio Glowarp. The subject matter of the research was the 18th century Königorgel pipe organ of Saint Steven's Church in Nijmegen (Holland). The one- hour audio-video performance, occurred on 9th of September 2014, thanks to the use of multimedia techniques, has got two purposes: attracting the youngest to classical concerts of organ and in the meanwhile promoting the Königorgel, known as symbol of city identity.

Il contributo si pone l'obiettivo di favorire una riflessione sulle potenzialità della realtà aumentata – nello specifico del video mapping – nell'ambito della valorizzazione e riqualificazione dei beni culturali attraverso la descrizione di una particolare esperienza realizzata dallo Studio Glowarp per l'organo settecentesco König della Chiesa di San Steven in Nijmegen, Olanda. La performance audio-visiva della durata di circa un'ora, svoltasi il 9 settembre 2014, attraverso l'utilizzo di tecniche multimediali si è posta una duplice finalità: attrarre i più giovani verso i concerti classici d'organo e contestualmente favorire la valorizzazione del Königorgel, considerato il simbolo della città e dell'identità cittadina.

Keywords: video mapping, enhancement, augmented reality, Cultural Heritage, edutainment

Parole chiave: *video mapping, valorizzazione, Augmented Heritage, Cultural Heritage, edutainment*

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1. INTRODUCTION

Sometimes happens that the historical Cultural Heritage, often because considering as 'classic', seems 'invisible' to the city consciousness. In that cases, the Augmented Reality, through the surfaces transformation, when is used in a performing way, can turn that perception, making its Cultural Heritage again present, so that it is recognized as part of its community.
Starting from this point of view, the paper wants to introduce the potentialities of the augmented reality- in particular of video mapping- for the promotion or rather the 'requalification' of the cultural heritage describing the multimedia Studio Glowarp's performance for the enhancing of the 18th century Königorgel pipe organ of Saint Steven's Church in Nijmegen, Holland.
This was the general goal of the one-hour audio-video performance, occurred on 9th of September 2014, that, thanks to the use of multimedia techniques, had got two purposes: attracting the youngest to classical concerts of organ and in the the meanwhile promoting the Königorgel, known as symbol of city identity.

KÖNIGORGEL PIPE ORGAN OF SAINT STEVEN'S CHURCH IN NIJMEGEN

The ancient [1] Church dedicated to Saint Steven (Fig.1), Stevenskerk in Dutch, today is used for concerts, exhibitions, festivals and one time a week a mass is celebrated on Sunday. It is set into the city of Nijmegen, the eldest city in the Netherlands, very active and sensitive to the spread of the new artistic techniques since many years.
Stevenskerk is keeper of four pipe organs, three of them have already the status of national monument and the Königorgel (Fig.2), one of the biggest and most important organ of the Netherlands, is one of the identity-making landmark of the city. The organ, realized between 1773 and 1776 by Cologne organ manufacturer Ludvig Koning, was inaugurated during a mess on 15th of September 1776. Due to the collapse of one of the two church towers during an air raid in 1944, it was strongly damaged and in 1974 was restored respecting its original aspect, and it started again to play only in 1998 when it was tuned.
The organ was decorated with neoclassical sculptures by Johan Keerbergen from Rotterdam, representing women who are playing violins, little angels, leaves, wreathes of gold and shining colors and the coat of arms of the city, represented by a two- headed eagle, in materials that want to imitate the marble (Fig.3)
It is made of three-hand keyboards, a pedal, 54 ranges and 3600 organ pipes that produce, pushed keys being equal, a very complex sounds symphony, a true mini orchestra [3]. But, its extraordinary complexity is partially hidden because the major part of the pipes and inner working operations are inside the organ.
In addition, the wooden church vaults help creating a perfect acoustic space that makes the organ sounds warmer and lends the notes a unique timbre perfectly linked to the space.

2. FROM THE PROJECT TO THE PERFORMANCE

THE PROJECT

The project for the performance [4] of a so particular object needed not only that everybody followed strictly a well- defined program but also it had to be founded on the respect of all its values, especially considering that it is a symbol of the city identity. So, the performance was built step by step, together with the data capture, and as mutually agreed with the organ players to define the best methods and the fairest purposes.
Actually, the best place for an organ concert is behind the organ, due to an acoustic rule, because the auricle amplifies the sound. During the performance, this acoustic rule was destroyed, because the aim was to create an audio-video performance, so the audience sight had to be pointed to the organ.
The show did not have to attract only a public that already knew and liked the organ performance that probably would have been there independently from the exhibition, but particularly a younger audience, that generally does not take part to such a 'traditional' appointment.
The first breaking point from the tradition was the playlist for the performance, selected in order to attract different audience targets. The success of the art installation was possible especially thanks to the coop-

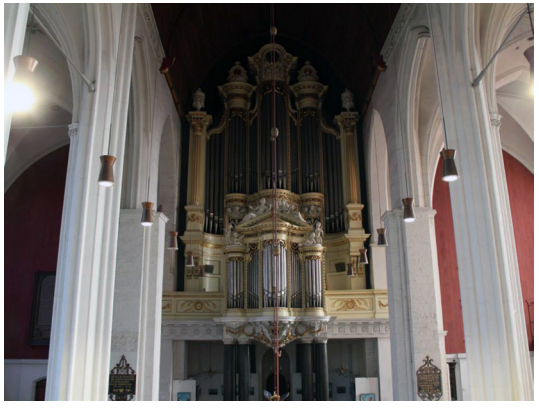

Fig. 1. Stevenskerk, included in the buildings of the historical centre, Nijmegen, Netherlands.

Fig. 2. Königorgel in Stevenskerk, Nijmegen, Netherlands.

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eration of two of the most esteemed and well known Dutch organ players Jetty Podt and Berry Van Berkum [5] [6], who performed the live pieces.
The application of the Augmented Reality (Milgram et al., 1994), meant as video mapping (Maniello, 2014), was useful for the success of the project and appreciated from the organ players, who shared the choice of it as expressive means: in a similar way, as mutually agreed, the pieces were selected, choosing to proceed as to create a "climax", from a mild to a more lively rhythm [8]. The design of the visual contents was developed starting from this rhythmic path, the central idea of the narration: every time the rhythm of the pieces became lively, little by little simple visual monochromes increased, becoming more and more marked.
One of the biggest challenge was the transformation of the melodies in digital self- generating narration through the use of the real time audio track originated from the organ: it was a live performance, so the synchrony of all the parts of the music-video "stage machine" had to be perfect, no hesitations allowed, and it could be possible only if there was a real cooperation of both the équipes.
The actual difficulties for staging the performance, added to the great expectation on the event [9], increased by the media resonance, imposed a tighten check for the success of the project, a four step program that coincided with four meetings with all the involved subjects. The organ players took part at the first three meetings while the last one, organized ten days before the inauguration, was attended by the organizers of the event and some Nijmegen's prominent personalities. This step by step planning allowed a more and more increasing participation of the local community, that actively worked for the staging and the success of the performance.
The cooperation between the different équipes, especially the one composed by the organ players, was possible thanks to the use of scale models (prints of the organ in three-dimensional representation Fig.5) where were projected the digital visual content while the different pieces were played. Aware that the live performance would have infused amplified chromatisms and emotions, due to the dimension and the overlap of the real organ with the video colors, this kind of working




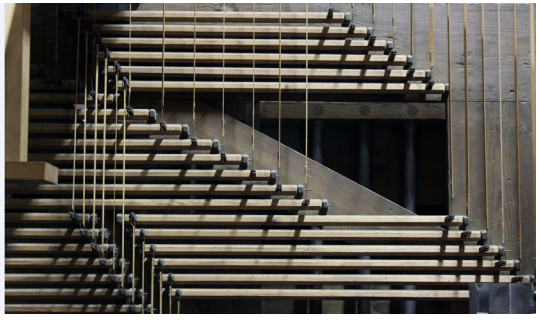

Fig. 3. Sculptural details of Königorgel in Stevenskerk, Nijmegen, Netherlands.
Fig. 4. Details inside the Königorgel in Stevenskerk, Nijmegen, Netherlands.

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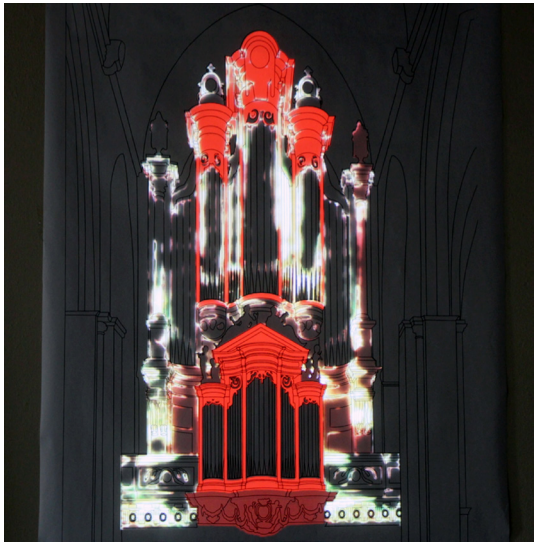
Fig. 5. Projection on a printed sheet for the simulation of the performance.



permitted to all the équipes to check in the better way all the designed contents and all their connections.

APPLIED TECHNOLOGIES AND CRITICAL ISSUES

The applied technology is the common one used for the augmented reality (Raskar et al.,1998). The previous outdoor and indoor experiences used in archeological and museum contexts (Maniello, 2015), allowed to solve the problem related to the spatial data capture, architecture and the organ, using the strengthened mapping techniques and defining new ad hoc solutions.
The recreation of the organ details (8.8 meters of width by 10 meters of height Fig.6), using a 1024x768 px resolution that depended from the projector used [10], was of course one of the most problematic issue. Moreover, the choice of the beamer was taken considering different factors such as the dimension of the place where was set the performance (fig.7), its brightness, its distance from the audience, the rendering fastness, the budget for the rent. The final decision of putting the projector at a distance of 25 meters from the organ and lifting it at 2.20 meters from the floor, while the organ was at about 4 meters from the ground, was chosen to allow the audience of having a full vision free of barriers, also beyond the organ, that could include also a part of the aisles and of the wooden roof.
The main working phases of the design project were the identification of the project area, the choice of the beamer taking care of the viewpoint, the ansilumen, the resolution, the contrast and the format, the organ scanning using a structured-light 2D scanner[11] and the cleaning of the image noise (Fig.8), the definition of the level masks (Fig.9); the 3D model processing (Fig.10); the 2D and 3D animations, the interaction with the audio in a self-generating mode; the warping for the overlapping of the real and virtual models during the beaming (Fig.11).
The file, that contains more than 1200 level masks, was used as base for the creation of the 3D model and for the videos that derived from the masks. The audio-video interaction in real time during the evening of the performance was obtained getting the sound

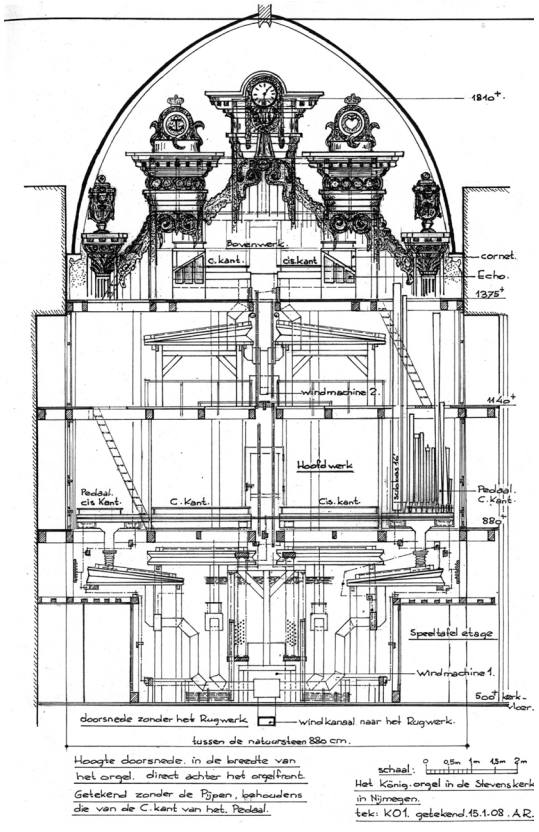


Fig. 6. Dimensioned drawing of Königorgel.

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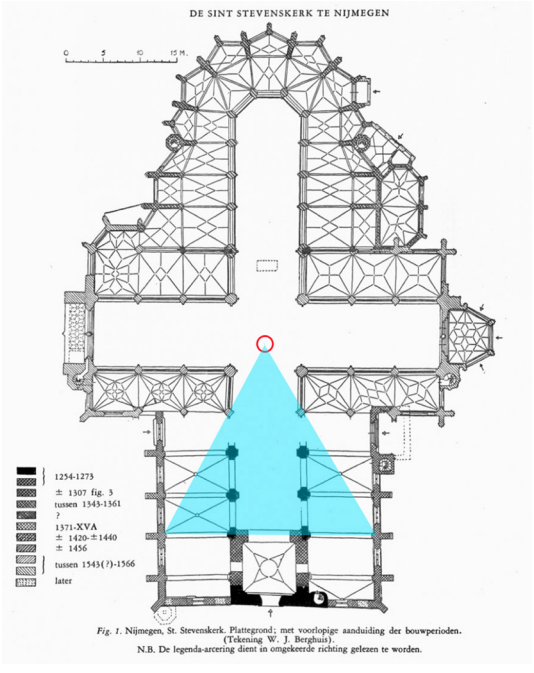

Fig. 1. Nijmegen, St. Stevenskerk. Plattegrond; met voorlopige aanduiding der bouwperioden. (Tekening W. J. Berghuis).
N.B. De legenda-arcering dient in omgekeerde richting gelezen te worden.

Fig. 7. Map of the Stevenskerk, with the indication of the area of intervention.

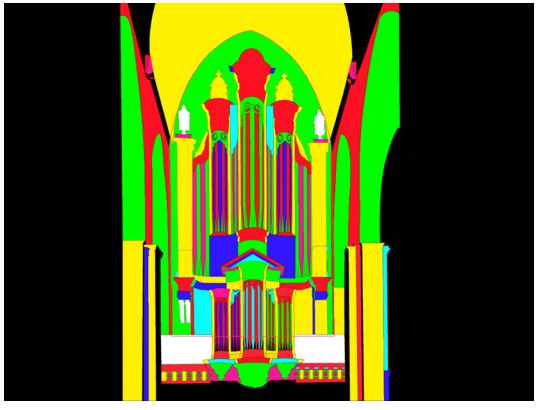

Fig. 8. The result of the 2D scanning with structured light and the following cleaning of the noise from image.

Fig. 9. Layer masks at the project resolution of 1024x768 in 4:3 with reference to the 2D structured light image.

from a microphone put at 3 meters from the ground and placed between the organ and the control location. All the sound volumes were used to create visual effects, possible only thanks to specific programs that also were essential for the final show and the warping, allowing the adaptation of the visual model to the real one(Fig.12).

NARRATIVE CONTENTS AND PERCEPTIVE OUTCOMES

The aim of the project was to explore the debate potentialities between space, technologies and the narrative structures, that were visual structures that supported the sound and vice versa, where “the plurality of the technological and communicative devices available during the planning phase led to develop a series of exhibition models which boosted the levels of the story” (Trocchianesi, 2014). This kind of approach allows to the performance user of undergoing a multilevel experience to explore unusual codes: self-generating videos and post-production video contents turned the cultural heritage space into a ‘didactic space’, giving it new values and/or meanings. More generally, this new proposal aims at the upgrade of the traditional vision of the performance and cultural enhancement, using tools and technologies that ‘include’ the space of culture and ‘turn’ it in media (Manovich, 2011), breaking

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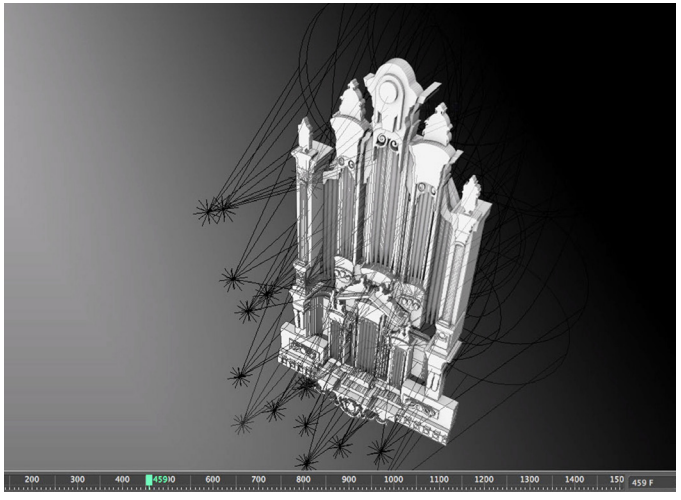
the usual vision linked to the concept of Heritage. Exploring the details of the narrative contents, the digital videos follow a general concept that is linked to the colors in a psychological feature; for example for John Sebastian Bach's Air we used all the shades of blue to recall the calm and harmony of the second movement Suite n.3 in major D (Fig.13). Then, going along with a 'crescendo' musical rhythm, the performance was organized in three different series, where at the beginning the visual contents were characterized by simple forms and monochrome then gradually they became more complex and polychrome. During this 'crescendo' of colors and forms, the audience discovered the architecture of the organ and its powerful three-dimensionality, showing its details gradually (Fig.14). The three dimensional contents, such as the light and shadow effects, the decomposition and re-composition, are used to emphasize exact moments of the acoustic performance, while the full and empties spaces, realized thanks to specific level masks, produced different levels of depth (Fig.15). Generally, the project wanted to generate into the public an estrangement effect since the beginning of the performance, so the audience was immediately lost into a flowing of images and sounds coming from all the directions. The viewer had the task of recollecting all the info, interacting with the performance that once turning the surfaces in 'hypersurfaces' or temporary 'media interactive facades' (Monteverdi, 2015), to produce a total and synesthetic involvement. The Andrew Darchey's concept of "the aesthetic of the surfaces"(Darley,2006), referring to the described project, helped to implement not only a music performance and a visual representation, but a real audio-video synesthesia, that had not the effect of blending but of creating 'intertextuality' (Monteverdi, 2013) where each of the two register enhances the complementary one. When the augmented reality techniques are used in a performing way, such as in this case study, the viewer becomes actor and becomes part of the performance, interacting with the cultural heritage, using the surfaces as means of cultural re-appropriation. A new mode of use that allowed the visual set-up of giving a new

Fig. 10. 3D model obtained from layer masks..



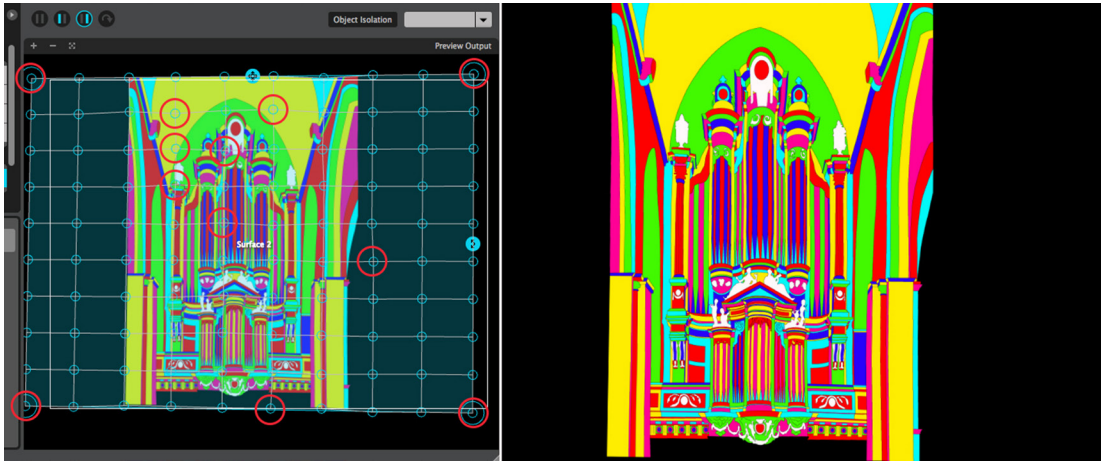


Fig. 11. Warping with matrix subdivision 9 x 9. The red circles indicate the necessary movements to get the overlap between real and virtual model.

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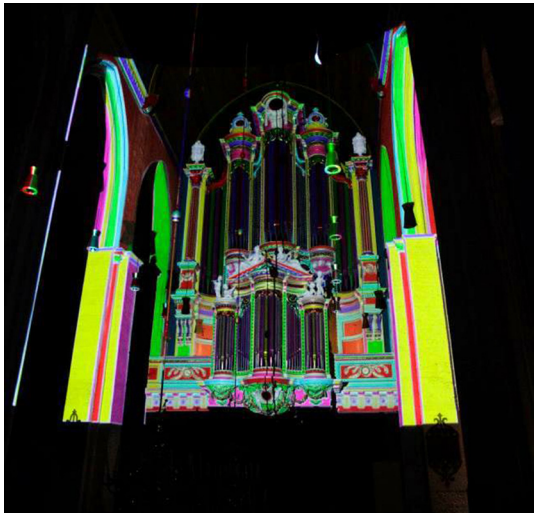


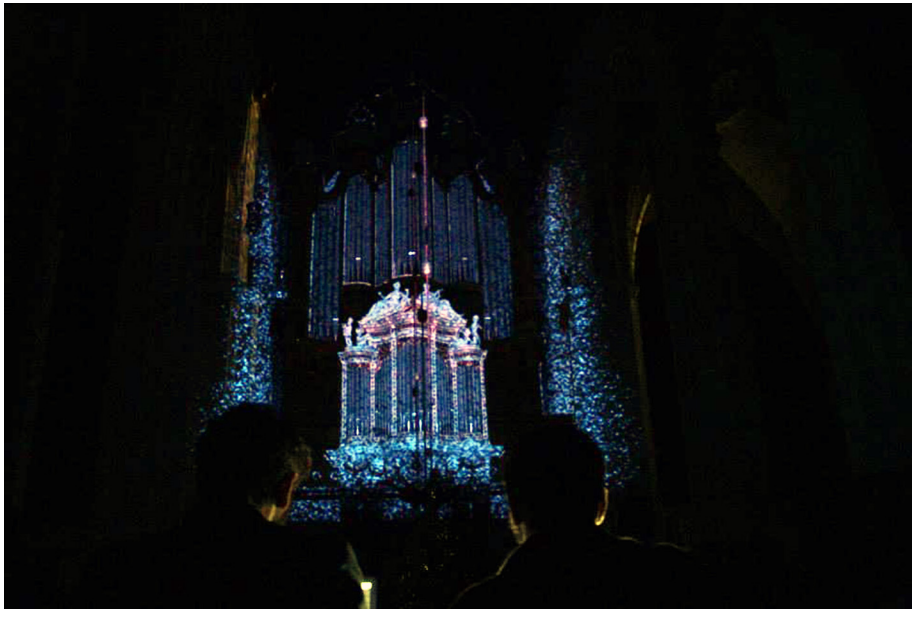
Fig. 12. The screening tests to establish the overlap between the three-dimensional object to the layer masks.

Fig. 13. The predominant color during the execution of the Air of Johann Sebastian Bach.

meaning to the Koenigorgel, following a new aesthetic manner, with an a alienating but addictive effect, obtained from the addition of multimedia contents beamed on the organ that for the occasion was a big screen, creating new art forms and dimensions. The interaction between the actual object and its virtual part was aimed at the 'emotional enhancement' of the cultural good in order to contribute to the re-actualization of its value a renewed inclusion as symbol of city identity.
An experience that coincides with a new vision of the cultural heritage where the citizen is the main subject of this new purpose, as defined by UNESCO Convention for the protection of the intangible cultural heritage in 2003, and by the European Council Convention about the cultural heritage value for the societies in 2005.

3. CONCLUSIONS

The multimedia and multidisciplinary approach of this immersive performance, both visual and musical, allowed us to reach our general goals: attracting a young audience and the enhancing of a symbolic cultural heritage of the city. But we realized also other specific aims, for example the use of the goods for a didactic purpose (the performance was filmed and recorded[13]) and the development of a responsible tourism interested in a modern and performing enhancement, even if always linked to special events.
It is everywhere well known that the use of the Augmented Reality into public spaces is one of the best and efficient communicative way; used in many areas for several years, today is finding application especially in museums as means of edutainment (Cirafici et al.,2016; Maniello, Amoretti, 2016). This kind of experience demonstrates how it is necessary to proceed following accurate and exact design and pro-



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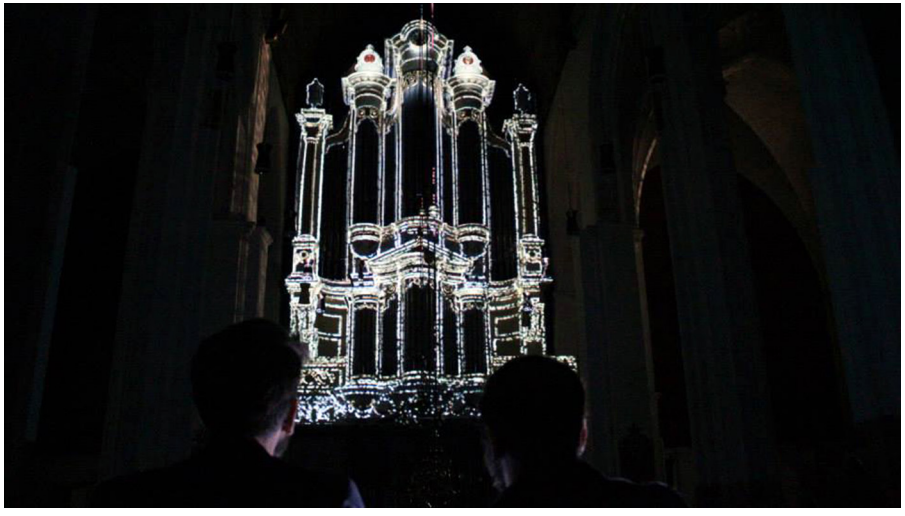

duction methods when we are talking about Cultural Heritage. Only on the base of these requirements, the augmented heritage can be an effective method of enhancement of the cultural heritage allowing the user of these visual and digital stories to make own the proposed experience and to interact with the cultural asset. The visual and musical contents that overlap the real cultural good evoke the fantasies of the public, that actually originates from the real good, to establish tangible relations, increasing the perception of its value and giving it new and present meanings.
The described performance, due to its temporary and unenduring nature, has the effect of arousing the viewer perception of being part of a not repeating moment, giving a unique character to the experience. An approach where the technology permits to live not only an experience by coming into a direct contact with the object-cultural asset, but also that cannot be achieved individually but together with others.
During the performance we are naturally led to share opinions and feelings with the people who are making our same experience in that space, overcoming that sense of alienation and isolation that inevitably some other technologies produce. In this way are used " the creative resources of the art to prevent that the technology reduces our memory to a database and to reconnect it to an emotional and narrative dimension" (Balzola e Rosa, 2011), turning the performing act into a spectacular action and giving untapped potentialities to the cultural elements which are reinterpreted and exploited. So, the 'space' is decisive in giving character and uniqueness to the performance / scenic action, while the responsibility to take part in the revitalization of Cultural Heritage is given to the community.
The installation / performance / scenic action becomes a tool for analyzing and re-appropriation of the places, involving the whole environment and causing a change due to the contamination of a different number of artistic disciplines (Fiore and Ruzza, 2013).

Fig. 14. The 3D effect stroke that enhances the essentiality of forms emphasizing the main constructive lines of the organ.

Fig. 15. Full and empty spaces, resulting with specific layer masks between the foreground (black) and the background layer.

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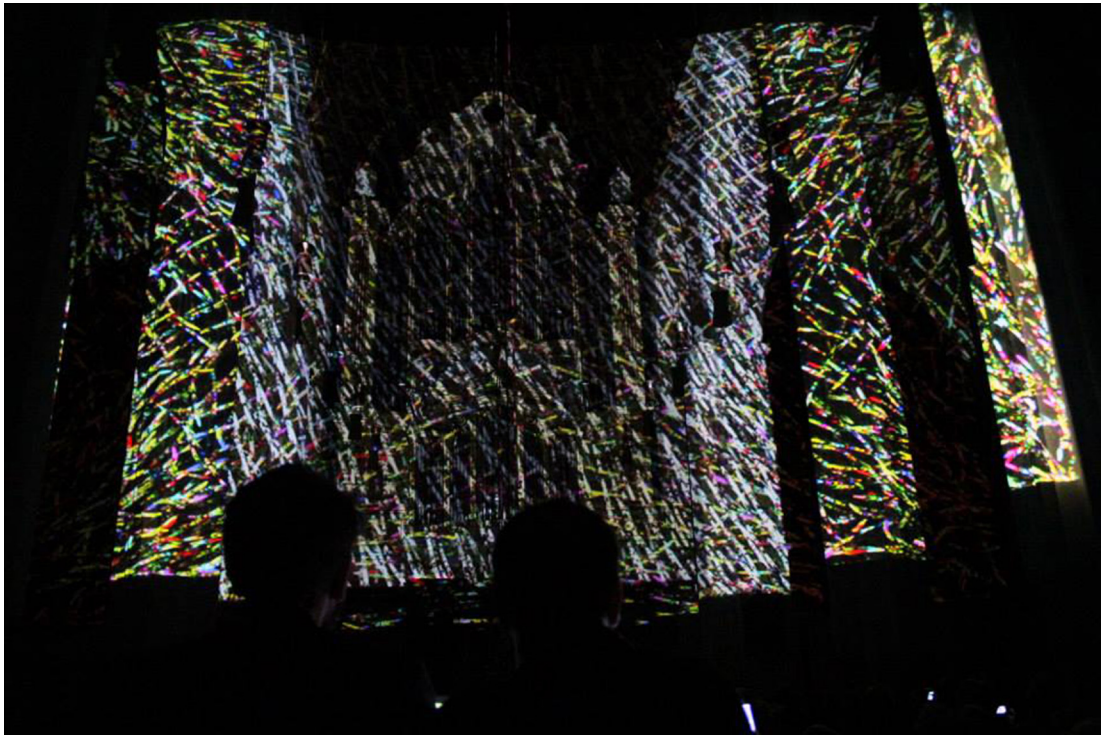

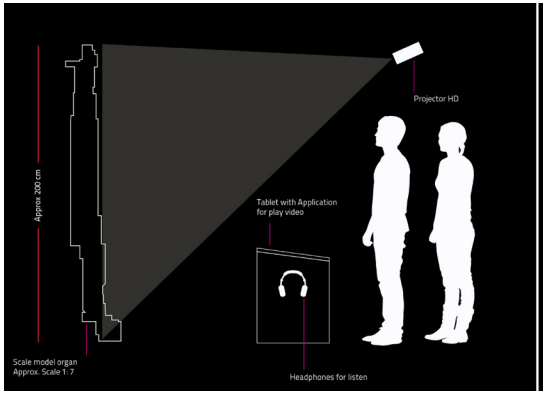

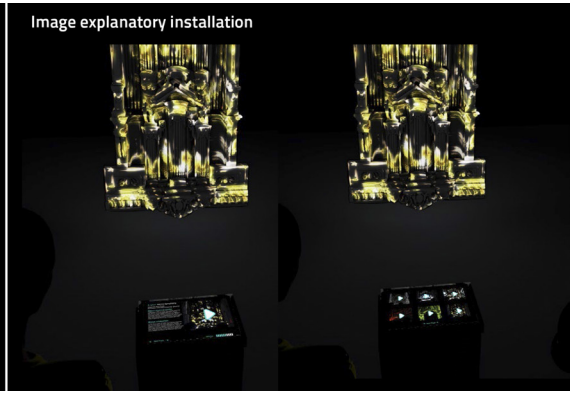

Fig. 16. Video effects during the execution of Birds, drums & signals – improvisatie, of Willem Tanke (1959), an improvisation with sound emphasized by the use of a second organ in this church, the Koororgel. Note the video projection beyond the structure of the organ.

Fig. 17. The figure shows an installation designed to make available the cultural knowledge of the organ once finished the event. For this purpose has been proposed the realization of a multimedia totem that was not realized. The project was composed of the model of organ, in scale 1:10, printable in 3D and with the video projections activated by users via a touch screen.

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NOTES

[1] The construction of the church began in the middle of 14th century; in 1273 the church was consecrated to Alberto Magno, bishop of Cologne; its visual uniqueness is limited today by the buildings that enveloped it;

[2] Assendelftorgel (ca.1750), Konigorgel (1773-1776), Koororgel (ca.1700), Clerinxorgel (1848), only the last one is not a national monument;

[3] The organ sound extension is potentially the widest of all the music instruments, since there are some organs capable of overcoming the ten octave;

[4] The first instrumental multimedia performance was documented by the Antivj group, pioneers of video mapping. In 2010 in occasion of the Mapping Festival at Saint Gervais in Ginevra they realized St Gervais an audio visual performance. The music, electronic and played by the organ, was played live while the monochromatic visuals were beamed on the organ, of very modest size, and on a part of the surrounding architecture (Cfr. http://www.antivj.com/st.gervais/)

[5] , www.berryvanberkum.nl

[6] Jetty Podt, together with Berry Van Berkum and Joost Langeveld, is one of the Stevenskerk organ players, known for their organ music performances for children and families, such as Alice in Orgelland and Onraad in Orgelland.

[7]The success of the event and its realization was possible in particular thanks to the Oddstream Festival, the A.I.R and the Nijmeegse Orgelkring Foundation.

The Oddstream Festival, in charge of the technical part and instrumental supporting, has the spread of the multimedia and digital arts as main goal. In 2012 the Studio-Glowarp design studio was invited by the Oddstream festival to curate together with the foundation a video mapping installation on the ruins of Barbarossa's mausoleum (Cfr. https://vimeo.com/54276300).

A.I.R., acronym of Artist in Residence, is a project conceived and organized by the city of Nijmegen where a 'special guest' was invited for a two-month stay with the purpose of starting a cooperation project with the organization, and where the community can take part through public events. The overall aim of A.I.R. Besiendershuis is to achieve high-quality cultural programs useful to the spread of the culture of the city of Nijmegen beyond its borders. The Glowarp Studio was host of this project (Cfr. www.besiendershuis.com/resident-14-orgelkringoddstream-glowarp).

The Nijmeegse Orgelkring Foundation organizes Koenigorgel concerts between June and September. The described performance was part of this program (Cfr. www.nijmeegse-orgelkring.nl/index.php/de-orgels/het-koenigorgel).

[8] Einleitung aus der Dante- Symphonie- F.Listz (1811-1886)- M.Duruflé (1902-1986), AIR- J.S. Bach (1685-1750), Shalom-Toon Hagen (1959), Passacaglia-Jan Welmers (1937), Aus tiefer Not-M.Reger (1873-1916), Birds,drums & signals-improvisatie-Willem Tanke (1959), Litanie for Organ- Jan Welmers (1937).

[9] The performance had a great audience success, 600 paying persons, the limit imposed by the authorities for safety reasons.

[10]A video projector, being equal the ansilumen but with a higher resolution, would have a higher cost. That is why it opted for the projector Panasonic PTEX 16 k, weighing 46 kg with throw ratio of 0.8f / 2.6, 1024x768 XGA 2500: 1 contrast and 4: 3 ratio. At a distance of 25 meters, the projected image was of 31.2 meters by 23.4 meters of height.

[11] The structured-light scanning is a three-dimensional detection technique that uses a video projector, a camera and a computer, and projects a pattern directly on the surface of the object obtaining a 2D image. The processed image, projected back from the optical center of the projector, will be comparable, after some corrections during the warping phase, with the object on which there will be the screening.

[12] The projection of the files that contain the level masks allows the warping operations because it permits to identify the architectonic elements on the base of their color group and modifying them to have the closest overlapping of the actual object and its visual model.

[13] For watching the video of the event cfr. www.glowarp.com/portfolio_82-organo-nimega.html.

[14] Such as the Glowfestival (www.glowfestival.it) created and realized in Ostuni (Br) by the Glowarp design studio where the Augmented Reality technique is used outdoor and indoor as tool for the enhancement of cultural heritage not sufficiently exploited.

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