THE SARCOPHAGUS OF THE SPOUSES

Etruscan Cultural Heritage

At the Villa Giulia National Etruscan Museum, Rome,
the History of Bologna Museum Genus Bononiae
and the Civic Archaeological Museum of Bologna;
Exhibit embedded in audiovisual storytelling
with 3D mapping environment and holograpy ...

FF Role/ Responsibility: New Media Design Adviser
& Project management (Creative&Tech); design and
development of exhibit installation, virtual storytelling ...
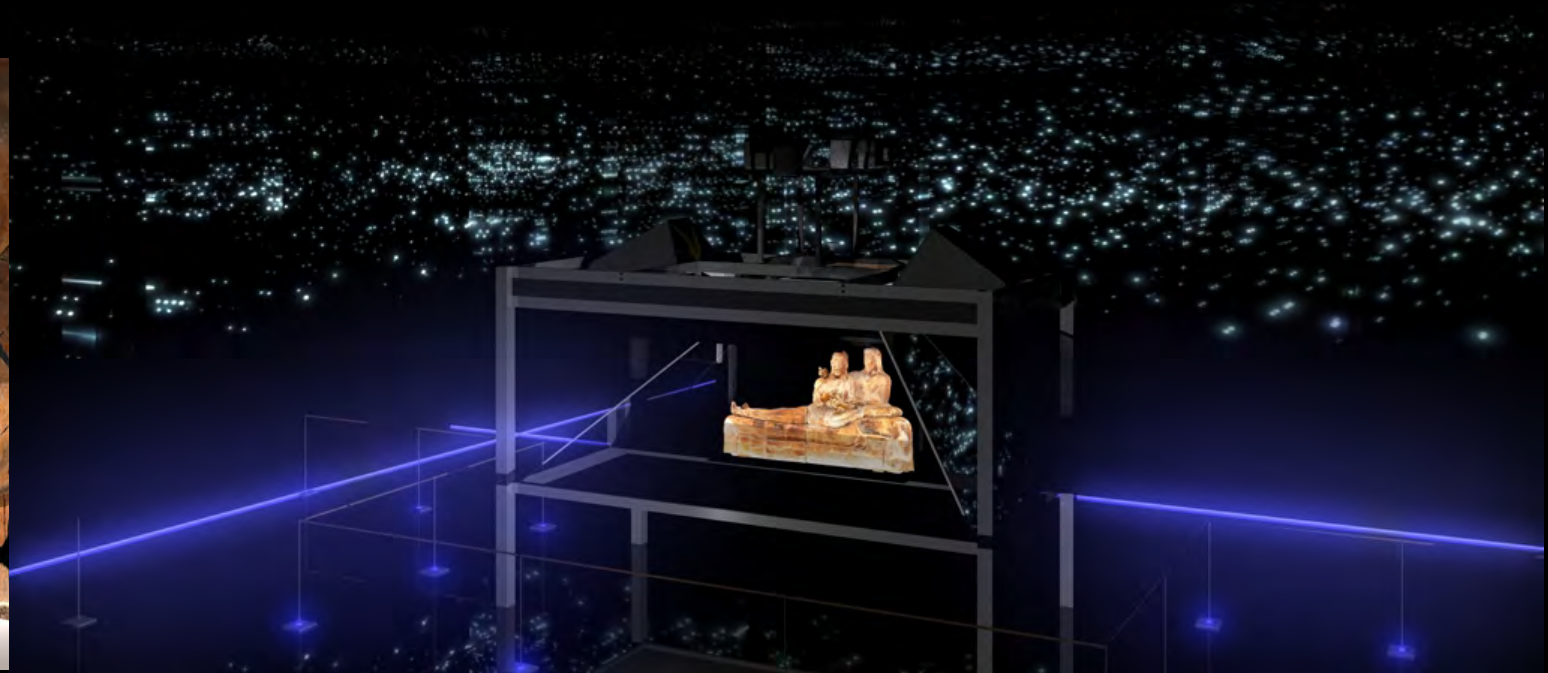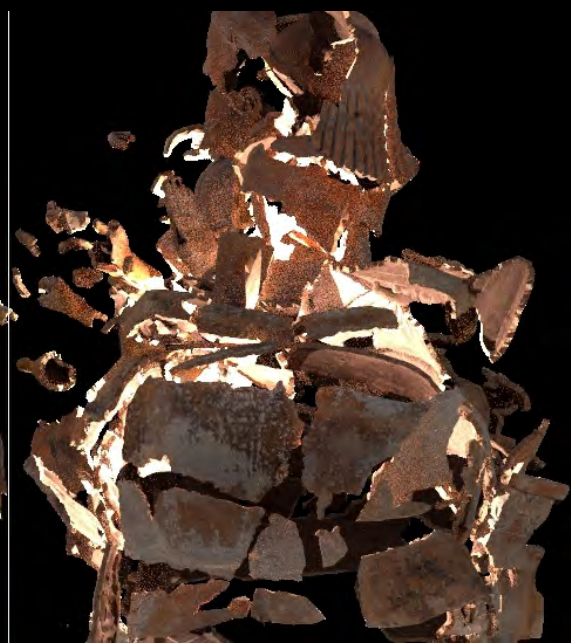

GENUS BONONIAE
MUSEI NELLA CITTÀ

Il viaggio oltre la vita.

Reconstructing the past at the museum of the history of Bologna
Creating a three-sided hologram and 3D video projection
using 10 Panasonic laser projectors
https://business.panasonic.fi/visual-system/sarcophagus-of-the-spouses-case-study

Lnks
https://www.glietruschielaldila.it/
https://www.glietruschielaldila.it/il-sarcofago-degli-sposi
https://www.glietruschielaldila.it/news/mostra-il-viaggio-oltre-la-vita-gli-etruschi-e-laldil%C3%A0-tra-capolavori-e-realt%C3%A0-virtuale
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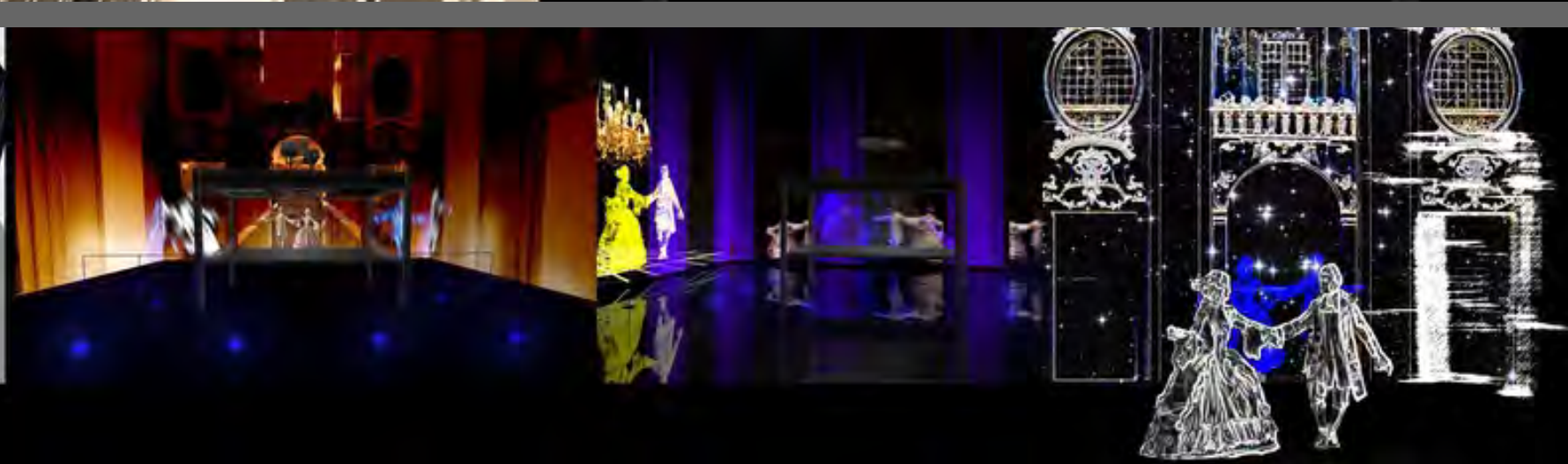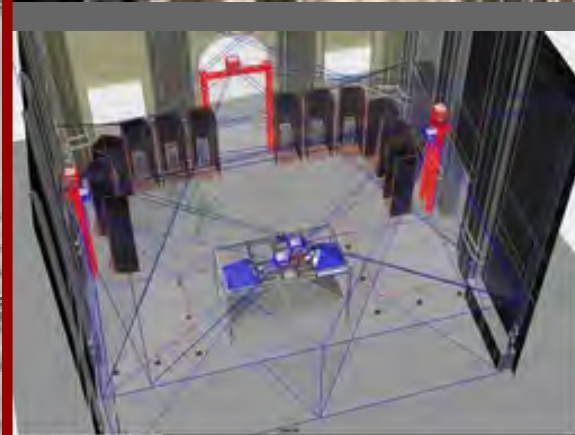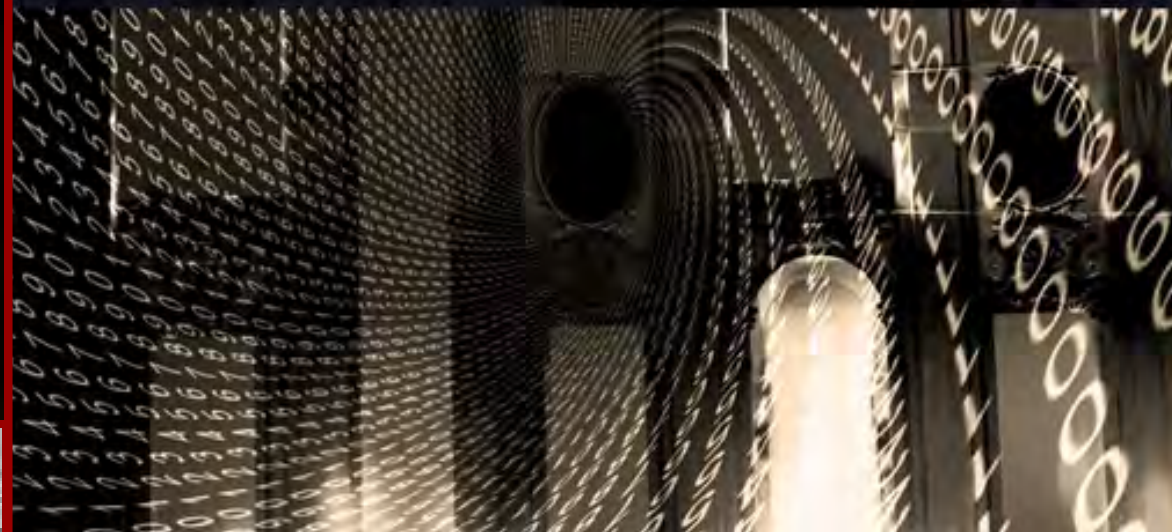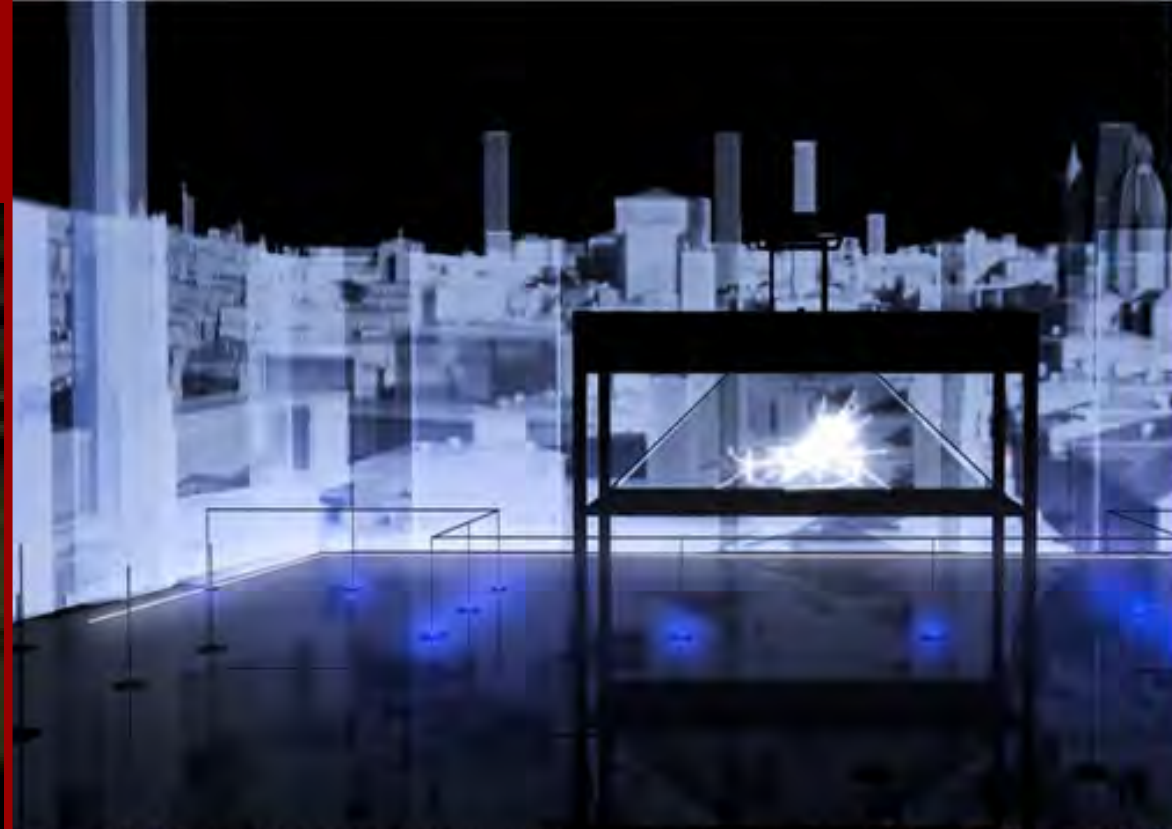
Project Partners and framework:
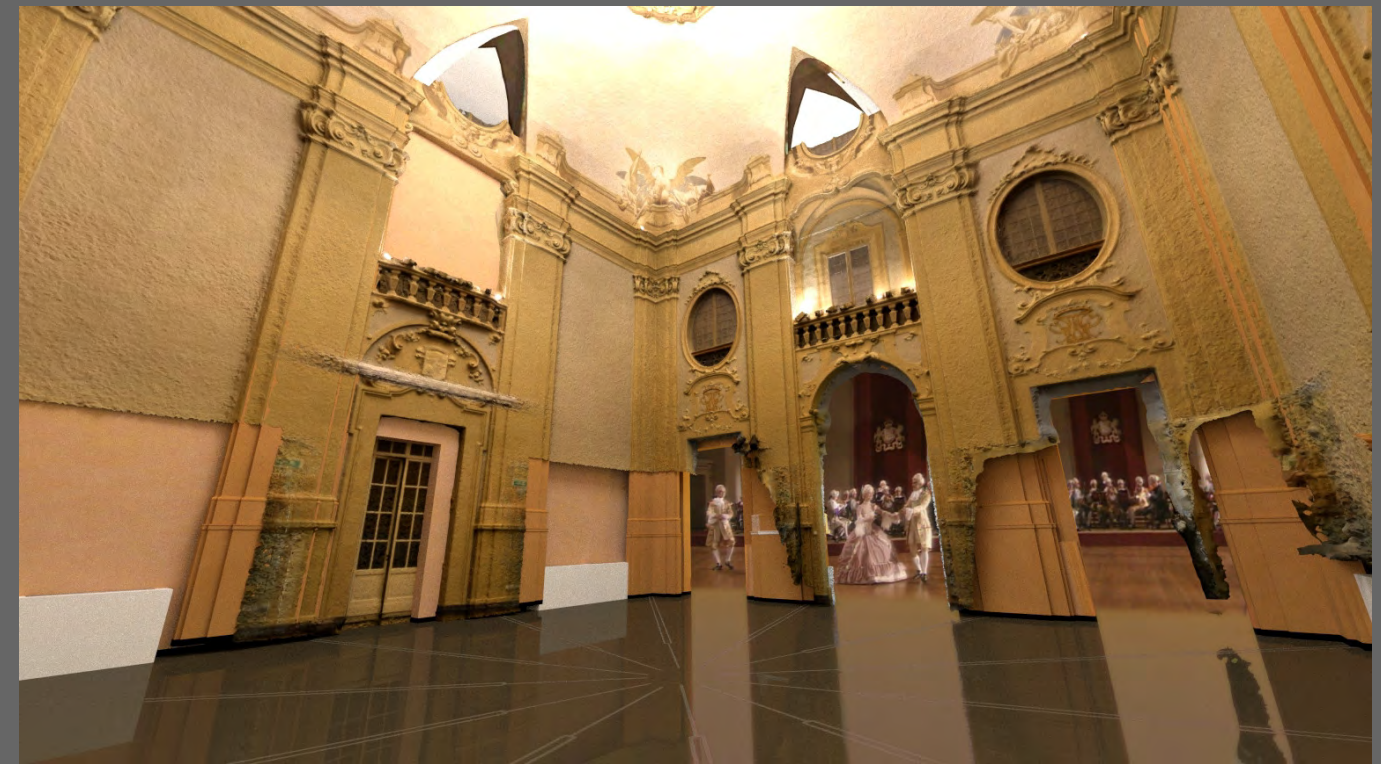
CINECA (Supercomputing Interuniversity Consortium), CNR-ISTI (the National Research Council of Italy), CNR-ITABC (The Institute of Technologies applied to the Cultural Heritage), Bruno Kessler Foundation, Bologna University. European Network of Excellence, (www.v-must.net).

Project: 3D mapping - Content

Sarcophagus of the Spouses Installation

Intersection Across Archaeology, 3D Video Mapping, Holographic Techniques Combined with Immersive Narrative Environments and Scenography

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Abstract **- This paper presents the Sarcophagus of the Spouses installation, an audiovisual performance and exhibit combining 3D video mapping, holographic techniques, computer graphics, high definition visualization with 3D reconstruction and digital storytelling embedded in an immersive narrative environment and scenography. The installation is based on the Sarcophagus of the Spouses (Italian: Sarcofago degli Sposi), a terracotta Etruscan masterpiece of 1.14 m high by 1.9 m wide created around 520 BC depicting a married couple in their last hug, now located in the National Etruscan Museum of Villa Giulia, Rome.**

Index Terms **- Archeology, Etruscan heritage, storytelling, 3D architectural video mapping, holographic techniques, projection system, computer graphics, 3D modeling, tools for museum installations, usability and interface design, virtual archeology.**

I. INTRODUCTION: THE SARCOPHAGUS INSTALLATION

This project aims at the design and development of an immersive solution for the fruition of DH. The design integrates virtual narrative and storytelling, with tools that provide a higher sensorial immersion. The design solution combines a large three-sided pyramid and a 3D architectural video mapping system generated by 10 laser projectors installed side by side, each one generating 2000x8000 pixels for a total of over 15 million pixels in a 3D mapping that goes up to 12 meters high to cover a total area of 360 m². This installation, has been conceived ad-hoc for the "Sala Della Cultura", the ballroom of Palazzo Pepoli of the Museum Genus Bononiae of Bologna, a 14x14 meters and 15 meters high domed baroque hall decorated with plaster and relieves in a typical late rococo style. The exhibit was an integral part of the "Etruscan journey towards the afterlife", a twin temporary exhibition that took place from 25th October 2014 to 19th April 2015, joining Villa Giulia National Etruscan Museum, Rome (where the Sarcophagus of the Spouses is located) and the History of Bologna Museum Genus Bononiae, Palazzo Pepoli in Bologna (where the Sarcophagus Installation was exhibited).

II. CULTURAL HERITAGE CONTEXT: THE ETRUSCAN CIVILISATION

Among the Italic populations dwelling along the Peninsula, the Etruscans were the most widespread and important, before the predominance of the Romans. Their area of influence covered central Italy and part of what now are Emilia-Romagna, Tuscany, Latium, and Umbria. By 650 BC they were a dominant culture, and their influence could be seen beyond Etruria's boundaries, up North to Po River valley and South to Campania. Rome was strongly influenced by the Etruscans and a series of Etruscan kings ruled the city until 509 BC, when Rome became a Republic [1], [2]. The Sarcophagus of the Spouses was found in 1881 in a tomb of the Banditaccia necropolis belonging to the Ruspoli princes. Felice Bernabei, the founder of Villa Giulia Museum, on perceiving its extraordinary beauty purchased the Sarcophagus in fragments (more than 400 pieces) [3]. Datable to the period between 530 and 520 BC, the Sarcophagus shows stylistic elements characteristic of the so-called "Ionian" artistic trend and consists of a case, in the shape of a "banquet bed" (kline), and a lid, reproducing a banquet with a couple in a half-reclined position, according to the oriental fashion. The man shows his naked trunk while the rest of his body is covered with a cloak. His arm is placed round the woman's shoulder, in a loving attitude; the woman is lavishly dressed and wears a hat (tutulus) and pointed sandals (calcei repandi) [4]. The Sarcophagus was probably originally lively coloured, colours that are partly preserved in the "twin" sarcophagus, also from Cerveteri, on display at the Louvre Museum in Paris [4].

III. PROJECT OVERVIEW

A. Methodologies - Aims

The project encompasses an interdisciplinary approach across disciplines such Arts, archaeology, cultural heritage, humanities and social sciences combined with leading technologies and advanced digital tools with the aim of empowering the implementation of an immersive installation which incorporates engaging and creative design solutions for the fruition of content and cultural heritage experience.

As experts in the field state, a strategic approach of the utilization of ICT (information and communication technologies) for research in the humanities and social sciences has demonstrated to be a key factor in stimulating the innovation at the service of scholarship and its advancement in cultural heritage practice. This project expects to provide valid results towards the use of immersive and creative technology in museums and cultural heritage centres, not only for heritage simulation and reconstruction of the past inside the museum,

but as a creative learning framework for the audience and dynamic vehicle for bridging the past to the present on more emotive and compelling ways.

B. Research Context - Motivation - Goal - Objectives

The rapid advancement of technology has transformed modern society. In the museum field, these advancements have had a significant influence on learning and experiencing cultural objects and the heritage associated with those objects. Museums throughout the world have adapted various digital media strategies in exhibition design, spatial and floor planning, educational outreach, and social media interaction to take advantage of this shifting paradigm. Consequently, integrating new media interpretation into exhibition planning has become a standard practice for enhancing the museum experience [5].David G. Stork, states: "We may be entering a new era in the evolution of the study of fine art, an era where computer-vision algorithms will build upon the science and technology of imaging to help answer old questions, open up new vistas, and expand our understanding of art.

Fig. 1. Sarcophagus of the Spouses, painted terracotta funerary urn (3.74 x 6.23 feet) - late 6th century B.C., Villa Giulia National Etruscan Museum.

A major goal of this project is developing a visual narrative and a virtual storytelling installation with digital learning environments supported by advanced technology and tools that provide a holistic immersive vision and a multi-sensorial experience to the visitors. Experts on the subject argues the cultural and heritage sector; practices grow progressively, dependent on digital technologies for the development, production, display and dissemination of works of art and cultural heritage intangible and tangible data. Museums are definitely required to keep a constant open and flexible approach of exploration, experimentation and challenge and to successfully connect with the new generation audiences, engaging in a much deeper way and a multiplicity of ways (i.e. participatory, aware and involved) enhancing the quality of the participatory approach a community and social value and to provide a meaningful service to the public. The installation incorporates engaging methods for the fruition of content and cultural heritage. This project gives special attention to the audience , stimulating their curiosity to go beyond the picture (cultural asset, artefact) and explore the story in, behind and around it, motivating users learning and exploration. Particular attention is given to location awareness, emotional involvement and cognitive processes in audio-visual perception enabling a sense of presence, bringing an emotional involvement that provides deeper ways of sensing and feeling the heritage artefact. Is undeniable that the digitization of art, artefacts, paintings etc. is generating changes in the cultural and heritage museums and institutions. The continuing acceleration in the digitization of information, combined with the increasing capacity of its storage, is causing the traditional model of museums (i.e. as static collection of collections of three-dimensional specimens and artefacts) to expand to include virtual exhibits and high-resolution images of their collections for perusal, study, and exploration from any place with Internet [6]. The sarcophagus of the Spouses, an icon of the Museum of Villa Giulia is a unique model in the world, except of the sarcophagus located in Louvre since the 1800's. This artefact is particularly fragile as it was re-composed over 400 pieces and for this reason the artefact cannot leave Villa Giulia. One of the motivations for developing the virtual heritage exhibit and of the simulation of the Sarcophagus of the Spouses was based on the impossibility of the artefact to be moved. As a consequence, this icon can travel around the world.

IV. DIGITAL ACQUISITION OF THE SARCOPHAGUS

47 GB of data were produced in 2013 by an acquisition campaign realized by five teams of researchers, coordinated by the Cineca consortium, pertaining to CNR-ITABC, CNR-ISTI, Bruno Kessler Foundation, Bologna University and Leica with different technologies (photogrammetry, TOF and triangulation-based laser scanning). The process has been documented during a workshop [7]. The point clouds were treated with MeshLab and Blender, creating an ad hoc video rendering for the holographic display following the requirement of the installation designer, Franz Fischnaller.
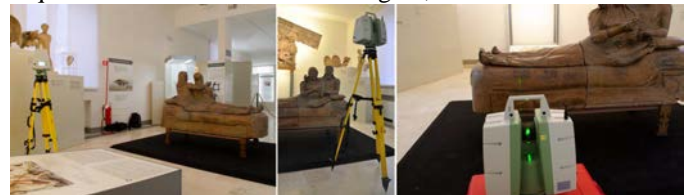

Fig. 2. Laser Scanning at the National Etruscan Museum of Villa Giulia in Rome.

In order to enable researchers to work on proper basis the Sarcophagus was extracted from the protective glass showcase and taken to a wider room of the Villa Giulia Museum [8]. The artefact was divided in its four parts. The last time that this occurred was during a restoration in the 1950's.

The digital restoration of the sarcophagus took into account the indications of etruscologists. Particular attention was paid to the creation of the static and dynamic model for the numerical simulation of the crushing of the sarcophagus, which was required to implement part of the content and the narrative, conceptual approach based on the original conditions at the time of its discovery in the XIX century [9].

Fig. 3. Opening of the Sarcophagus and Photogrammetric results.

Fig. 4. Photogrammetric Acquisition

V. THE SARCOPHAGUS INSTALLATION COMPONENTS

A. Design, technology and display system

The installation is a mixed media installation articulated of a holographic three-sided pyramid and a 3D video mapping projection system (3D architectural video mapping), to cover a total area of 360 m².

Fig. 5. 3D model of the "Sala della Cultura".

B. Hologram - customized projection system

The holographic display System is a 3-sided pyramid shaped installation (HoloBox), that visualizes the Sarcophagus of the Spouses in scale 1:1 (114x190 cm). The footprint of this HoloBox is about 4.6 x 2.4 meters; the 3D image and video footage floats in the size of 200x115 cm behind the 45 degree angled 150 cm high pyramid shape [10].

The supporting structure is made of aluminium and iron kept as transparent as possible to not interfere with the visual scenography projected at the surrounding walls. The 3 screens are made of of 100% transparent Holographic film XXL in pyramid shape framed with magnetic bars on the iron frame. 3 Projectors in HD resolution (1920x1080 pixel) beam from the top with 5000 ANSI Lumen on 3 Greyfire rear projection rigid screens located on the upper part of the structure: the central for the front projection has the size of 233x175 cm and the two on the right and left side have a size of 115x86 cm.

Fig. 6. Three-sided pyramid hologram

These retro-projected images reflect on the Holographic foil generate the 3D illusion of the hologram floating within the pyramid. The 3 HD projectors are connected and synchronized to the 3D mapping Projection System that allows the visualization of the Sarcophagus in its original size, to be integrated into the entire scenography.

Fig. 7. 3-sided pyramid display System-Video mapping

C. 3D Video Mapping - techniques and projection system

The 3D projection System of the Sarcophagus installation wraps the inside walls of the "Sala Della Cultura" in a 180 degree scenography with a total resolution of 15 million pixels on a 360 m² surface covering the area of 30x12 mt walls. The surfaces of the walls has been divided into two horizontal parts. The lower stripe, starting from the ground level up to 4 meters high and the second stripe of 8 meters (up to 12 meters). The lower part, to a height of 4 meters, has been covered by a total of 4 projectors, two sides and two central working in edge blending and the upper part, to cover an area of 14 meters by 8 meters high, 6 managed by the laser projectors, two for each wall, installed in stacking for increased brightness for larger images [10]. The lower 4 meters high projection has been articulated by 4 PANASONIC PT-DZ6710 projectors, luminosity 6000 ANSI Lumens, resolution 1920x1080 pixel), installed on an aluminium truss structure at the height of 4 meters and is divided as follows: 2 projectors at the front wall each projects the visuals with 1709x1080 pixels, and 2 more projectors, one on the left side wall at the resolution of 1908x1080 pixel and one on the right side wall with 1804x1080 pixel. This gives an entire image wrapping of the lower stripe in 180 degrees with 7130x1080 pixel on the length of 30 meters [10]. The upper 8 meter stripe projection, part of the 12 meter high wall, has been divided with 6 projectors, type PANASONIC PT-DZ870 at the luminosity of 8500 ANSI Lumens with a resolution of 1920x1200 pixels beamed as follows: at the front/centre wall with the resolution of 1920x1080 pixel, at the left side wall 1071x1080 pixel and at the right side wall 1013x1080 pixel resolution.

Fig. 8. The Sarcophagus holographic Installation

These 6 projects have been also fixed to a structure of aluminium trusses at the height of 5 meters and 2 projectors are set up for each projection to increase the luminosity to keep the same level of the lower 4 meter stripe projection [10].The front/centre wall is 14 meters width and 12 meters high; the side walls (right and left) are projected each with 8 meter width and 12 meter heights. To be able to project on the short throw distance we have used on each projector a special wide angle lens 0.8-1:1 of PANASONIC.

Fig. 9. Details of the Sarcophagus audiovisual performance

To synchronize the images of the projected surface, it has been used 7 media players, AV Dataton Watchout controlled and programmed by 1unit AMX and interconnected the 10 projectors to one projection screen. We used the software Geometry Manager Pro for every single projector to facilitate Edge Bending and enable stacking, ensuring a precise quality.

D. Content visualization

Thanks to the scientific rigour of the digital acquisition, visitors can enjoy on realistic basis the simulated artefact .The realization of this application and public exhibit provided for a high quality close vision of the Sarcophagus elements into a level of detail which has never been achievable before The performance ends with the explosion of the sarcophagus, hinting at the 400 pieces that were found at the necropolis in the XIX century and were used to reconstruct it.

Fig. 10. Sarcophagus 3D model special effects

In order to achieve the light effect of the explosion filtering through the scattered pieces, two omnidirectional lights were set inside the model and rendered as the cracks expand for their projection, calling the public to its materiality of fragile archaeological object. Blender was used in order to produce and map 3D contents onto the geometries of the reconstructed environment. The animations made in Blender were edited in Premiere and some effects,were realised with AfterEffects.

VI. CONCLUSIONS AND FUTURE WORK

The exhibit closed the 19th of April 2015 having more than 50.000 Visitors. Currently, the development of an itinerant installation is on progress.

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