



European Union's REKconstructed content in 3D to produce XR experiences



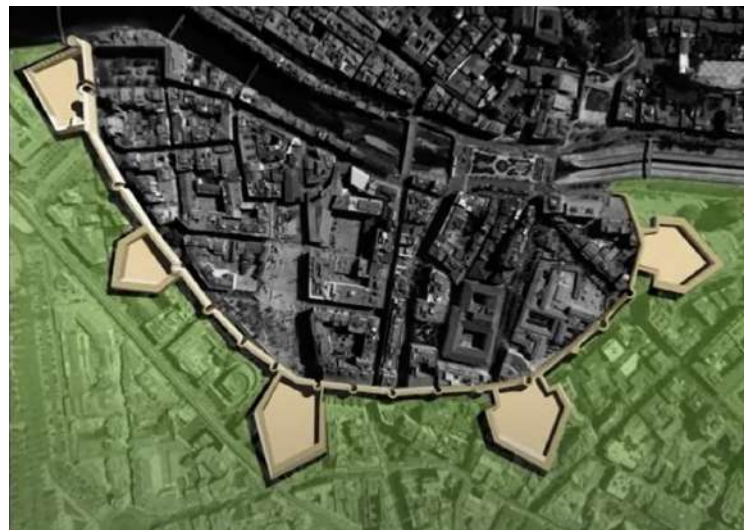
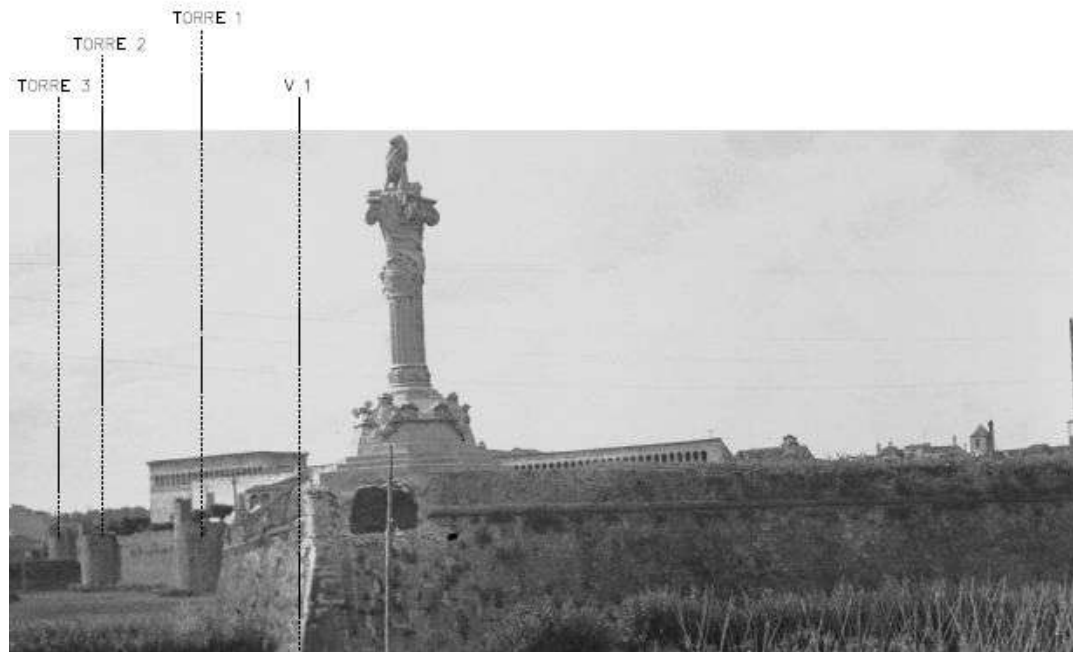
Scenario 1 – Virtual visualization of the Girona Historical Walls

Eureka3D-XR project is co-financed by the Digital Europe Programme of the European Union, GA n. 101174054

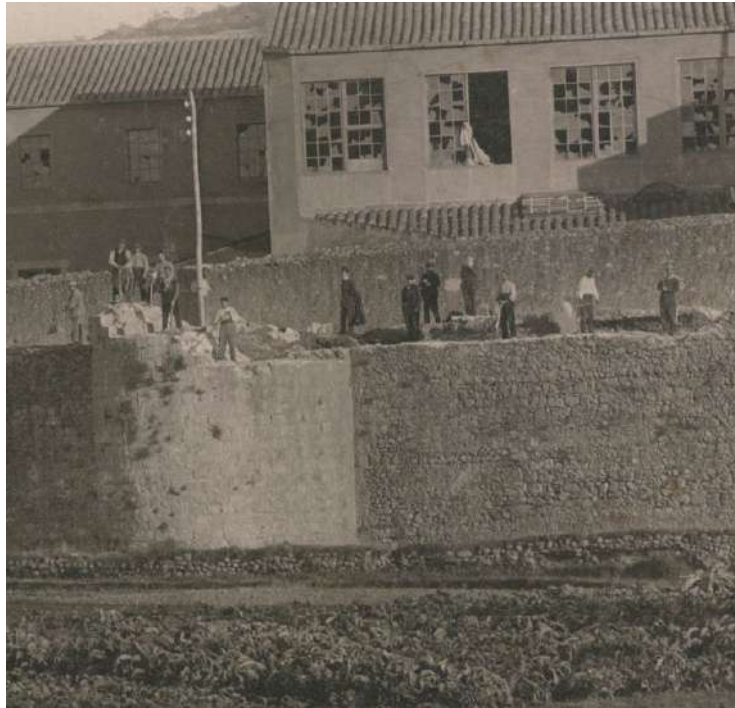


**Co-funded by
the European Union**

The scenario: the medieval walls of Girona



The scenario: historical context



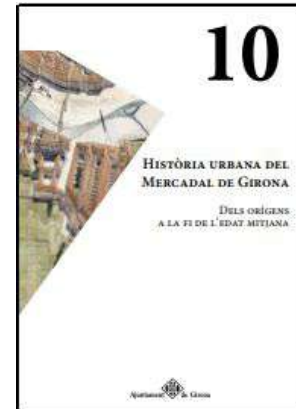
It has been **2,100 years** since the foundation of Girona by the Romans (**Gnaeus Pompey the Great, in 76 BC**)

- The medieval walls of Girona were built in the **15th century**.
- The building of towers and bastions (**16th- 17th century**)
- The walls and all these elements were partly demolished at the beginning of the **20th Century**.
- The walls of the **eastern side** were kept, even if they were abandoned for many years.
- It was during the decade of the **1980's** that the works carried out in different phases aimed to reuse a space for walking and enjoyment, more than carrying out an archaeological restoration.

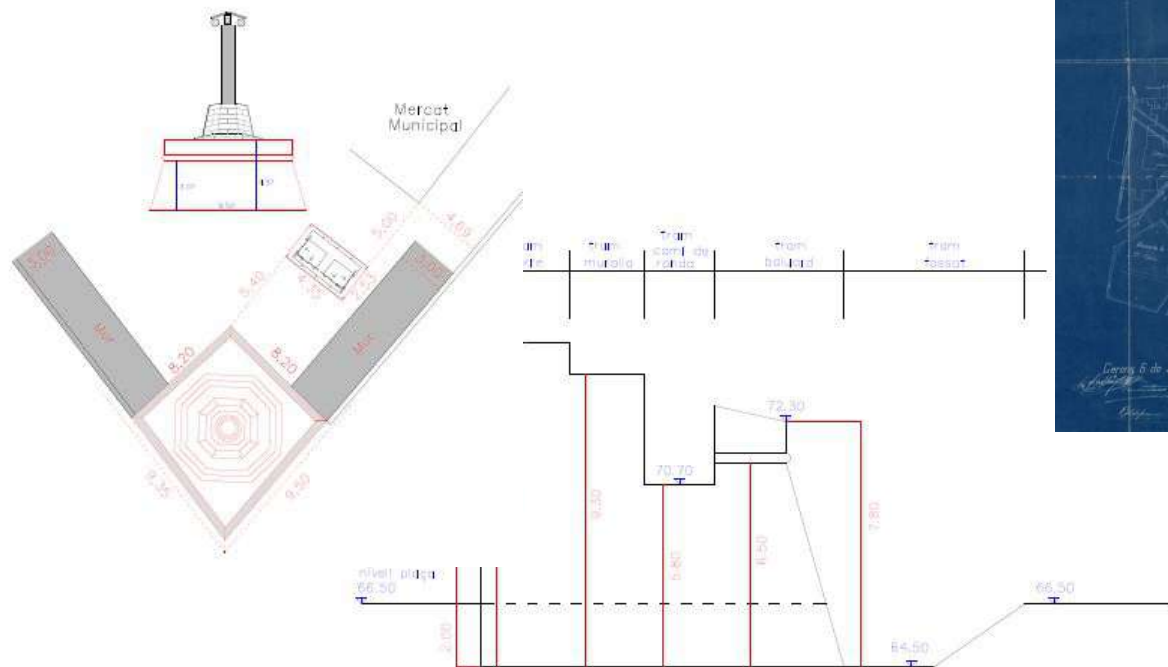
Now, it's time for virtual reconstruction!

Challenge 1: scientific research

In the early 1990s, the **Urban History Research Group of Girona** was formed, with the aim of investigating the city's medieval past, especially its urban aspects, and of publishing these studies in a collection, edited by Girona City Council.



Challenge 2: records & data (engravings, photographs, audiovisuals, maps, text, ...)



Challenge 3: new images for textures



REQ #10: Title: EXPOSURE VALUE

The photos should have a proper exposure value. Overexposed images lead to misinterpretation in 3D reconstruction by the AI tool. It is recommended to use an ISO value between 100 and 400

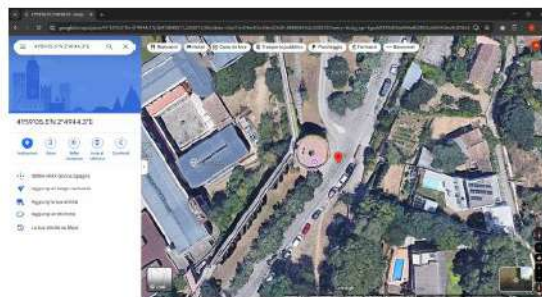
Compliant image:



Non Compliant image:

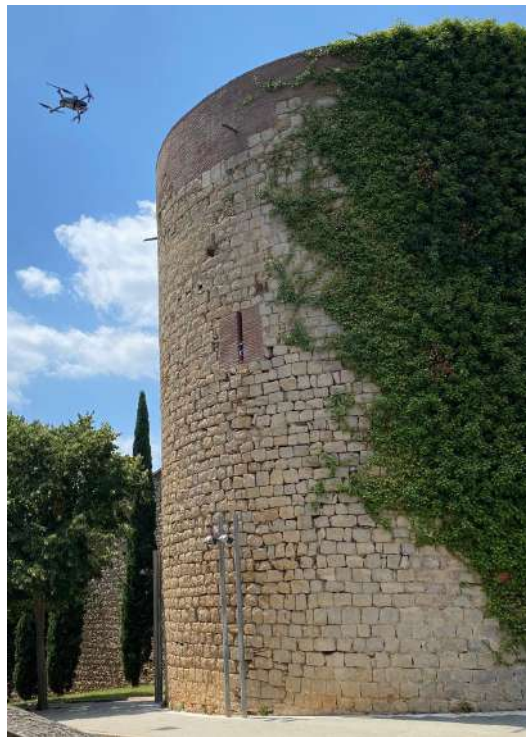
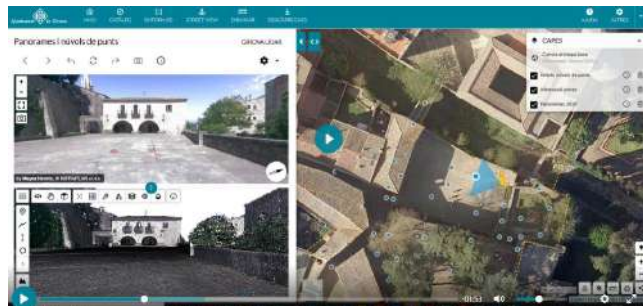


- Point #3: Name: Carrer de la Muralla
LatLong Coordinates: 41°59'05.5"N 2°49'44.3"E

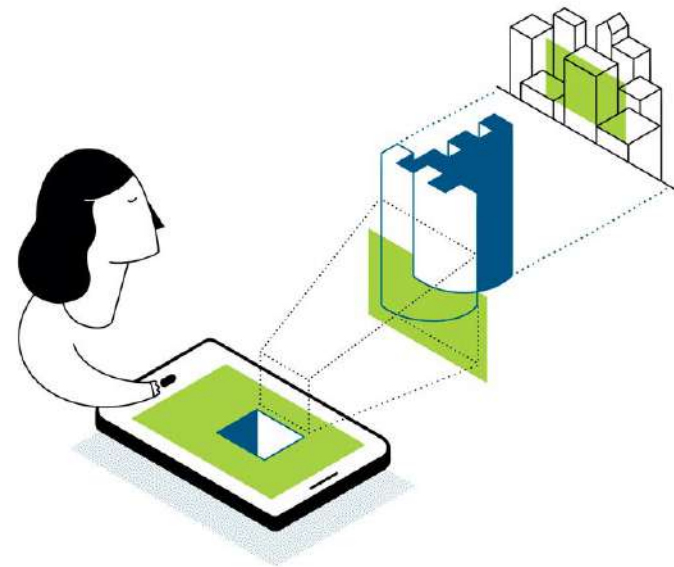


Name	FAJ6717.4.jpg
Resolution (px)	1417 x 914
Is blurry	Yes
Is coloured	No
Perspective	Top
Perspective efficacy	1/5
Level of detail	1/5
Level of usability in AI	1/5
Reason for scoring AI	The image, although presumably representing a small portion of the wall, does not provide sufficient details for the reconstruction of the 3D model. Furthermore, the low resolution of the photo does not allow the details to be distinguished correctly.
Usability in design	1/5
Usability in validation	1/5

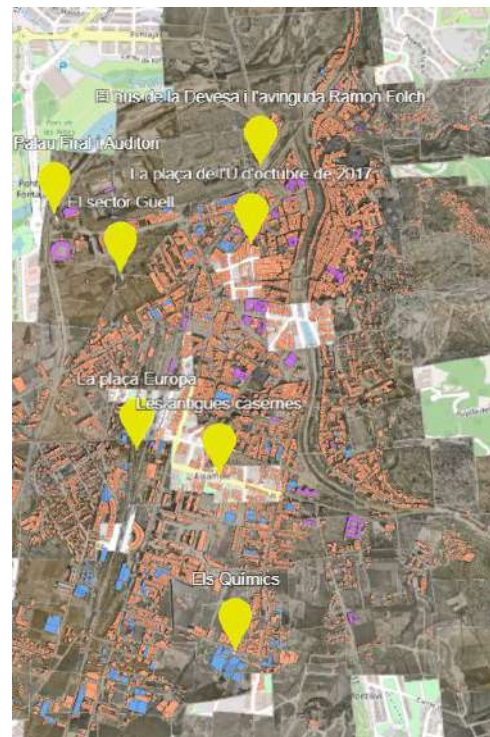
Challenge 4: aerial images



The XR experience



Girona City council plan for 3D visualisation





**EUreka3D – European Union’s REKonstruted
content in 3D to produce XR experiences**

**Many thanks
for your attention!**



www.eureka3d-xr.eu



LinkedIn: [EUreka3D-XR](#)
Instagram: [@EUreka3D_XR](#)
YouTube: [@Eureka_3DXR](#)
X: [@EUreka_3D](#)



diglesias@ajgirona.cat



Eureka3D-XR Capacity Building Event

Brussels, september, 26 2025

Marco Pappalardo (marco.pappalardo@softwareengineering.it)

Marco Falciglia (marco.falciglia@softwareengineering.it)

Gian Paolo Donnarumma (gianpaolo.donnarumma@softwareengineering.it)

Francesco Generali (francesco.generali@softwareengineering.it)

Angelo Belfiore (angelo.belfiore@softwareengineering.it)

Tools #3 AI 3D BUILDER

Tools #4 3D XR STUDIO



Tool #3

AI 3D BUILDER

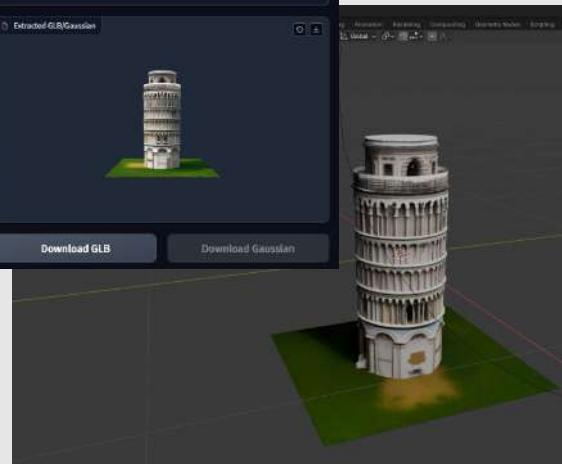
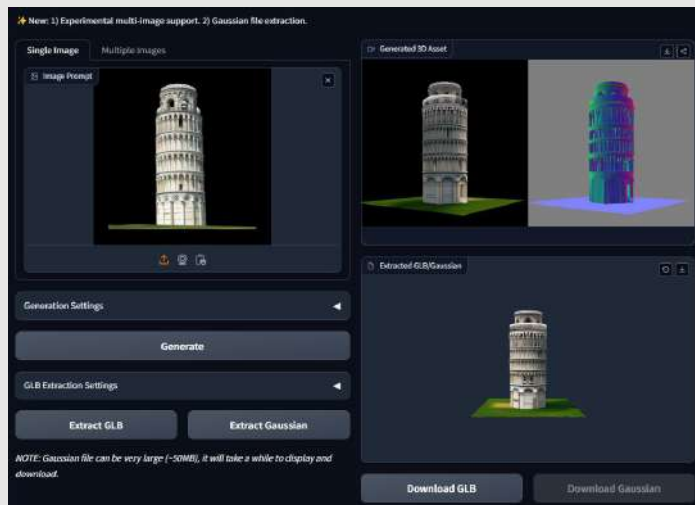
Development of an **AI-powered software pipeline**
generating 3D models of objects

TRELLIS 3D AI

Microsoft Trellis as IMG-to-3D conversion AI model

Reasons:

- Free commercial MIT license
- Local deployment by using the API
- Tests showed encouraging quality
- Upload of multiple images



Menu

Eureka3D-XR_0001... x Eureka3D-XR_0003_image... + Crea

Tutti gli strumenti Modifica Converti Firma elettronica

Trova testo o strumenti

Condividi

Chiedi all'Assistente IA

Tool #4

3D XR STUDIO

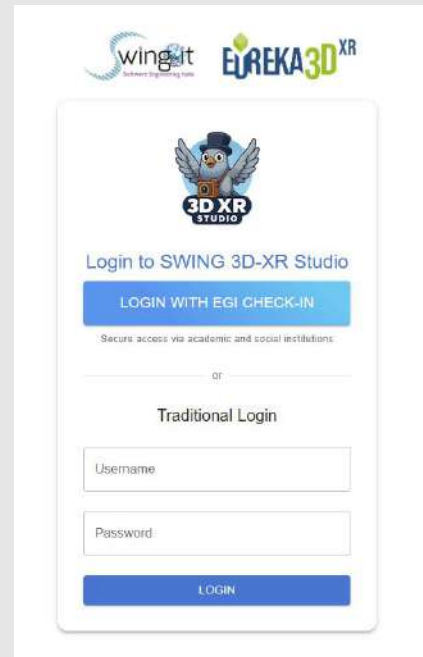
Creation of XR scenarios with 3D models, paths and interest points within a reference archaeological site.

3D XR Studio - Overview

- The **Swing:It 3D XR Studio** is a dual-component system comprising
 - a **web component**
 - a **mobile component**.
- **Web Component**
 - Allows users to define XR experience areas by inputting coordinates
 - Provides a 3D map to visualize existing structures.
 - Enables import of 3D models
 - Facilitates precise positioning of 3D models within the virtual environment by defining coordinates, orientation, and scale.
- **Mobile Component**
 - Used for on-site refinement of the virtual area and 3D model placement.
 - Allows users to view virtual objects in extended reality by positioning their mobile device at a known reference point.
 - Provides tools for precise selection, rotation, scaling, and repositioning of 3D models.

3D XR Studio – WebApp component

- **Goal:**
 - Creating and editing 3D environments directly from the browser.
- **Key Functionality:**
 - Select areas and place 3D models on the map.
 - Draw routes and Points of Interest (Pols).
 - Export objects and scene to the 3D Studio XR mobile component for an immersive experience.



3D XR Studio – Frontend

- Intuitive and modern User Interface.
- Import and place 3D models on a map with just a few clicks.
- Define guided routes for tourists, instantly viewable on a map.
- Add POIs enriched with multimedia (audio, video, images, links) contents.



AR/XR app approach: Placement Without Anchors

This technique links 3D models positions on a real-world reference point established by the editor of the XR/AR experience.

It can also be possible to add special objects to manually create an occlusion effect.

Pros

- No dependency on external packages or APIs, completely free and customizable
- No need of environmental scans
- No need for continuous Internet connection or GPS
- High accuracy in positioning
- Objects visible from long distances, no relying on recognition patterns

Cons

- The visitor must perfectly align the device with the initial position chosen by the editor



Admin View



EUREKA3D^{XR}

wing.it
Software Engineering Italia

Thank You!

Creating AR tours: an application at the archaeological site of Bibracte

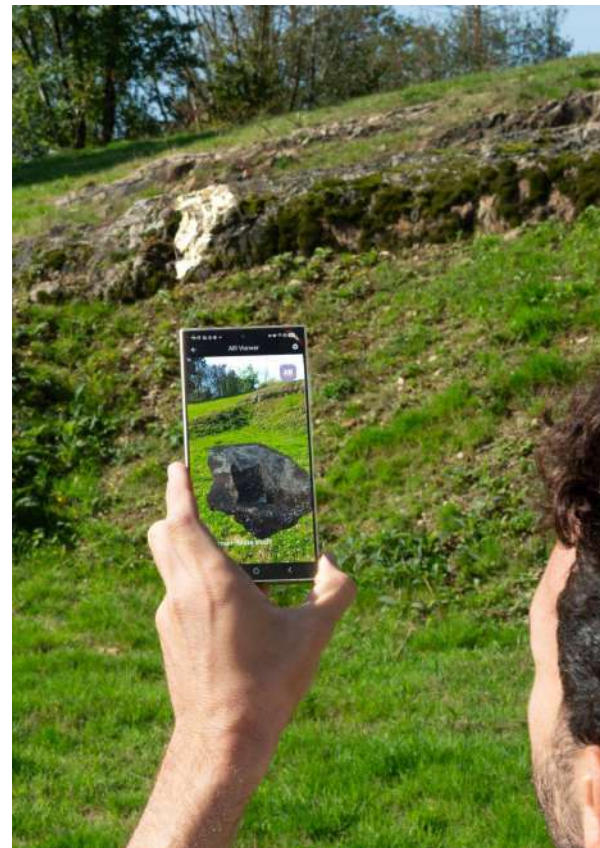


Eirini Kaldeli, NTUA

Agathe Le Riche-Maugis, BIBRACTE EPCC

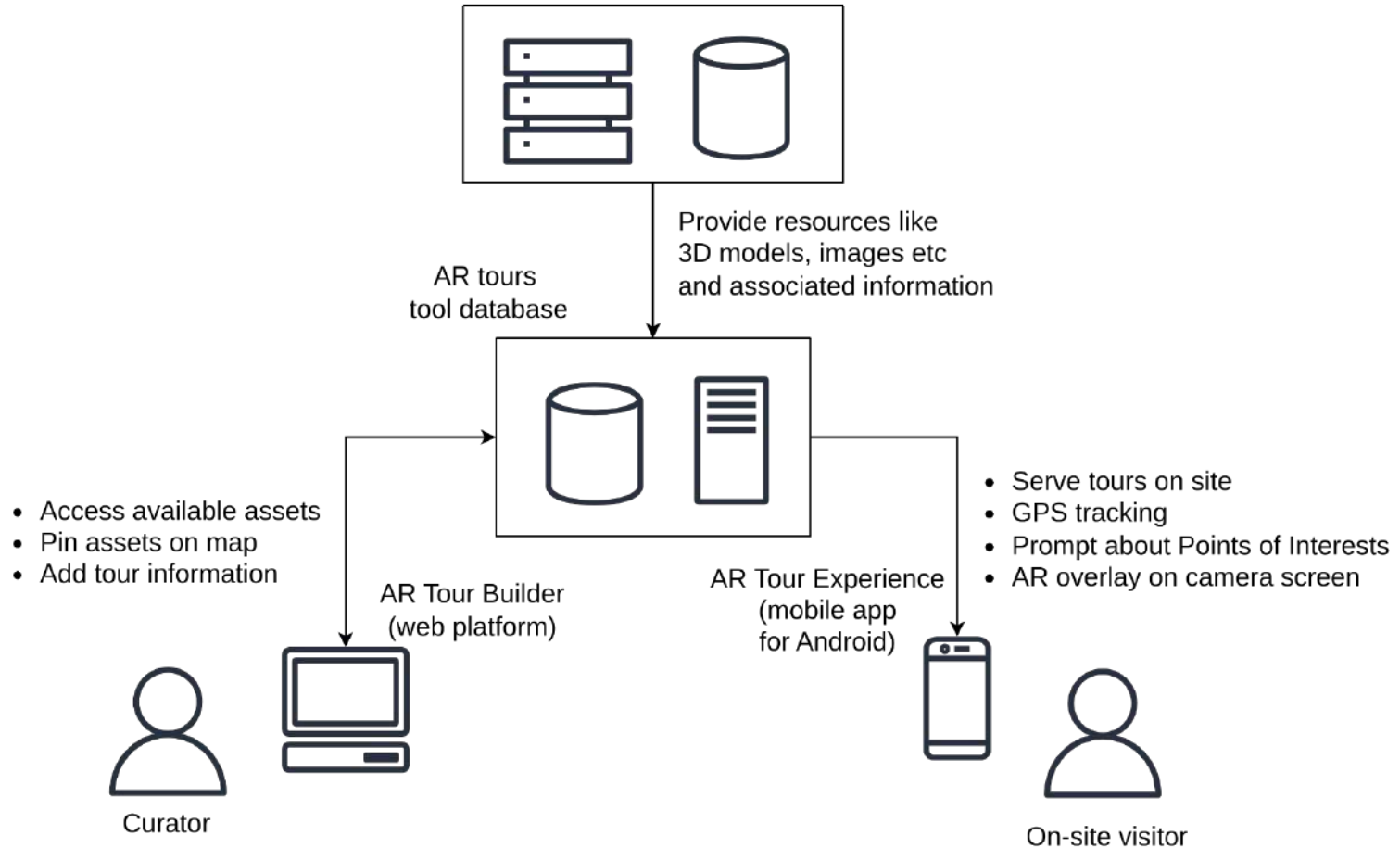
Objectives

- ❖ Enable **cultural heritage professionals** to design AR narratives by contextualising collection items from existing repositories via an *open and reusable web platform*
- ❖ Serve carefully curated tours as *lightweight, smartphone-driven AR experiences* to **on-site visitors** based on their geolocation and preferences
- ❖ Test and evaluate the technical tools on the Bibracte archaeological site
- ❖ Design a tour **scenario** that employs AR to reveal what is no longer visible at the archaeological site
 - highlight the potential of the tools
 - serve as a case study for their further uptake



TOOLS

External Databases and APIs (Europeana, Eureka3D Hub...)



AR Tour Builder

Asset Library

+ Add New Asset

Search assets...

Type: All Sort by: Date

ASSET	TYPE	SIZE	LAST MODIFIED	CREATOR	ACTIONS
Historic Building Exterior	Image	2.4 MB	3 Apr 2025	John Doe	
Tour Introduction Script	Document	145 KB	2 Apr 2025	Maria Smith	
City Hall 3D Model	3d	8.7 MB	1 Apr 2025	Alex Turner	
Walking Tour Introduction	Video	24.5 MB	30 Mar 2025	John Doe	
Museum Exhibition Details	Document	320 KB	28 Mar 2025	Maria Smith	

Edit Point of Interest

Position Details

City Hall

Click on map to reposition

400

250

Interactive map would allow pin placement in actual implementation

Latitude

40.7128

Longitude

-74.006

Address (optional)

1 City Hall Square

Continue to Details

Cancel

Save POI

Edit Point of Interest

Position Details

Title

City Hall

Description

Historic city hall building completed in 1908. Features beautiful neoclassical architecture and a prominent clock tower.

Type

Landmark

Assets (3)

City Hall Exterior

Description

Front view of the historic City Hall building

Display Mode

Default

Clock Tower Details

Description

Display Mode

Available Assets

Interior Tour Video

Video

Renovation Plans

Document

Night View

Image

+ Browse Library for More Assets

Cancel

Save POI

Support for multilingual tours

- Frontend: React, ThreeJS, Google maps
- Backend: Django, Postgres

Eureka Tour Builder API

1.0.0

OAS 3.0

/api/schema/

A comprehensive API for building and managing interactive tours with multilingual support.

Features

- **Project Management:** Create and manage tour projects with group-based permissions
- **Tour Creation:** Build interactive tours with customizable routes and content
- **POI Management:** Manage Points of Interest with rich metadata and multilingual content
- **Asset Management:** Handle media assets (images, videos, audio) with automatic thumbnail generation
- **User & Group Management:** Role-based access control with personal and shared groups

Authentication

The API uses token-based authentication. Include your token in the Authorization header:

Authorization: Token your_token_here

Data Format

All multilingual content is stored in JSON format, allowing for flexible language support.

Servers

http://localhost:8000 - Development server

Authorize

User

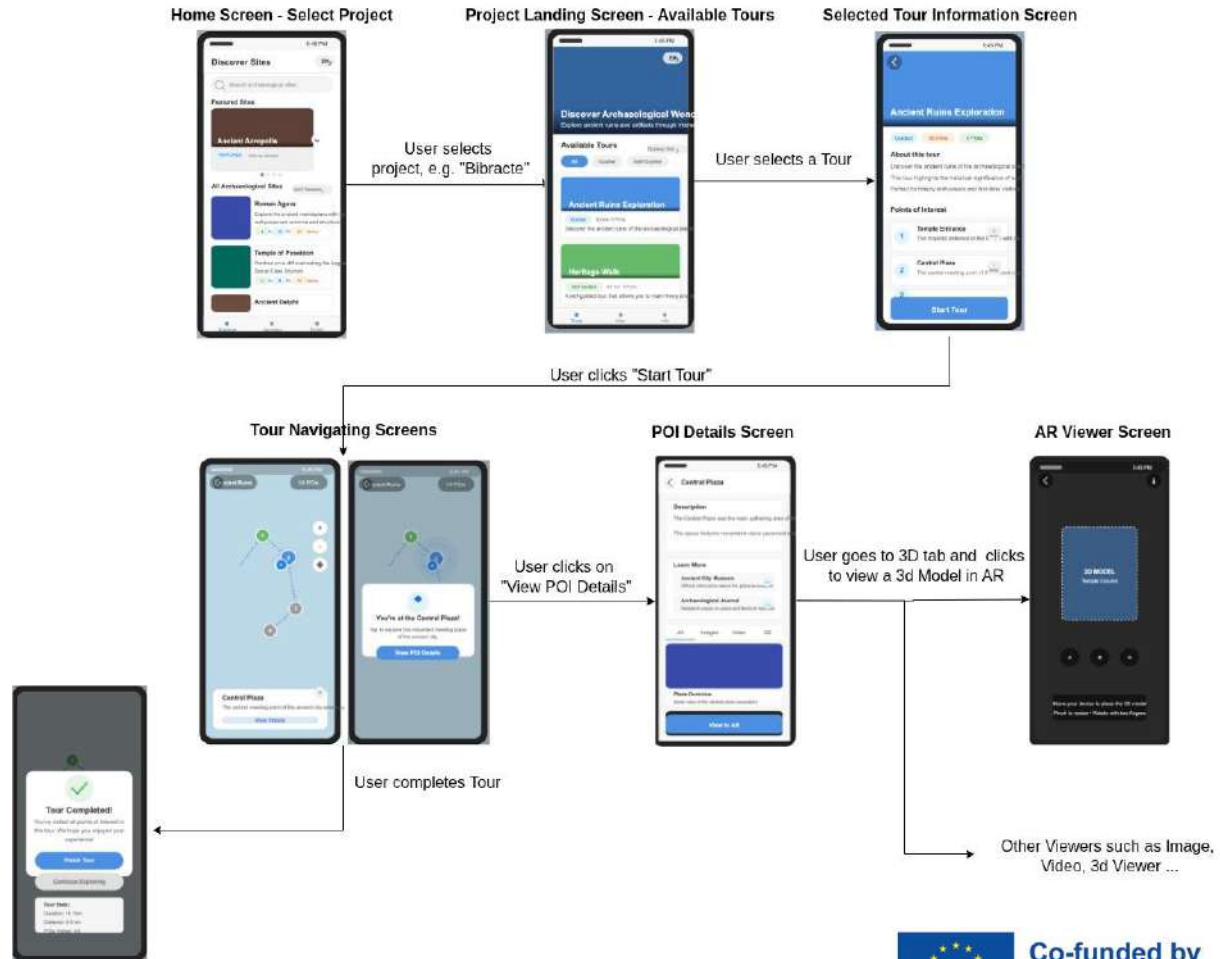
User authentication, account management, and user-related operations including login, signup, and user listing.



POST	/api/auth/login/	User Login		
GET	/api/auth/me/	Get Current User		
POST	/api/auth/signup/	User Signup		

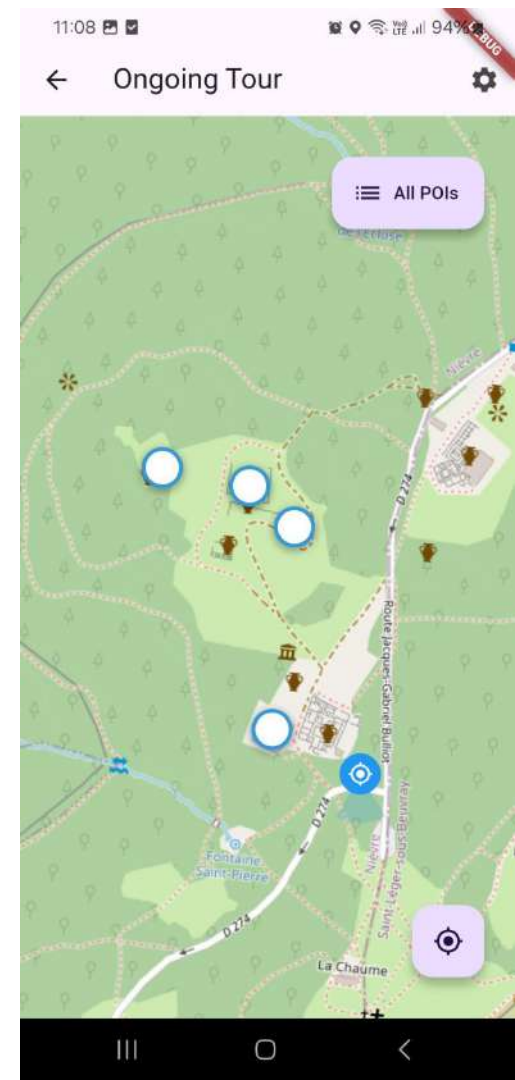
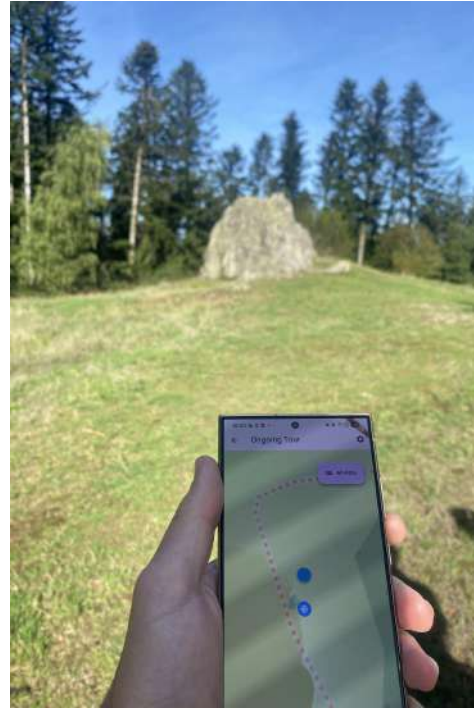
AR Tour Experience Main steps

- Flutter and ARCore
- OpenStreet maps
- GPS coordinates



Navigation

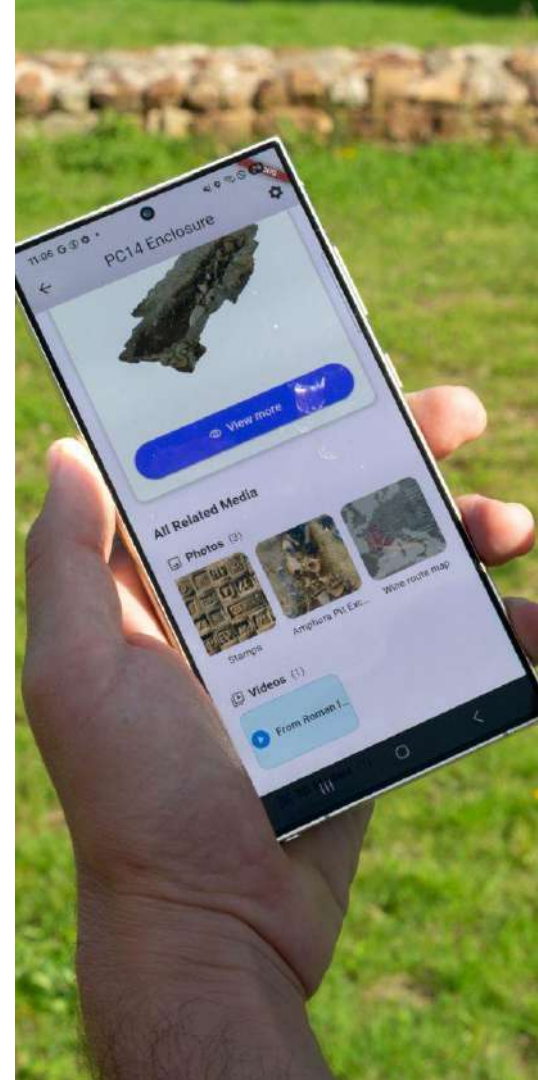
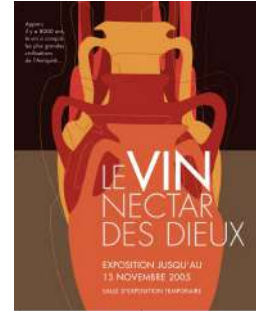
- OpenStreet maps
- Possibility to position other maps (e.g. LIDAR, historical maps) on top depending on context



Point of Interest

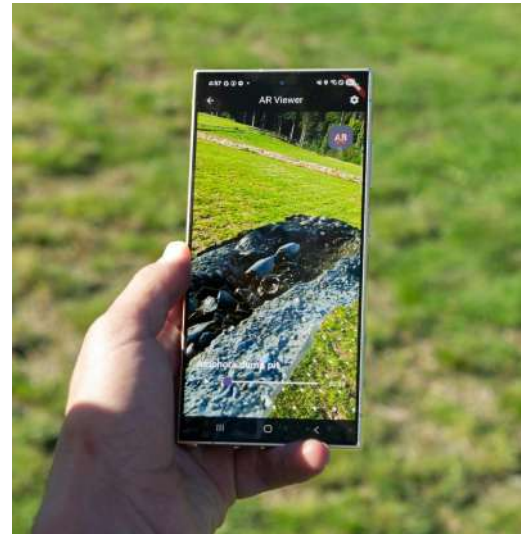
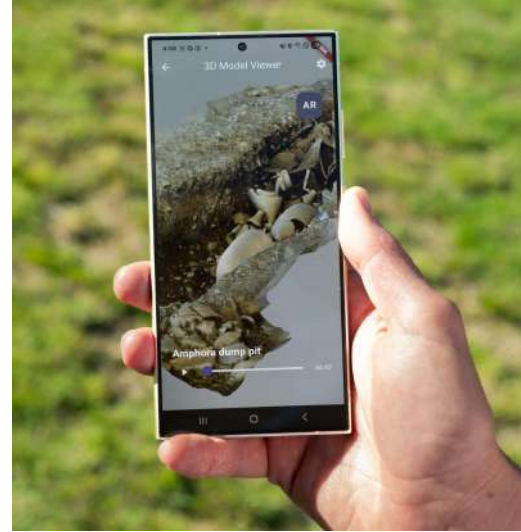
Multiple types of content associated with a certain location

- 3D
- Audio
- Images and videos
- Textual documents
- Links to external content
- Multilingual support



3D object visualisation

- Visualisation on 3D viewer (e.g. decorations and objects now preserved elsewhere, missing structures) manipulated via touch screen (zoom, rotation etc)
- Visualisation on AR viewer, i.e. overlay on the physical environment as captured by the mobile camera with view dependent on body motion (distance, angle etc)
 - Fixed anchoring based on georeferencing information for immovable heritage (e.g. backfilled excavations, missing parts of buildings)
 - Free positioning for movable heritage (e.g. see an artefact in the physical environment where it was discovered)



SCENARIO

Bibracte

- The site of a Celtic town of the 1st century BC
- Since 1984, an integrated site management system and a research project shared by different European universities
- Around 100,000 people visit each year the site, with free access, but half do so without any guidance,
- However, while many artifacts are on display in the museum, very few remains are visible on site.



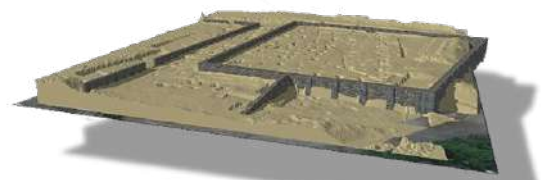
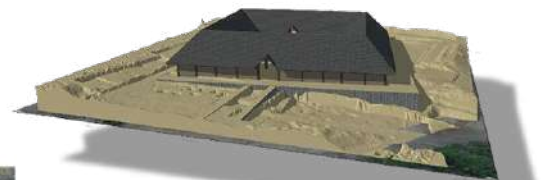
What is not, or no longer, visible today



Subtle remains of gallic wooden buildings (postholes, circulation levels, fireplace, etc.) destroyed during excavation process or backfilled afterwards. (Here *Côme-Chaudron workshop*)



Former excavated structures (cellars, mine shafts, etc.) filled to prevent them from collapsing and to protect visitors. (Here *Theurot de la Roche Mine shaft*).



Reconstructed hypotheses of wooden building elevations, based on posthole plans that are now backfilled. (*Here the PC15 Public space*)



The architectural evolution of buildings, especially stone ones, of which only the final state remains visible today.
(Here the PC1 domus)



And also other realities, not directly perceptible, such as craftsmanship, economic networks, natural phenomena...

Our challenge is helping visitors visualize and understand these non visible realities through the AR tour **"The Hidden Side of Bibracte"**



The POIs selection is made on 3 criteria:

- Their potential to illustrate this "staging of the invisible,"
- The availability of 3D models.
- The existence of complementary and engaging media to showcase the full potential of the tools

The “Hidden side of Bibracte” tour and its POIs

Rock of the Wivre

See the lost landscape

PC15 Public space

Stand amid the missing building

Theurot de la Roche

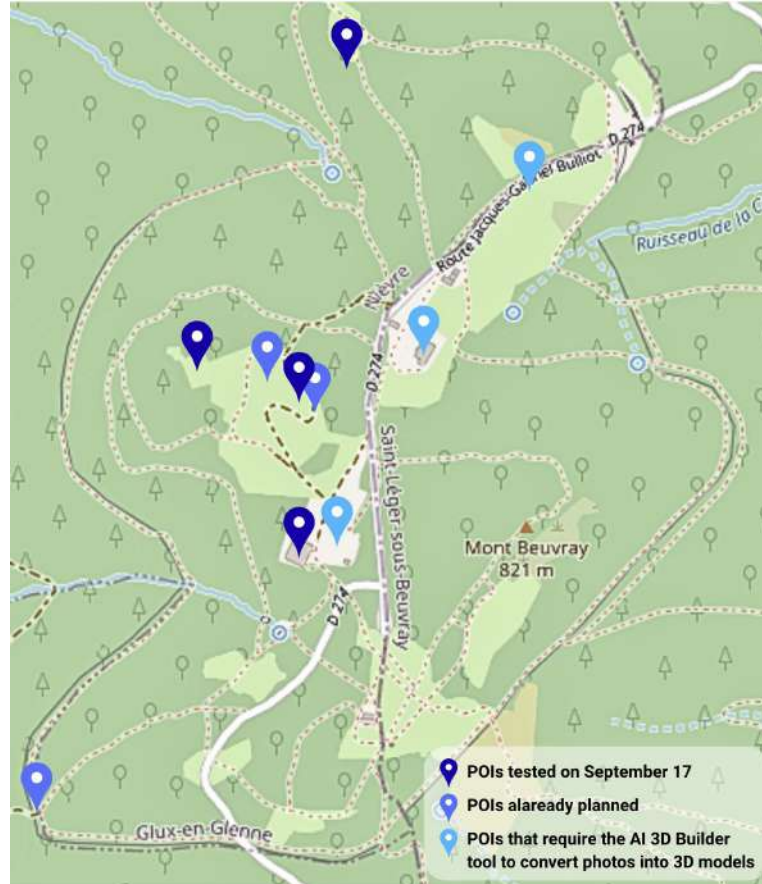
Explore the depths of a silver ore mine shaft

PC 2 domus

See Roman construction rise from its foundations

Great Gates

Walk through the lost murus gallicus



Côme-Chaudron

Trace the spaces where bronze was crafted

Monumental center

Stroll among a Romanized city

PC 14 enclosure

Glance into the amphora dump pit and wine trade

PC 14 well

Peer into the depths where wood survives time

PC 1 domus

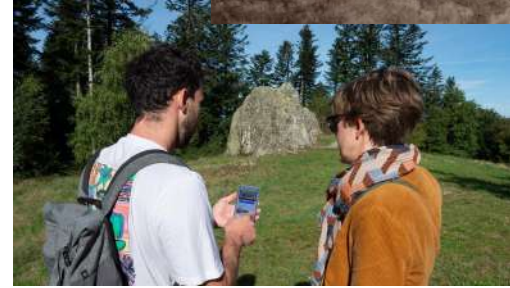
Step inside the houses beneath the house

Specific cases: content and location

Past and present landscapes: historical photos appear only when visitors adopt the original viewing angle, enabling direct comparison with today's scenery.

Participatory experience: quizzes on Historiana (used here not as a space for dissemination but as part of a project deliverable) encourage engagement and exchange.

Sensitive POIs: sites that are very close or hard to access are managed with precise activation radius in the AR Tour Builder.



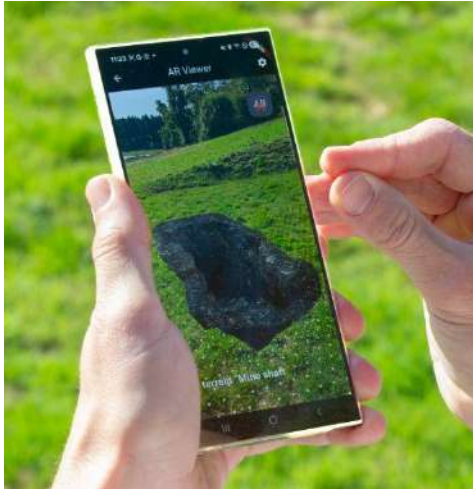
CHALLENGES & NEXT STEPS

Challenges

- Limited or no internet connection at remote places (AR tour experience)
 - 💡 Need to download parts of the tour in advance
- Inadequate georeferencing information for the exact positioning of 3D objects (AR tour experience)
 - 💡 Concrete instructions to curators
- Limited storage resources for hosting heavy content (AR tour builder)
 - 💡 Content hosted in CH repositories and only links added as tour metadata

Challenges

- The 3D models of underground structures necessarily appear above ground, which is problematic for their proper understanding



Example of the Theurot de la Roche mine shaft :



Entrance of the mine shaft seen from above.

Complete structure of the mine shaft seen from the sides.



Display models when visitors approach them and hide them when they move away

Next steps

- Refine the AR tour experience app in light of feedback and testing at Bibracte
- Design the User Interface of the AR tour builder
- Test the tools in combination (online vs on-site)
- Complete the preparation of all content and information for the tour
- Iterative testing and evaluation on-site with stakeholders and then visitors





European Union's REKconstructed content in 3D to produce XR experiences

SCENARIO 3

The creation of a new virtual life of Saint Neophytos' Enkleistra in Cyprus

Marinos Ioannides and Drew Baker
Cyprus University of Technology

Nadia Thalmann and Nedjma Cadi-Yazli
MiraLab, Geneva, Switzerland



MIRALab SARL

Eureka3D-XR project is co-financed by the Digital Europe Programme of the European Union, GA n. 101174054



Co-funded by
the European Union

Saint Neophytos Monastery's Enkleistra Location - Selection Criteria

12th century
Byzantine
Monument



Saint Neophytos Monastery's Enkleistra



Saint Neophytos the Recluse (1134 – ca.1214 AD)



lifetime. It is located inside the Enkleistra of the Saint.

Saint Neophytos' Enkleistra: The intangible aspect

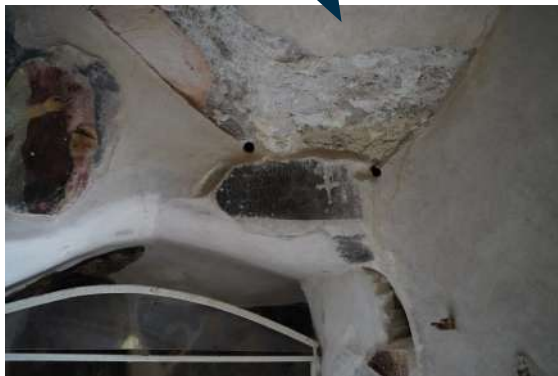


Saint Neophytos Monastery's (Hermitage) Enkleistra

Interior of the Enkleistra



Cracks and Damaged Areas



The Frescoes of the Enkleistra



Turning back time with EUreka3D-XR



Turning back time with Eureka3D-XR



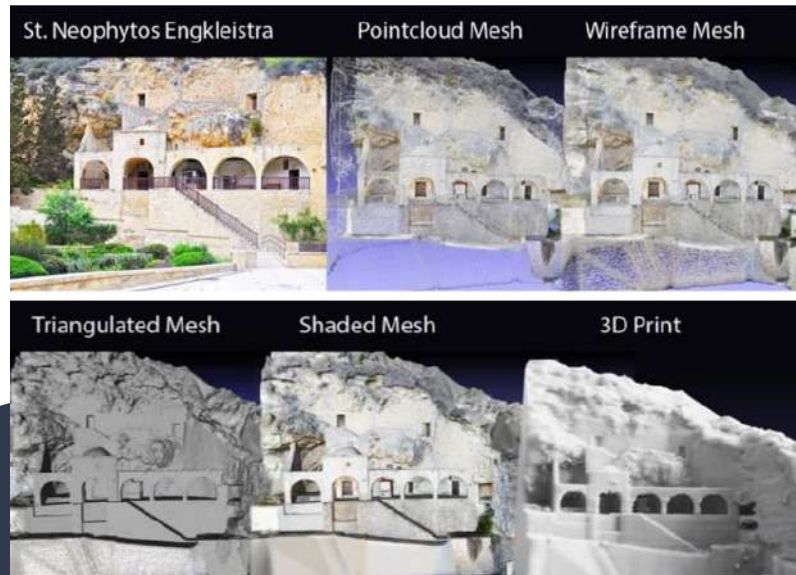
The Enkleistra's Digital Documentation

Geometric Documentation

Sections

Orthoimages

3D model



The Enkleistra's Digital Documentation: Data Acquisition



**Digitising the
Enkleistra using a
terrestrial laser
scanner**

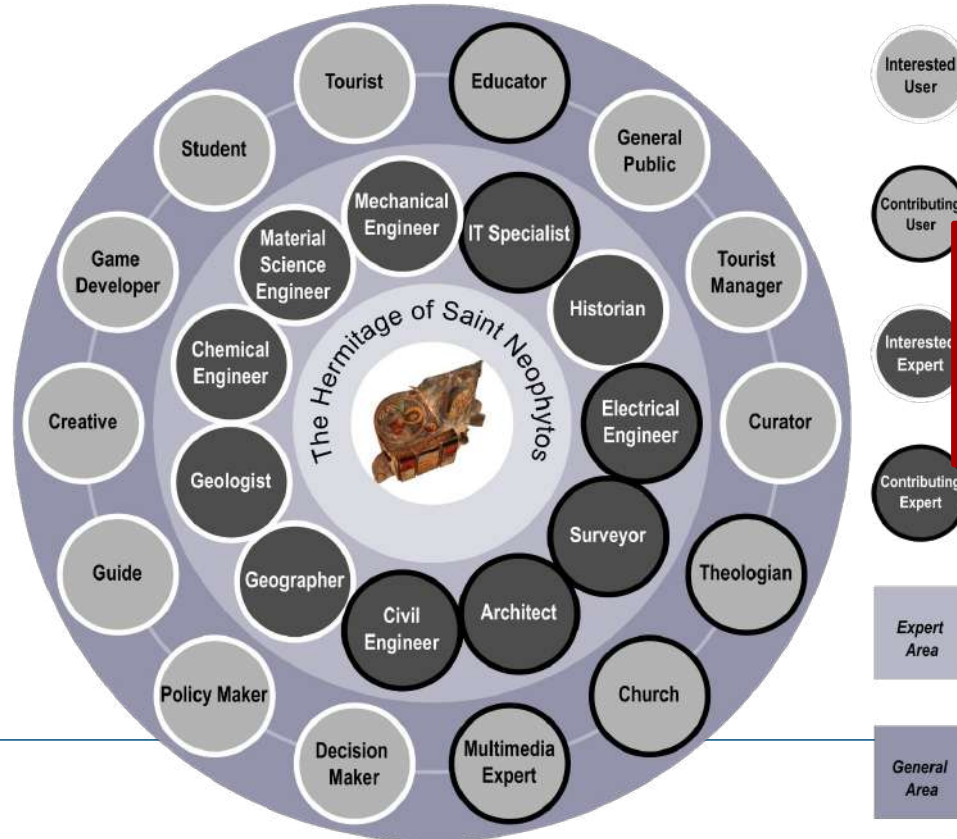


**Exterior and interior 360° images of the
Enkleistra**



**Digitising the Enkleistra using a
UAV aerial Photogrammetry**

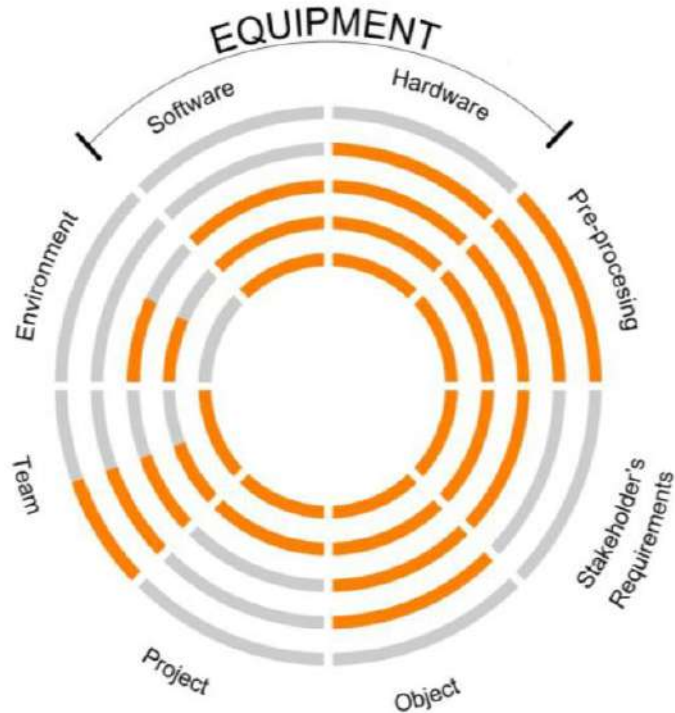
The Enkleistra's Holistic Documentation: User Category Groups



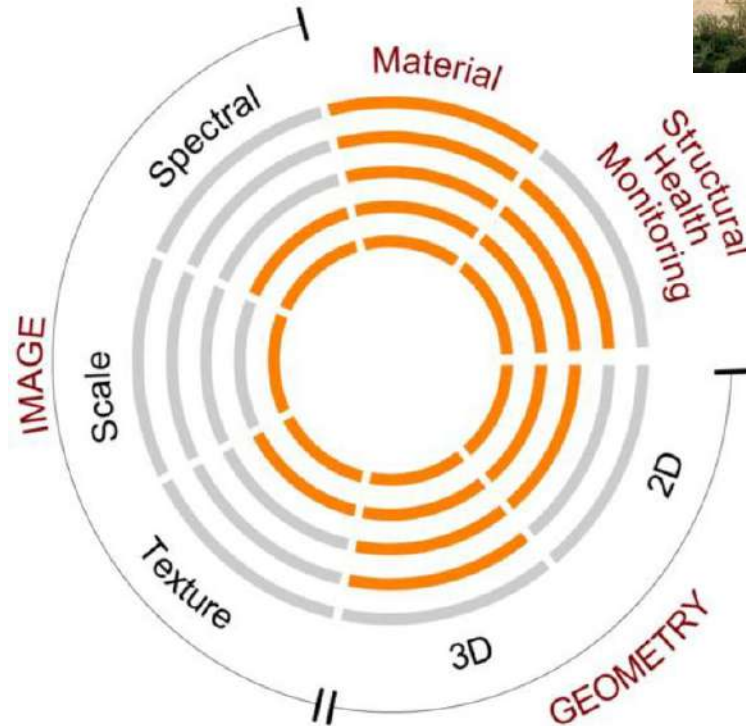
User Groups involved in the holistic documentation of the Enkleistra of Saint Neophytos

The Enkleistra's Holistic Documentation: Complexity and Quality

COMPLEXITY



QUALITY



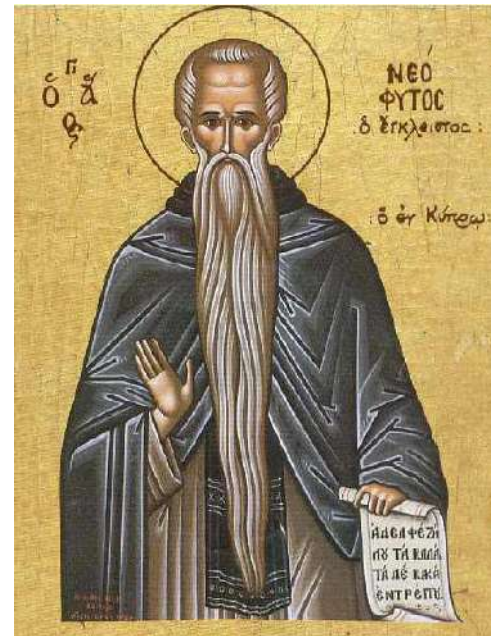
Radial Charts depicting the parameters for Complexity (left) and Quality (right) regarding the Enkleistra of Saint of Neophytos

Turning back time with Eureka3D-XR



Transport the viewer back to the time of St Neophytos

- Recreate the enkleistra (hermitage caves) to their state circa 1214 AD
- Populate the enkleistra with digital representations of the monks
- Stage a partial recreation of St Neophytos' liturgy in the virtual space
- Enable the real monks to tell the history of the enkleista through their digital representations
- Allow the viewer to ask the digital St Neophytos questions about his life and times



Reuse High-Quality MemoryTwin assets to create a new visitor experience

- Assess the current digital assets identifying relevant components to the narrative
- Directly engage the monastic community to tell the history of the saint and the religious community he founded
- Work to resolve visualisation challenges of restoring frescos, architectural elements and artifacts that are now absent
- Explore how far current technology can be used to create a sense of embodiment and emotions engagement with CH



The Purpose

To Extend the EUreka3D model into the Cross Reality Domain

- Provide access to the monument through XR implementation
- Develop new methods for exploring cultural heritage data (exploiting MemoryTwin repositories)
- Engaging communities in line with CARE principles
- Aligning dissemination to the ICOMOS Principles of Saville and the London Charter



Storytelling



Scenario 3 - Cyprus: Saint Neophytos Englystra

Completed:

- Digitisation of the ca. 850 year old monument:
 1. Internal photogrammetry survey of the Englystra
 2. Internal terrestrial laser scanning of the Englystra
 3. External *Simultaneous Localization and Mapping* (SLAM) scanning of the monument
 4. External *Unmanned Aerial Vehicle* (UAV) photogrammetry survey of the monument
 - 5. Monument under Risk: Long-Term Monitoring (Satellite Monitoring)**
- **Post-production**
 2. 3D Point cloud creation
 3. 3D mesh – modelling - asset creation

The first unified holistic documentation of the monument under The Digital Cultural Heritage Research Centre MNEMOSYNE

A satellite map of the Agios Neophytos Monastery in Tala, Paphos. The map shows a coastal area with a road and buildings on the left, and a large, dark, forested area on the right. The monastery is marked with a red pin in the center of the forested area. The title "Agios Neophytos Monastery in Tala, Paphos" and "Long-Term Monitoring via Satellites" is overlaid on a dark blue rectangular background in the top left corner.

Agios Neophytos Monastery in Tala, Paphos Long-Term Monitoring via Satellites

The monastery itself is nestled within a natural cave, with various buildings and structures constructed around it over the years.

The landscape in the area is characterized by rocky terrain while the area surrounding the monastery is predominantly arid, typical of the Mediterranean climate. The vegetation consists of hardy plants and shrubs adapted to the dry conditions. You may find scattered olive trees and other native species that can withstand the harshness of the rocky terrain.

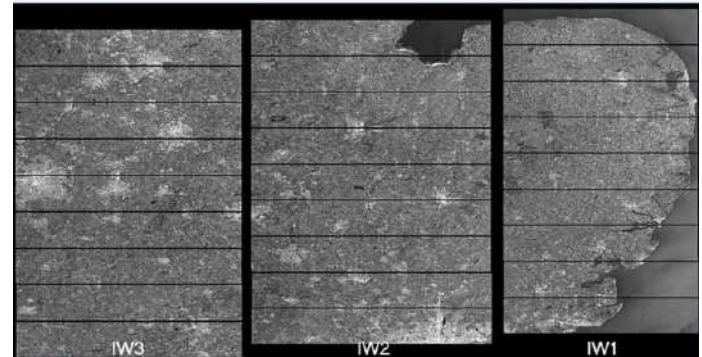
European Space Agency's Sentinel-1A and Sentinel-1B
Interferometric SAR processing exploits the difference between
the phase signals of repeated SAR acquisitions to analyze the
shape and deformation of the Earth's surface

Days:

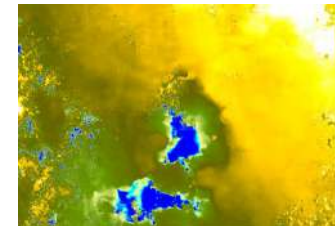
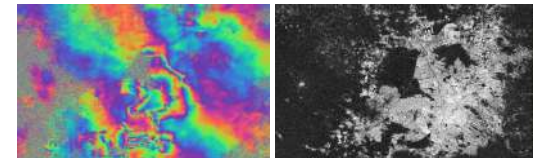
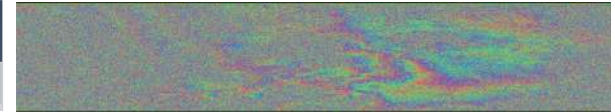
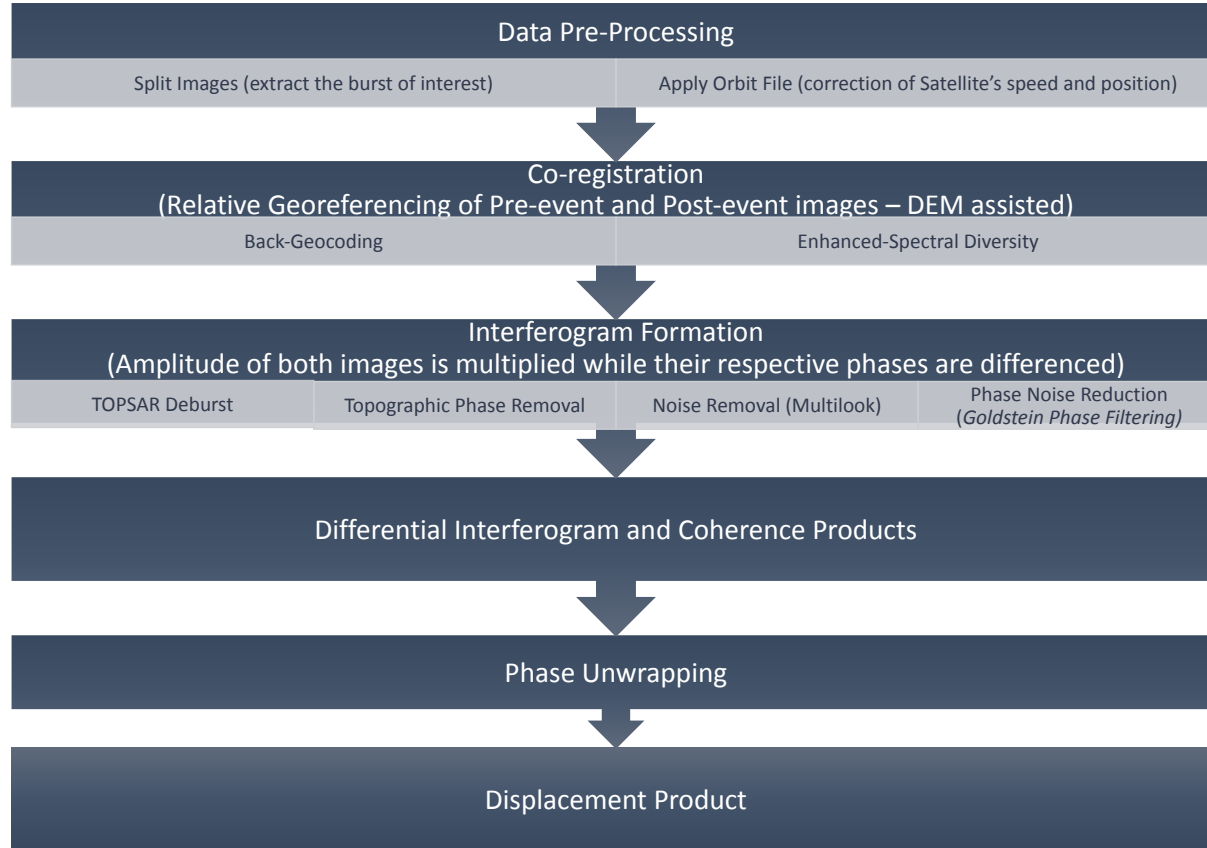
0 1 2 3 4 5 6

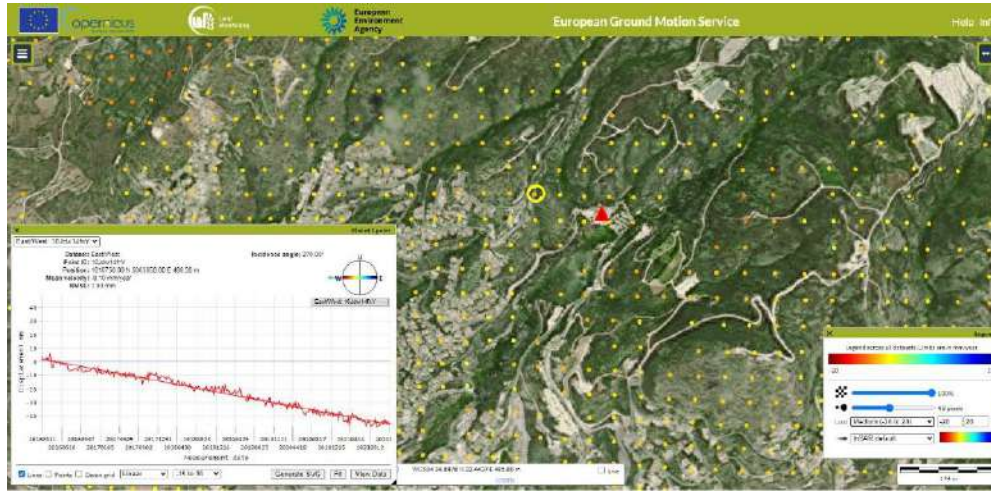
A word on Sentinel-1 Interferometric Wide Swath (IW) Mode

- Active Sensor
 - **Transmits** a signal and **Measures** the reflected wave
- The Interferometric Wide (IW) swath mode is the main acquisition mode of Sentinel-1 for Land Applications such as:
 - Landslides, Earthquakes, Land Subsidence and deformation, Volcanic activity etc...
- Acquires data with a 250km swath at 5m x 20m spatial resolution (single look complex - SLC)
 - **Level -1 SLC Data** → Amplitude and Phase of the returned signal (mandatory data for Interferogram Formation).
- IW mode captures three sub-swaths using the Terrain Observation with Progressive Scans SAR (TOPSAR) acquisition principle



InSAR Processing Chain



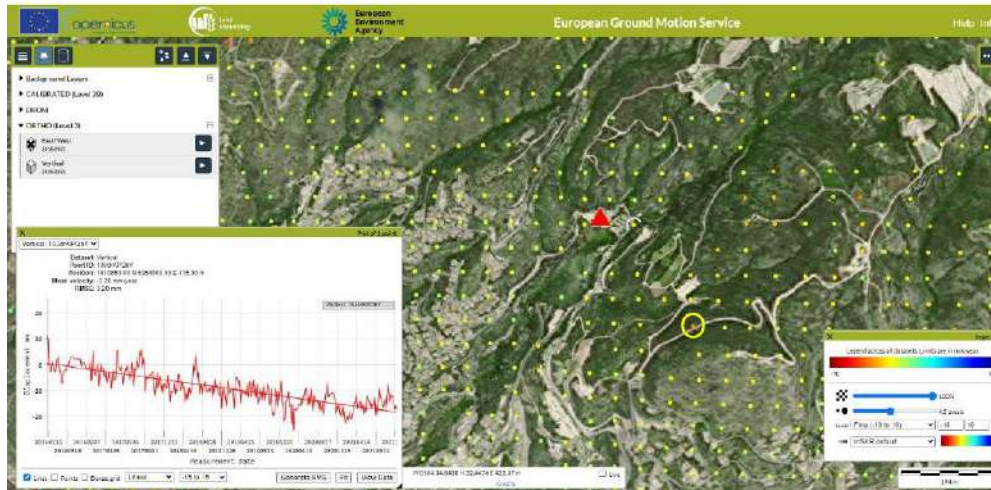


Horizontal Displacement

Average of -8 mm per year is occurred at the location of the monastery

A total of -40 mm displacement west of the monastery in year 2021

Agios Neophytos Monastery in Tala, Paphos



Vertical Displacement

Average of -3.2 mm per year
-16 mm displacement in year 2021 at the location of the monastery
250 m near the monastery – top of the hill = -20 mm in year 2021.

Turning back time with Eureka3D-XR



Virtual Saint Neophytos

Scenario 03

Prof. Nadia Magnenat-Thalmann

Nedjma Cadi

Dr. Thiago Freitas

MIRALab

SARL

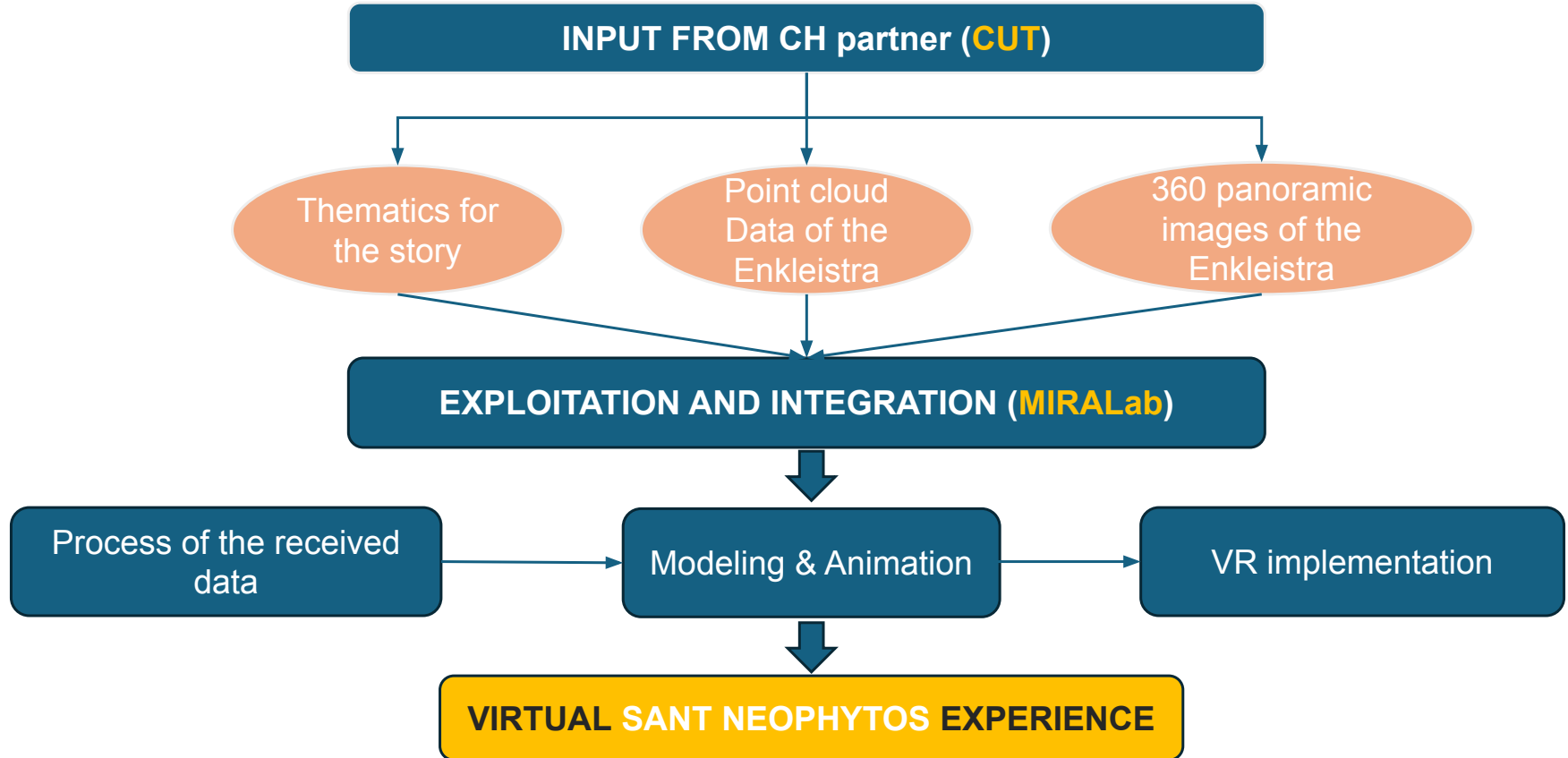
The aim

- *Bringing a historical figure to Life in a Virtual Space and elevate the experience from passive visualization to immersive simulation*
- *How virtual humans can act as mediators of history*

Main items

- **The workflow** (from partner's input → AI-generated text and sound → narration & Neophytos dialogue → virtual human).
- **The added value** of our tools: speech synthesis, facial animation, integration into Unity.
- How this workflow **can be reused** for other heritage sites.

From Historical Data to Virtual Experience





Historical Thematics for the Scenario

Construction
Decoration
Monastery Origins
Transformations After Death



From Data to Virtual Space
different formats :

Point cloud files
360 pano images in HR
2D plan of the building

The 3D simulation pipeline (MIRALab)

The static 3D avatar



3D geometry and textures

Body and facial animation



Body and facial animation, voice and storytelling

Storytelling

Text
Speech
Narrator
3D building
User interface

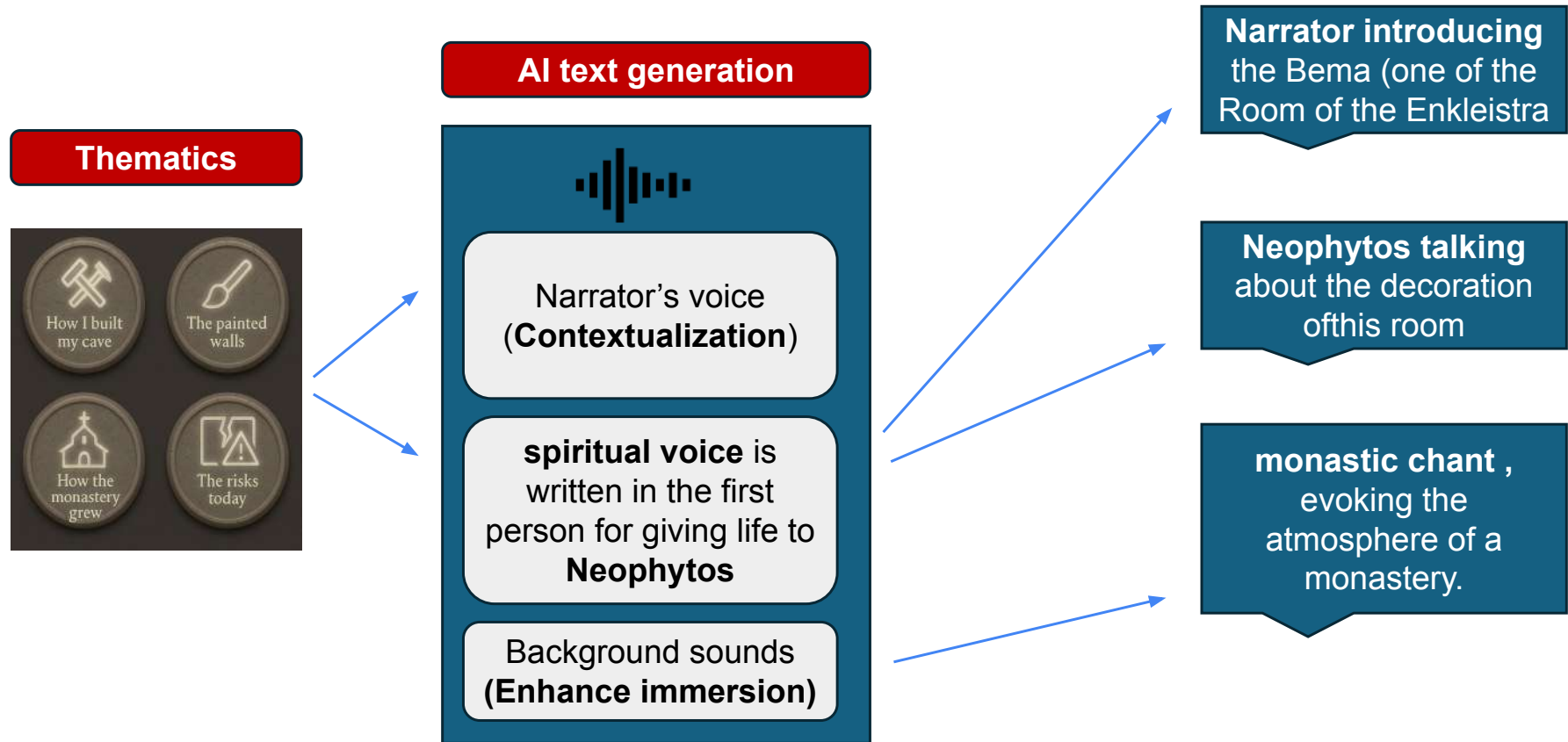


The viewers



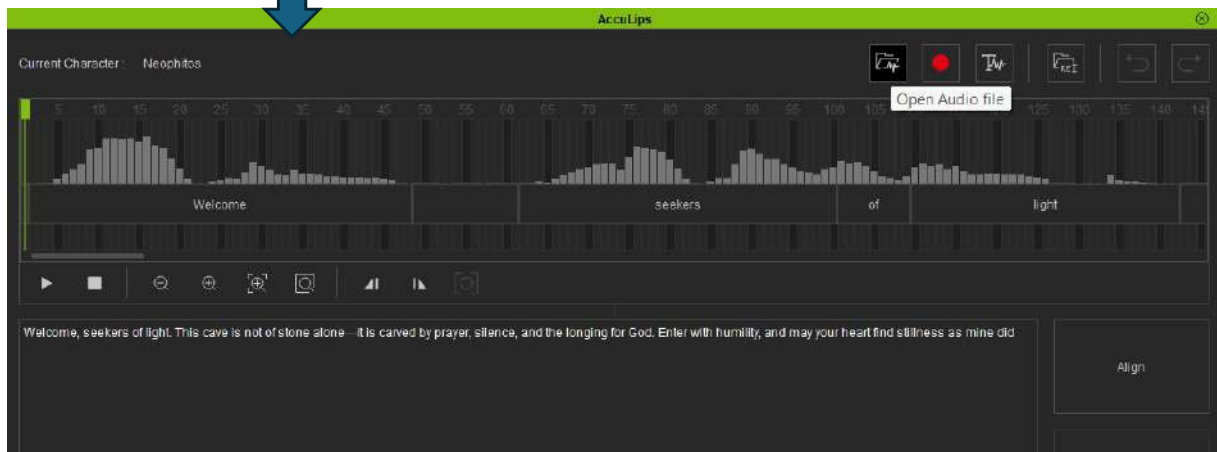
In Virtual reality/Mixed reality
on the web

Dual Narrative Approach



Text to Speech

**From
AI-generated Text
and Sound**





**Exploit and integrate:
Making the Most of Point
Cloud Models**

Virtual Saint Neophytos XR Simulation

- Multi-format immersive experience centered around **Saint Neophytos** and the **Enklestra**
 - The experience will be available in three distinct formats:
 - Web-Based Application
 - Mixed Reality (MR) Experience for Meta Quest 3
 - VR Experience for Meta Quest 3

Web-Based Application

what the audience will see ?

- **Technology:** Babylon.js (WebGL-based)
- **Format:** Browser-accessible simulation
- **Features:**
 - **3D animated Saint Neophytos** appearing within a stylized 2D backdrop of the cave
 - **Small GUI interface** to interact with the scene and trigger dialogues or animations
 - Optimized for quick access and educational use on desktops and tablets



MR Experience with headset

what the audience will see ?

- **Technology:** Unity (Mixed Reality for Android)
- **Format:** MR application with Saint Neophytos appearing in the user's physical space
- **Features:**
 - **3D animated Saint Neophytos** integrated into the **real Enklestra**, using passthrough
 - **Live interaction** between the physical and virtual world
 - **Interactive UI** enabling user control over dialogues and actions





VR Experience with headset

what the audience will see ?

- **Technology:** Unity (Android build)
- **Format:** Fully immersive virtual reality experience
- **Features:**
 - **3D Virtual Enklestra**, reconstructed using **real panoramic images** for spatial realism
 - **3D animated Saint Neophytos** fades in at the beginning of the experience
 - **Multiple speech sequences** about his life, teachings, the Enklestra, and more
 - **Interactive User Interface (UI):**
 - Trigger dialogues or scenes
 - Navigate through the virtual environment
 - Learn through contextual interaction

MIRALab Contribution

- Design a complete AI-driven storytelling pipeline:
 - Text → Audio → Facial Animation → VR integration
- Blended authentic scans with interpretive immersion
- Enabled museums to animate intangible heritage:
 - Voices, stories, and presence of historical figures

Value for Museums

- **Accessible & engaging** heritage experiences
- **Reusable workflow** for any site or artefact
- Institutions provide:
 - Topics / script
 - 3D scans or images
- We provide:
 - Virtual humans
 - AI voices & animation
 - VR Integration into immersive presentation tools

SAINT NEOPHYTOS THE RECLUSE

IMMERSIVE SIMULATION

VR Demo





**EUreka3D – European Union’s REKonstruced
content in 3D to produce XR experiences**

**Many thanks
for your attention!**



www.eureka3d-xr.eu



LinkedIn: [EUreka3D-XR](#)
Instagram: [@EUreka3D_XR](#)
YouTube: [@Eureka_3DXR](#)
X: [@Eureka_3D](#)



marinos.ioannides@cut.ac.cy
cadi@miralab.ch

