



Dipartimento di Ingegneria dell'Innovazione
Università del Salento



Augmented and
Virtual Reality Laboratory



eXtended Reality Cultural Heritage – lecture 1

Lucio Tommaso De Paolis

**THE CASTLE OF CORSANO BETWEEN
HISTORY AND MEMORY
VIRTUAL REALITY FOR THE ENHANCEMENT OF
TANGIBLE AND INTANGIBLE CULTURAL HERITAGE**

Sofia Chiarello

Topics

1 Virtual Cultural Heritage

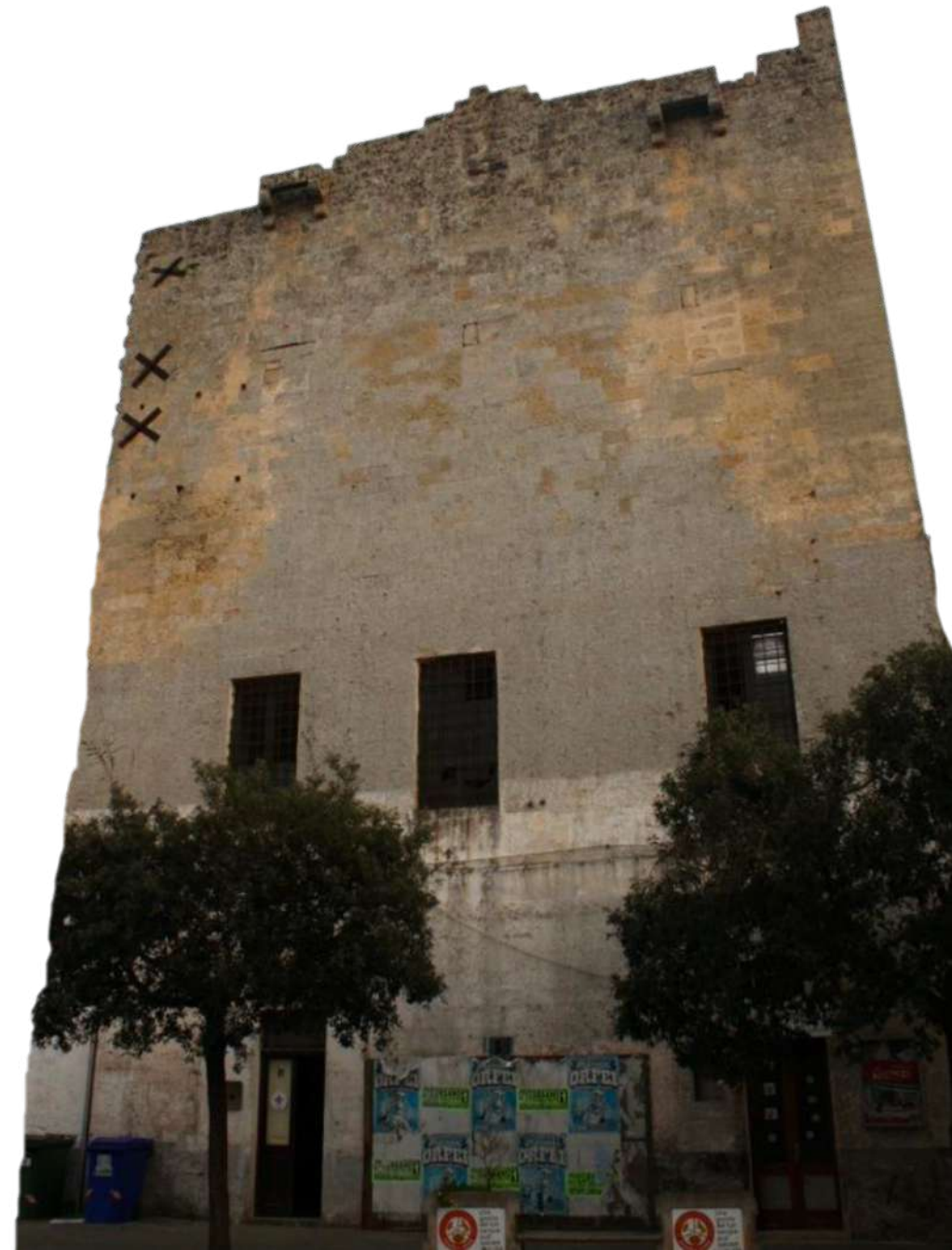
2 The castle of Corsano from XV to XIX century

3 Design of the experience

4 3D modelling

5 Application Development

6 Test



Virtual Cultural Heritage

ANALOGICAL ERA

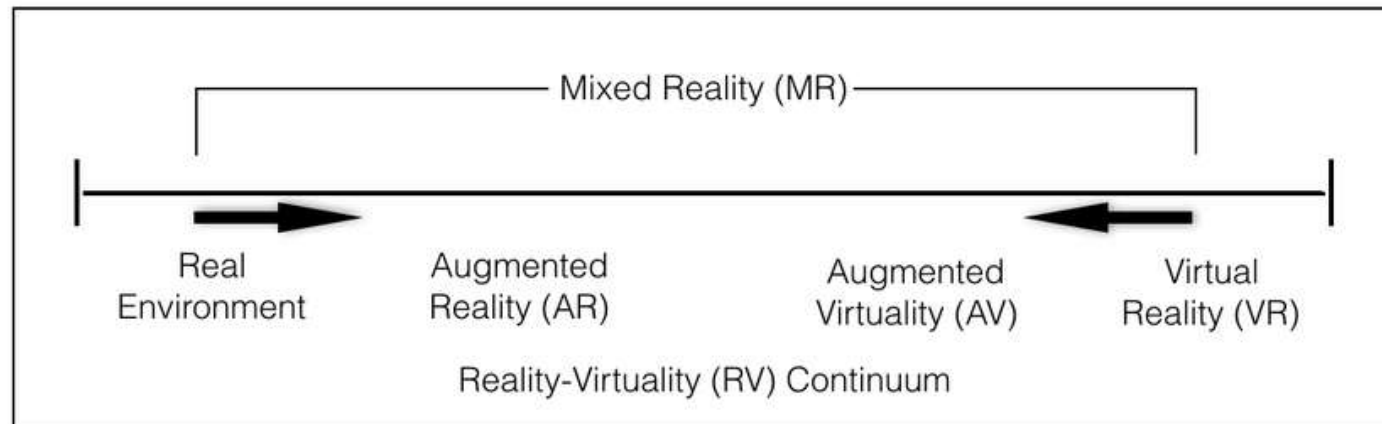
- Physical restoration of objects/ buildings
- High labour costs
- Long times

DIGITAL ERA

- Virtual and more creative restoration
- Reconstructive hypotheses
- Simulation of a destroyed or damaged building
- Knowledge of different spatial and temporal contexts

EXTENDED REALITY (XR)

It includes several forms of reality represented graphically in the *Virtual Continuum diagram* (Milgram et al., 1994)



1

1
9
9
6

Serious Game

*Versailles 1685: Complot à
la cour du Roi Soleil*

2
0
1
7

Roma, Parco Archeologico del Colosseo
Domus Aurea Experience

2
0
2
1

Lecce, Palazzo Vernazza
IsideINSIDE Lecce -phygital experience



RELATED WORKS – from the first 3D reconstructions to the latest immersive experiences

2

3

4

5

6

HARDWARE AND SOFTWARE PROJECT PROPOSALS



1

Oculus Quest-2

- Stand-alone
- Integrated cameras
- High resolution and *refresh rate*
- Oculus Touch
- “Passthrough+” System



Unity

Cross-platform graphics engine (PC - Windows and Mac, Play Station, Wii, Nintendo, Android, iOS) with C# language



Blender

Free, cross-platform 3D modelling software

2

3

4

5

6

The Castle of Corsano from the 15th to the 20th century



FINDING SOURCES

1

Written testimonies

- Two Different Acts
- One cadastre
- A file with a tobacco licence and arrangement and modification project (1958)
- A previous thesis

3

4

Oral testimonies

- Interview with two tobacconists

5

6

del barone Giuseppe Galluccio
rito in pietra bastello in
Corsano

• progetto di sistemazione e modifica.

rappr. 1:200

The Castle of Corsano from the 15th to the 20th century



THREE MAIN HISTORICAL PHASES IDENTIFIED

1

- 5 April 1410 deed of sale of Corsano Castle to the Count of Caserta

2

- Giovanni Antonio Orsini del Balzo

- Securo's family

3

- Cicala's family

4

Reconstructive hypothesis: fortress with entrance and piombatoie for defence against enemies, still visible today.

5

No mention of the interior of the building.

6



1400 – *Fortilitium*

The Castle of Corsano from the 15th to the 20th century



1

**The Capece family, from Campania to Salento, divided into three branches:
Lucugnano - Barbarano - Corsano**

2

- 24 May 1636 deed of sale of the castle to Giovanni Tommaso Capece

3

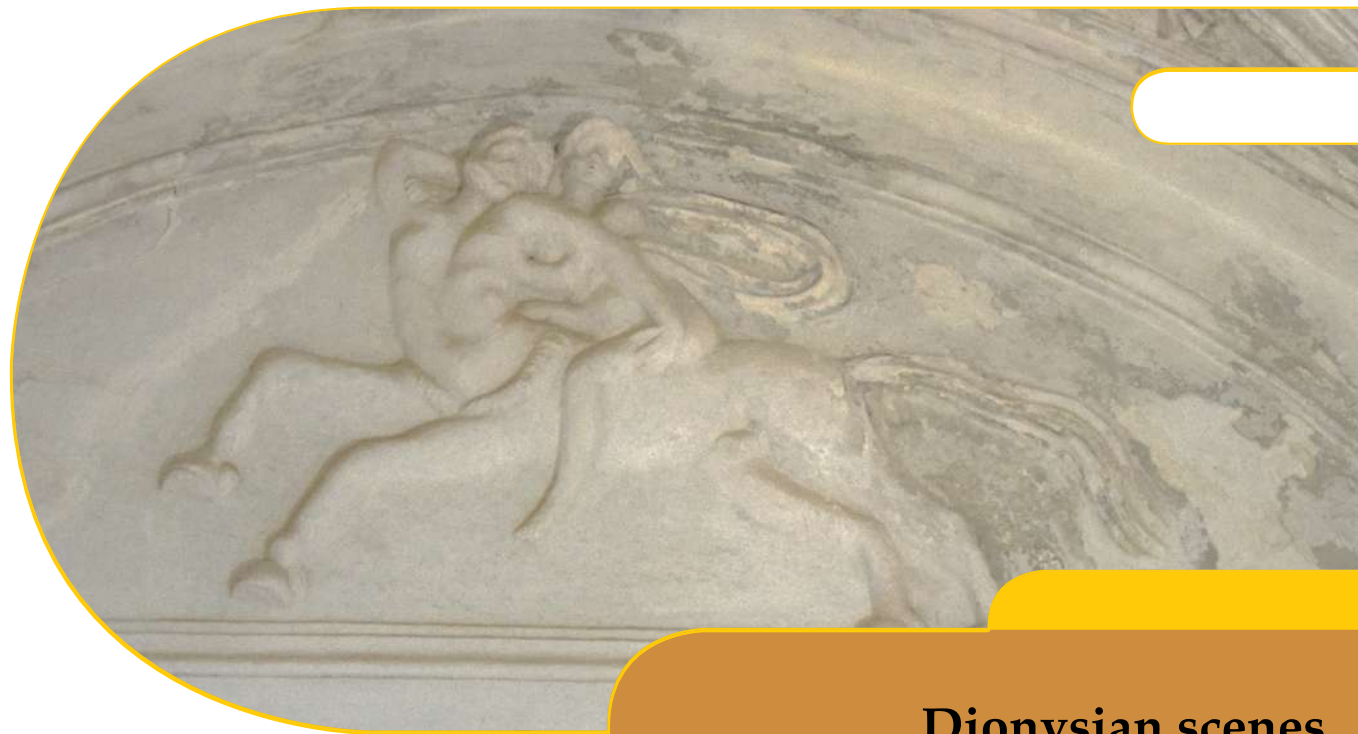
- 1719 Inventarium Ereditatis drawn up by the notary D'Urso for Oronzo Capece

4

- 1730 decorative stucco cycle by Giovanni Capece

5

6



Dionysian scenes

The Castle of Corsano from the 15th to the 20th century



1

- 1849: Marriage of Carmela Capece to Giuseppe Galluccio

2

- End of the Capece's family
- Giacomo Galluccio strips the Castle of its possessions

3

- 1958: The son Giuseppe Galluccio obtains a special licence to use the Castle as a tobacco warehouse

4

- 1980s - today: Tagliaferro family

5

- End of tobacco processing

6



1900 – Tobacco factory

EXCURSUS – TOBACCO PROCESSING

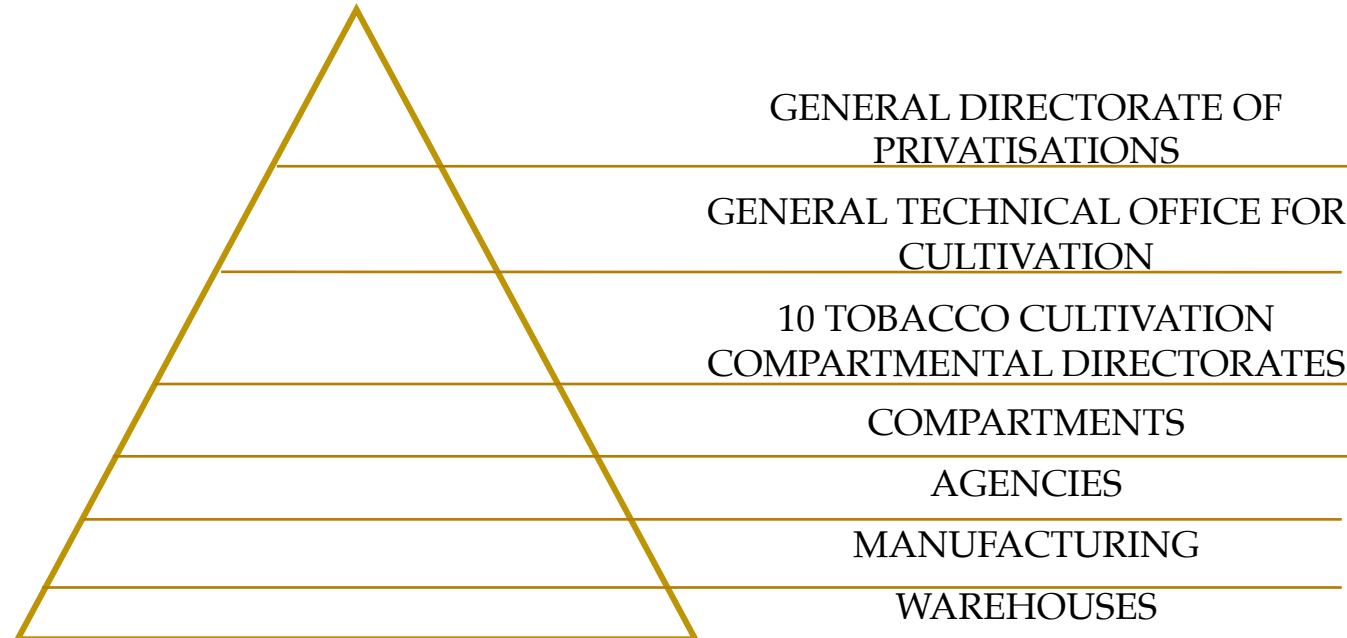


1
2
3
4
5
6

1560: arrival of tobacco from Portugal in Italy;
1700s - 1800s: spread of cigars and start of free cultivation;
1900s: Tobacco Monopoly and concessions
From the 1960s: peronospera attack and reduction of cultivation

THE THREE TYPE OF
«LEVANTINO» TOBACCO

- **Xanti Yaka**
- **Erzegovina**
- **Perustitza**



WINTER

AGRICULTURAL PHASE

Sowing in seedbeds

SPRING

Transplanting and weeding

Leaf harvesting

Stitching with *cuceddha*

Drying on *talari*

SUMMER

Formation of *chiuppi*

AUTUMN

IN THE WAREHOUSE

Sorting

Flattening on the knee and
pressing on wooden discs

Packing with jute sacks through
presses or formwork

Oven at 25-28°

Fermentation

Resting



1

2

3

4

5

6



Emigration to Ginosa

Design of the experience



Inspections and
photographic acquisitions

Content selection and
storytelling creation

1st HYPOTHESIS: reproduction
only of 20th century rooms with
industrial machinery

2nd HYPOTHESIS: large hall as the
fulcrum of temporal navigation
between the 20th - 18th - 15th
centuries

3RD HYPOTHESIS:

- For the 20th century: great hall
and adjacent rooms
- For the 18th century: single room
with stucco vaulting and furniture
description
- For the 15th century: only
reconstructive hypothesis of the
outer fortress

Corridor with door
= time gap between
the three eras



3D Modelling

WALLS - OPENINGS - ROOFS

1

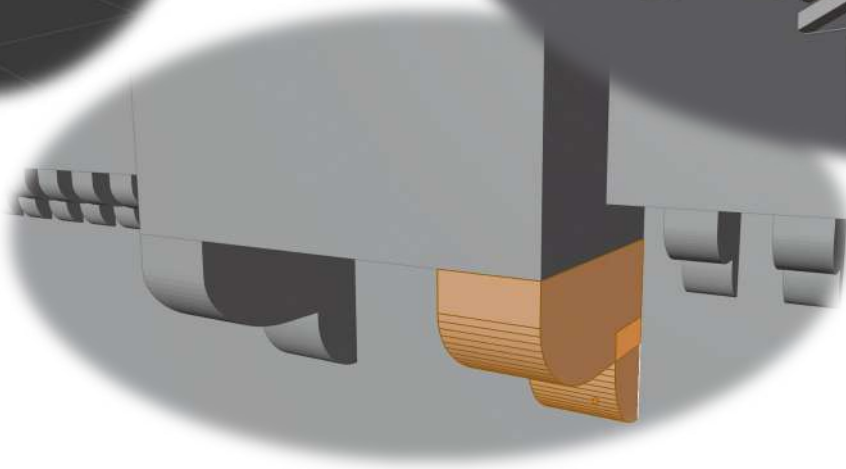
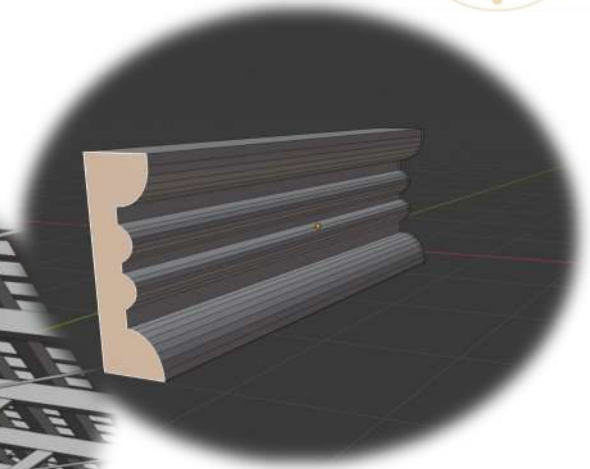
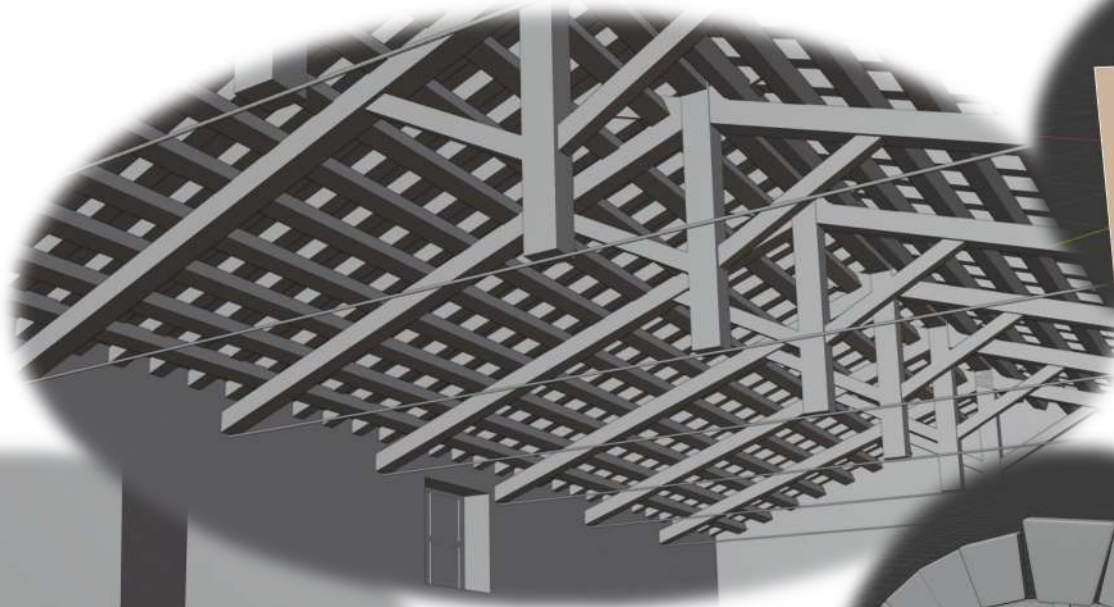
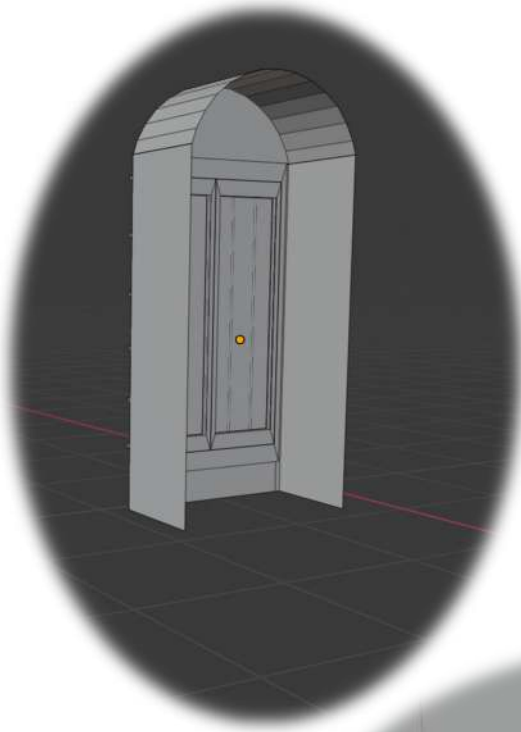
2

3

4

5

6



3D Modelling

PHOTOGRAMMETRY: a surveying technique that allows the shape and size of objects to be reconstructed using information contained in photographic images of the same objects, taken from different points (Cannarozzo et al., 2012)

Software: Agisoft Metashape Professional

Step: 1) Photographic acquisitions

2) Adding photos on Agisoft

3) Alignment

4) Dense point cloud creation

5) Mesh creation

6) Texture generation



3D Modelling

FURNITURE AND TEXTURES

The fortress in the 15th century

1

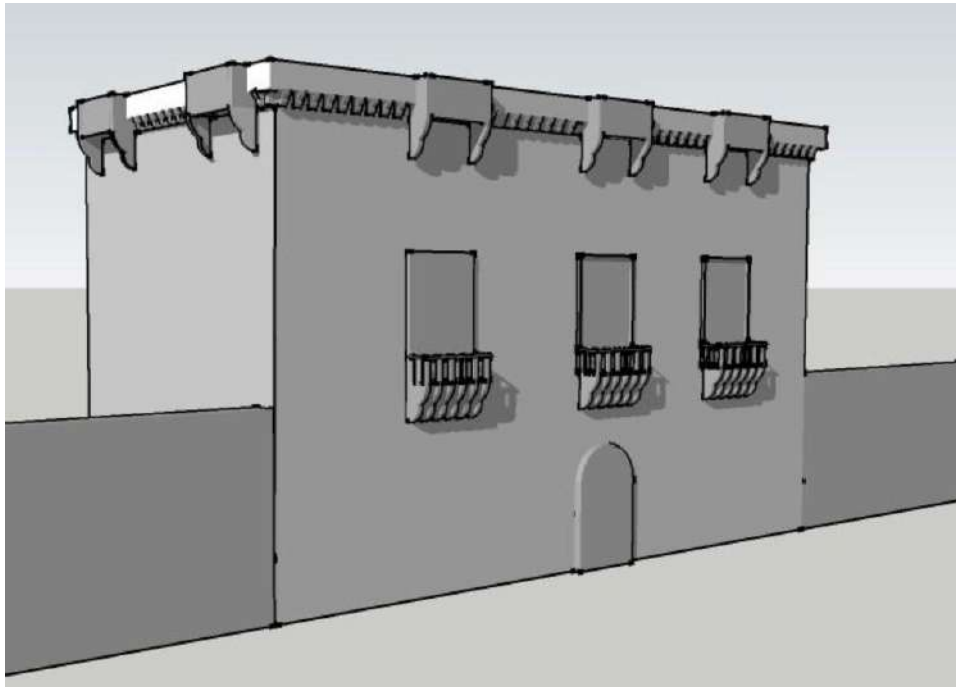
2

3

4

5

6



Reconstructive hypothesis



Reconstruction

3D Modelling

FURNITURE AND TEXTURES

The Baron's chamber in the 18th century

“ In the third room [on the south side] there are four large paintings of saints, all in large black frames, an iron bed, two mattresses, a curtain of Portanova cloths, a yellow background and turquoise flowers, a blanket of the same material [...]; a walnut desk with pullers, [...] a gilded tin holy water stoup in front of the bed, a copper brazier. ”

Description by notary Pomponio D'Urso, 1719



Reconstruction

3D Modelling

FURNITURE AND TEXTURES

The tobacco factory in the 20th century

1

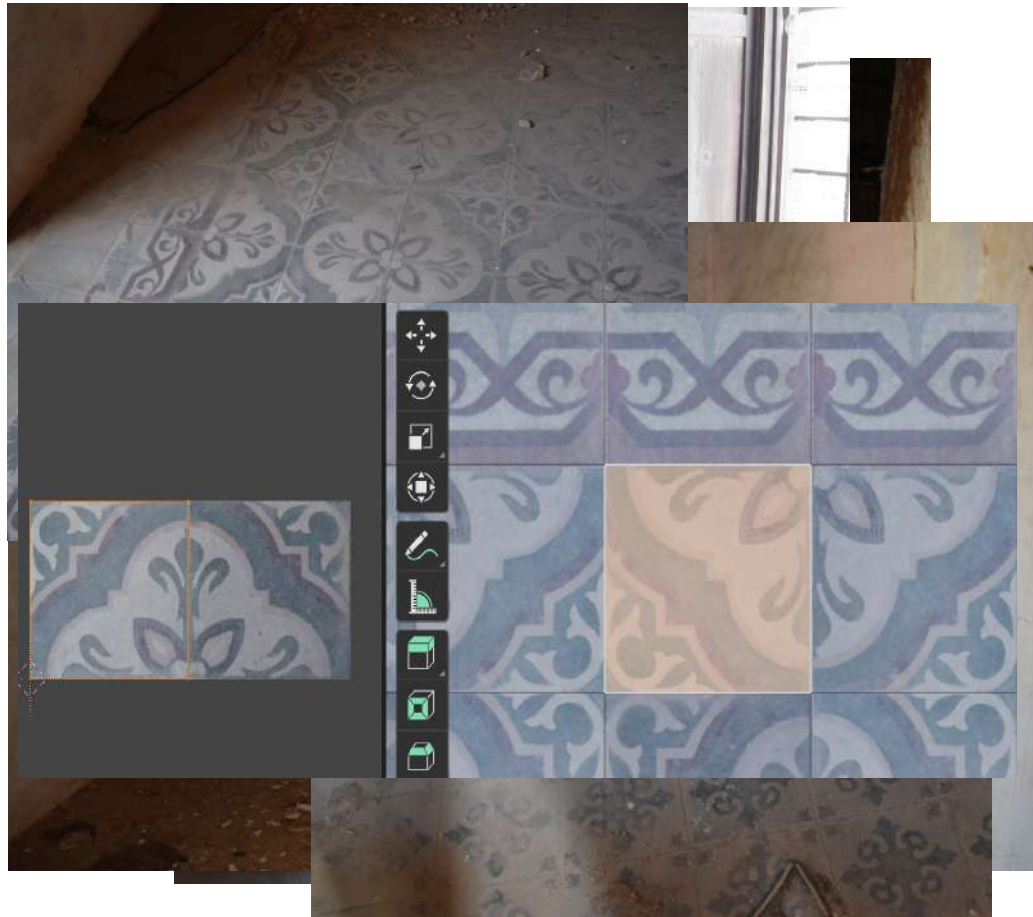
2

3

4

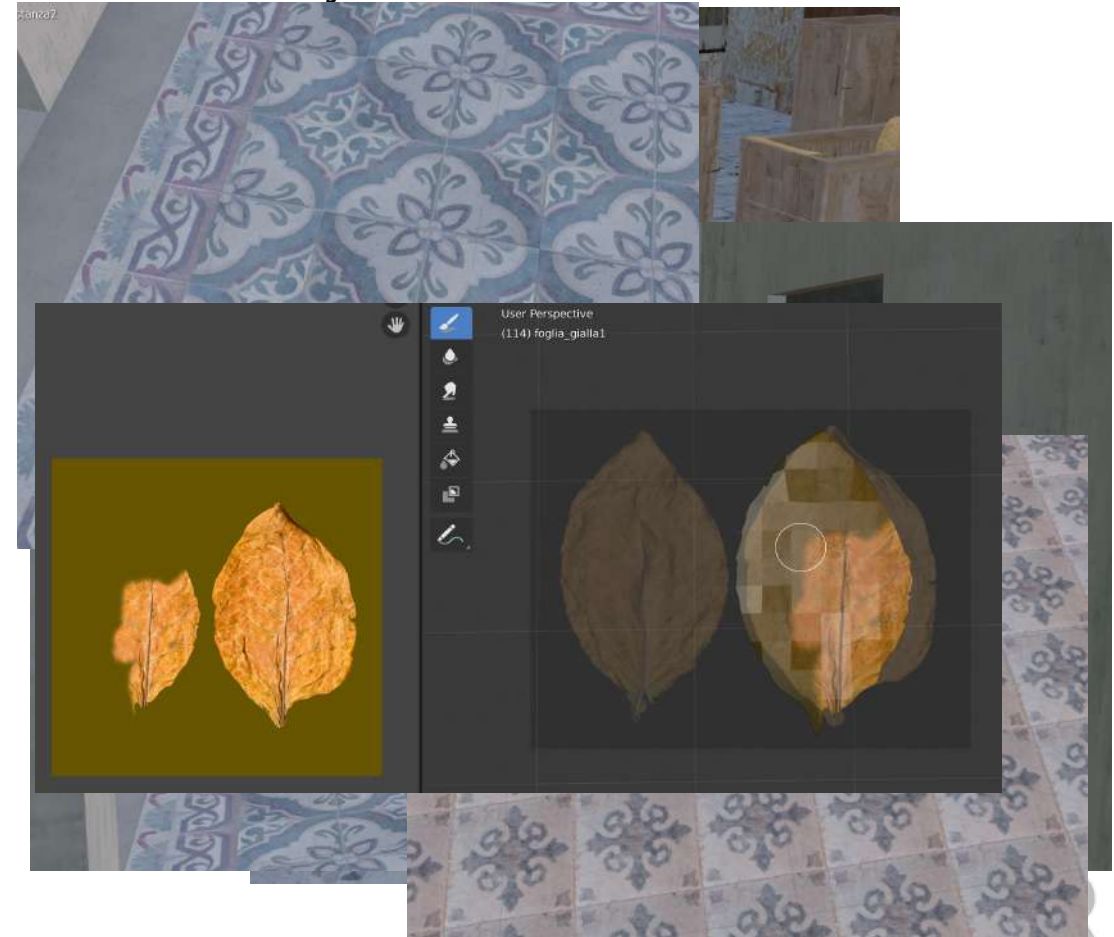
5

6



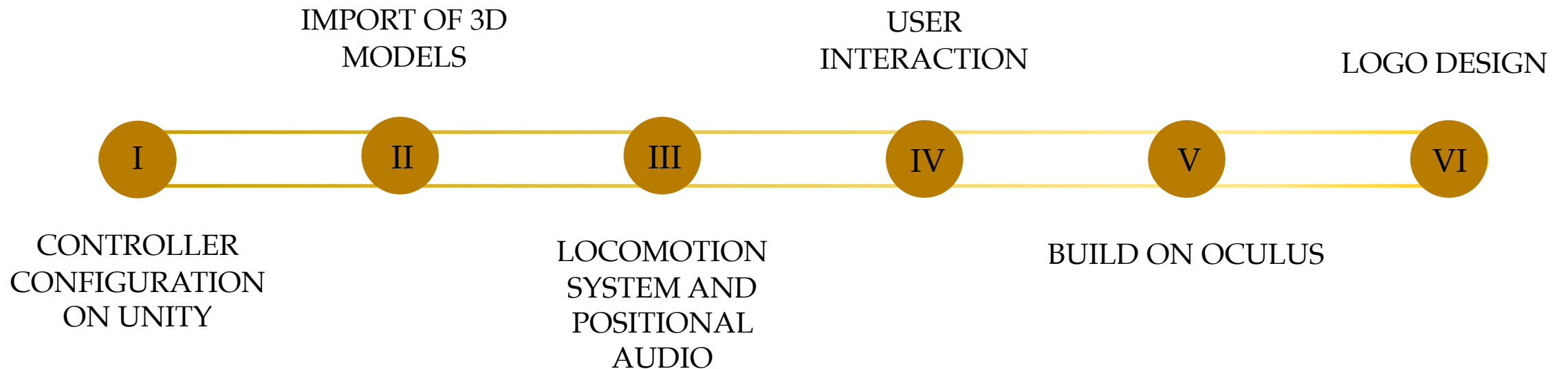
Current Map

vs



Reconstructed

Application Development



1

2

3

4

5

6



Application Development

I

CONTROLLER CONFIGURATION ON UNITY

New 'action-based' Input System

associates input from player actions with each Oculus controller

From Package Manager

- **Open XR**
- **XR plug-in management**
- **XR Interaction Toolkit** - set of preset actions linked to individual controller buttons

From hierarchy → **Room-scale XR Rig**



Application Development

II

IMPORT OF 3D MODELS

MODELS

Creation 3 Empty Objects
(models + panels + sound + lighting)

BACKGROUND

Rural background texture

ILLUMINATION

Point light (18th century world)
Directional Light (1900s and 1400s
world)



Application Development

III

LOCOMOTION SYSTEM AND POSITIONAL AUDIO

MOVEMENT

Teleportation Area

→ *grip button*
left controller

ROTAZIONE

Snap Turn Provider

→ *thumbstick*
right controller

Increases or decreases
the loudness **depending**
on the position of the
player relative to the
centre of the room



Application Development



IV

USER INTERACTION

MULTIMEDIA PANELS

- **text**
- **audio** of women who worked on the tobacco factory ('900) and notary ('700)
- **animation** of tobacco leaves



POP-UP

- Pop-up 'zoom' on images
- In-depth pop-up



TRANSITION BETWEEN ERAS

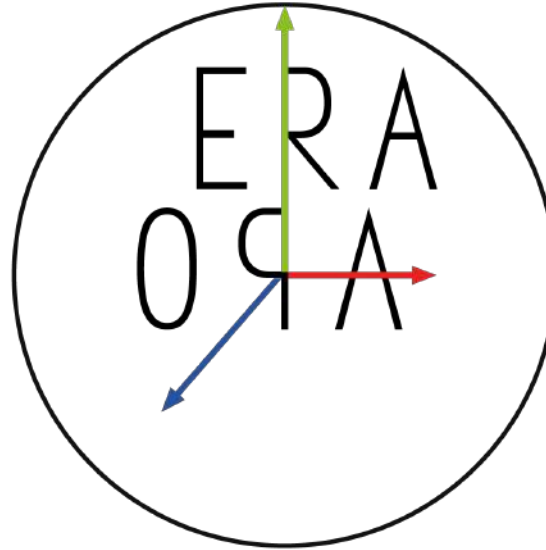


AVR
Lab

Application Design

V BUILD ON OCULUS

VI LOGO DESIGN



PASSATO È PRESENTE

ATTRAVERSO IL CASTELLO
CON LA REALTÀ VIRTUALE



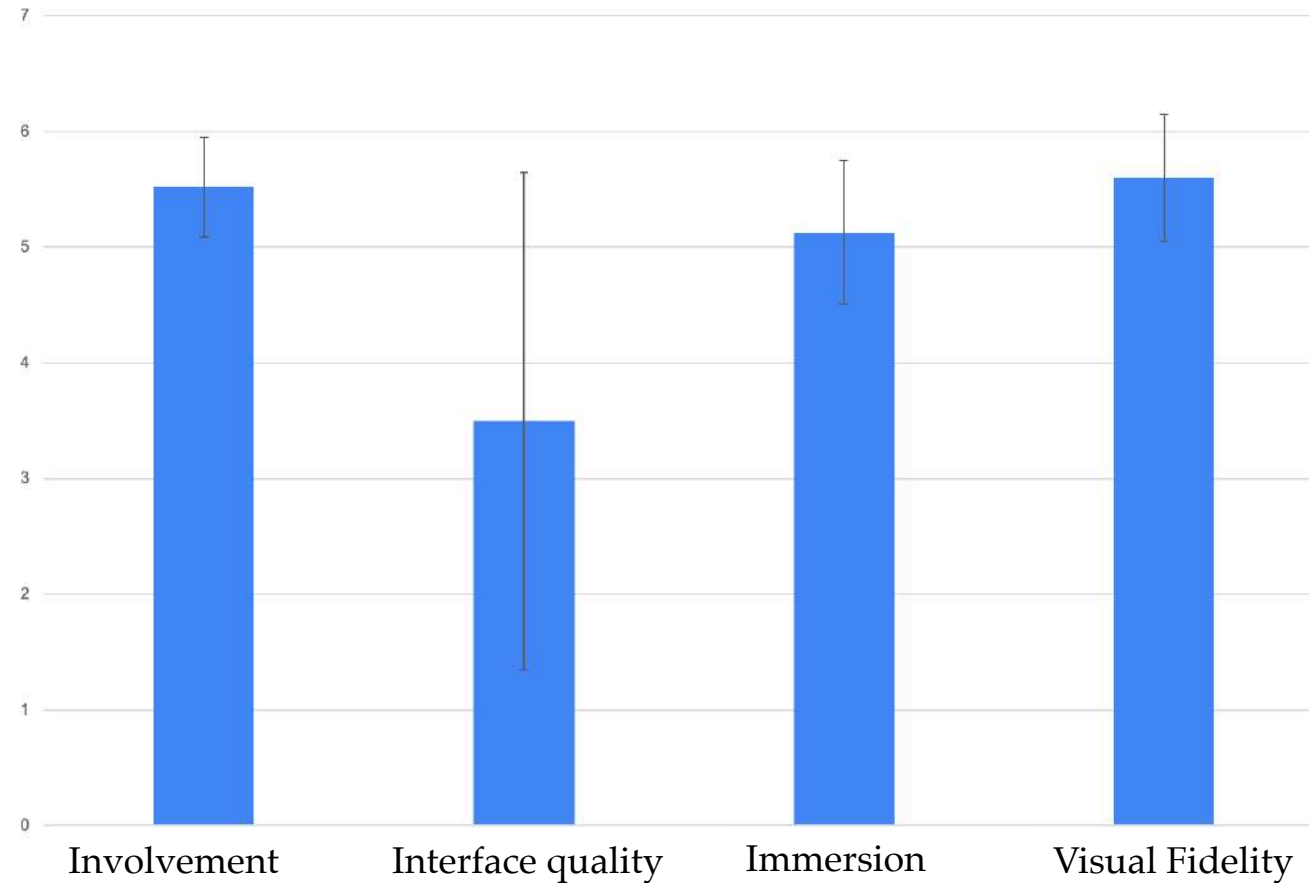
Test



Presence Questionnaire (Witmer e Singer, 1998)

22 items divided into 4 macro-components

25 users tested (17 secondary school students, 8 users 25-60 years old)



Publication



Digital Applications in Archaeology and Cultural Heritage 27 (2022) e00238



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Digital Applications in Archaeology and Cultural Heritage

journal homepage: www.elsevier.com/locate/daach



Virtual reality for the enhancement of cultural tangible and intangible heritage: The case study of the Castle of Corsano

Lucio Tommaso De Paolis^{a,*}, Sofia Chiarello^a, Carola Gatto^b, Silvia Liaci^c, Valerio De Luca^a

^a *Augmented and Virtual Reality Laboratory, Department of Engineering for Innovation, University of Salento, Lecce, Italy*

^b *Department of Cultural Heritage, University of Salento, Lecce, Italy*

^c *Department of European and Mediterranean Cultures, University of Basilicata, Matera, Italy*

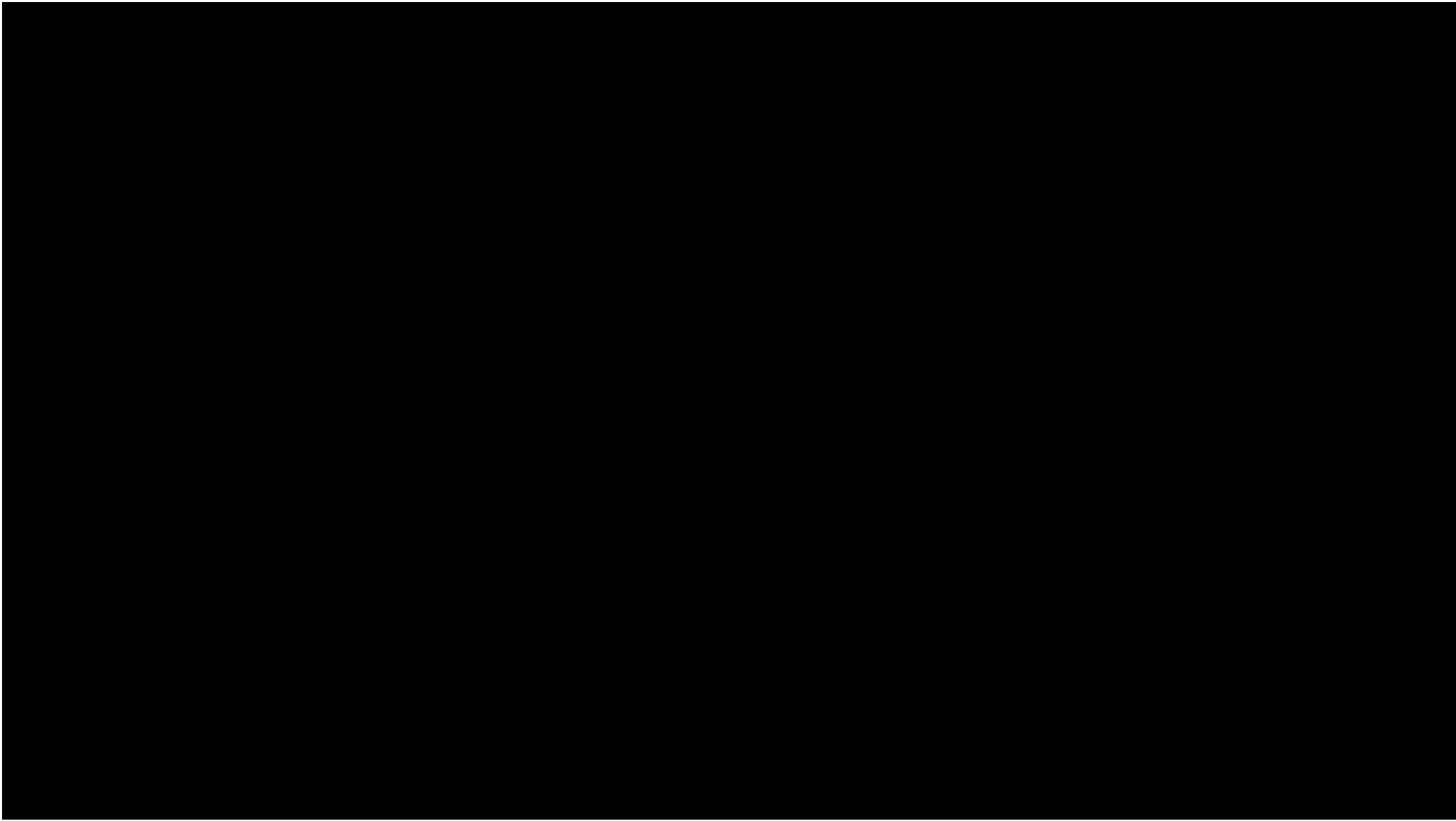
ARTICLE INFO

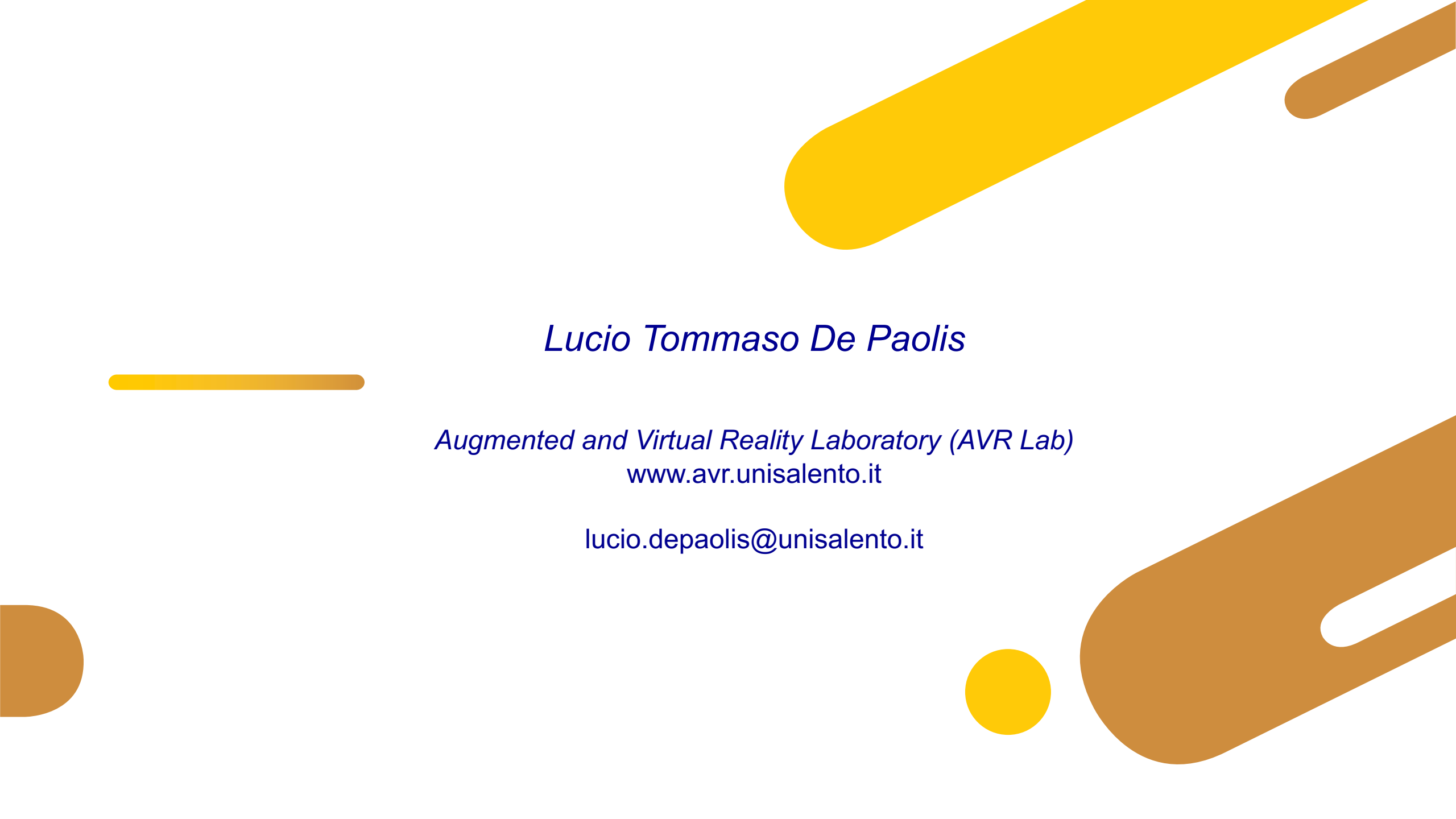
Keywords:

Cultural heritage
Intangible heritage
3D modelling
Virtual reality
User experience

ABSTRACT

This paper concerns the development of an immersive VR application for the enhancement of an inaccessible old Castle in Corsano, a small village in Salento - Italy. Starting from the 3D reconstruction of the building, the project allowed the development of an interaction system aimed at providing the user with the historical information about the Castle. These contents come from the analysis of the tangible cultural heritage (such as the architectural elements, the furniture, the decorative motifs of the castle, and their evolution through the centuries), but also from the collection of intangible heritage, such as reminiscences on folk customs and traditions related to the context of the castle. Moreover, in order to evaluate the user experience of the developed application, some tests were carried out on a heterogeneous sample of users, obtaining positive feedback on the degree of immersiveness and sense of presence of the application.





Lucio Tommaso De Paolis

Augmented and Virtual Reality Laboratory (AVR Lab)
www.avr.unisalento.it

lucio.depaulis@unisalento.it