Etruscanning 3D
the Etruscan grave n.5 of Monte Michele in Veii: from the digital documentation to the virtual reconstruction and communication
AIMS:
to explore the possibilities of new digitization and visualization techniques, in order to re-create and restore the original context of the Etruscan graves.

Consortium of museums and research organizations from 3 European countries:
Allard Pierson Museum and the University of Amsterdam, The Netherlands, coordinator
CNR-ITABC in Rome, Italy
Visual Dimension in Ename, Belgium
National Museum for Antiquities in Leiden, The Netherlands
Gallo-Roman Museum in Tongeren, Belgium

Associated partners:
Soprintendenza ai Beni Archeologici dell'Etruria Meridionale and National Etruscan Museum in Villa Giulia, Rome, Italy
Museo archeologico dell'Agro Veientano, Formello, Italy
Vatican Museums, Città del Vaticano
Scientific consulting: Francesca Boitani and CNR – ISMA, Rome, Italy
V-MusT NoE

Duration: 2011 – 2013
INTERNATIONAL COOPERATION

- Research in the fields of
  DIGITAL ACQUISITION
  DIGITAL RESTORATION
  3D REPRESENTATION
  INNOVATIVE VR ENVIRONMENTS
  NATURAL INTERACTION

- Final communication of Etruscan tombs and collections during temporary exhibitions in the Netherlands, Belgium and Germany, and, at the end of the project, for permanent use in Vatican Museum and Dutch museums.

- Enable and support Cultural Heritage institutions to create, run and exchange digital 3D reconstructions.

FOCUS ON:
Two important Etruscan tombs:
Tomba Regolini Galassi, grave of a princess, in the Sorbo necropolis in Cerveteri,
Tomba 5 Monte Michele, grave of a warrior, in Veio.
## Digitization Approaches

### 3D
- Laser-scanner
- Digital photogrammetry

### 2D
- Photos
- Photos for QTVR
- Movies

### The Choice of the Best Method Depends On:
- Final attended result
- End user
- Dimension of objects
- Complexity of objects
- Availability of sources
- Required accuracy
- Possibility of new information acquisition
- State of preservation

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## Aims
- Correctness, Appearance and Communicative Impact
The tombs are situated in a section of the Monte Michele necropolis at Veii with other five chamber tombs.

A princely tomb from the middle Orientalising period, dated 670-650 BC.

The tomb was discovered in 1980.

Nowadays the tomb presents a high level of degradation (as from historic photos). The objects are preserved in the National Etruscan Museum of Villa Giulia in Rome.
Let people know the whole archaeological process:
-the reasons of the excavation;
-excavation methodologies;
-documentation procedures;
-conservative and reconstructive aspects.

→ Digitization
→ Virtual Reconstruction
→ Virtual Restoration
→ Final application
3d DIGITIZATION

Laser scanner

Riegl LMS Z390i
6 scanstations
6 panoramica scans +
    7 high resolution scans
900,000 points
3d DIGITIZATION

SfM + DSM
Photogrammetric method to texture the 3d model

about 100 images oriented by Agisoft Photoscan

Coordinates from laser scanner pointcloud used to scale and georeference all the images.

Laserscanner and photogrammetry in the same reference system
3d DIGITIZATION

SfM + DSM
obtain 3d model from images

Agisoft Photoscan
turning table
neutral background
controlled set of lights
2d DIGITIZATION
VIRTUAL RECONSTRUCTION OF THE TOMB

Historical sources

Up-to-date sources

Direct sources
The difference between two models can be understood as the erosion by time.
Dromos of tomb n.6 in the same Necropolis

Tomba Campana, VI a.C.
The Wagon

Remains:

- iron wheels
- hubs
- nails and small fittings
- wooden remains
- embossed bronze plates
## Analysis on the remains

- reconstruction of the fragments of the wheels in Photoshop
- analysis of the number of nails
  - metal structure of the hubs,
  - with a rectangular hole
- analysis of the position and the shape of bronze coverings and of the wooden remains

a four-wheeled or
- two two-wheeled wagons?

## Results

- they were at least four, with a diameter of around one meter
- spokes could have been seven, one every four nails
- wheels were fixed to the axle and rotated together. It was a slow vehicle
- position of bronze coverings not decisive, variation in shape suggested their different position, wooden remains suggested a 2.13 m by 0.78 m wagon
- Not enough evidence to confirm the presence of two wagons; potential evidence of the rotation mechanism of front wheels
Reconstructed wagon of Monte Michele n. 5 tomb
The restoration procedure of the bronze coverings

Decoration in repoussé, subdivided in three different levels: a braid motif (guilloches) and rosettes.

Using Photoshop we created the depth map of the decoration.

We imported these depth maps in Blender, in TIFF format, and we used them as normal maps for the digital coverings.
Bronze remains of the urn found crushed under the weight of the roof, it contained the cremated remains of a man. They were wrapped in a piece of cloth, following an anatomical order.

In its shape, the urn imitates the kind of house used at that moment by the Etruscans: it was almost 45 cm high and its base covered a surface of 30 cm by 68 cm.

Decoration: on the short sides ornamental and figurative motifs, which included a Gorgo-Potnia, on the long sides similar to the decoration of the wagon coverings, the edges of the roof decorated with guilloches.
Funerary Urn

Reconstructed urn of Monte Michele n. 5 tomb
**Final Application**

**In-depth movies** for selected objects:
- Archaeologica map
- Historical images
- Documentary images
- Documentary movies
- 3d models
- Render
- Storytelling

Video demo of the application:
https://vimeo.com/76964607
The restoration procedure

The structure of the urn reconstructed in Blender using coeval examples.

The decoration was restored in Photoshop. The depth map was then imported in Blender and used as a normal map.
The scepter

- It is the only scepter definitely identified as such from Etruscan orientalizing tombs

- A wooden stick, covered with silver sheets secured by silver pins, about 68 cm long

- A bronze orb, decorated with iron inlays forming a series of Phoenician palmettos and a four-pointed star on its top. Diameter of the orb 4,5 cm.
The restoration procedure

The preservation state of the scepter was good enough to allow a 3D reconstruction in Blender.
National Etruscan Museum in Villa Giulia Rome: possible integration in the exhibition
the possibility to play some parallel video tracks with different contents but with the identical camera animation through the tomb.

Idea of Multiangle DVD

The **storytelling**, in first person, simulates the archaeologist who discovered the tomb coming back today in the site, entering the tomb and remembering her past wonder at the moment of the discovery and also all the questions she was asking herself about the identification and the meaning of the objects.
FINAL APPLICATION

TRACK 1
steadycam

Point cloud visualization

TRACK 2
current state

Wireframe visualization

TRACK 3
Reconstruction state

Textured visualization
FINAL APPLICATION

Steady

Extract Camera Path

Apply camera track

Steady
3D actual + objects
Pointcloud

Virtual Reconstruction

Track 1  Track 2  Track 3

Camera Matching
FINAL APPLICATION: layout

Select language

Switch between different tracks

Select Archaeologist's interview

Select objects for Specific movies